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Filip Hampl
Miroslav Svoboda

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PREFACE

Dear readers,

It is my pleasure to introduce you a collection of papers from the 15th annual international scientific conference The European Financial Systems 2018 organized annually by Department of Finance of the Faculty of Economics and Administration, Masaryk University in Brno, Czech Republic. This year's conference was focused especially on the current issues related to accounting, banking sector, insurance, financial literacy, financial law, new regulations of financial markets, different tax systems, corporate finance, cryptocurrencies, public finance and financing of non-profit organizations.

Since the collection of papers presents the latest scientific knowledge in this area, I believe you will get a number of new insights usable both for your scientific, and educational or practical activities. I would also like to express my strong conviction that we meet each other in occasion of the 16th year of this conference held in 2019.

I wish you pleasant reading!

Petr Valouch

Chairman of the Program Committee

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The Financial Analysis of the Education Support Fund: Recent Results from Slovakia

Mária Barteková[1], Ľudomír Šlahor[2]

[1] Comenius University in Bratislava
Faculty of Management, Department of Economics and Finance
Odbojárov 10, 820 05 Bratislava, Slovakia
E-mail: maria.bartekova@fm.uniba.sk

[2] Comenius University in Bratislava
Faculty of Management, Department of Economics and Finance
Odbojárov 10, 820 05 Bratislava, Slovakia
E-mail: ludomir.slahor@fm.uniba.sk

Abstract: *The analysis of institutions providing financial services has always been particularly challenging because of the manner how the financial institutions operate and generate profit. The purpose of this study is to analyse the financial performance of the Education Support Fund – the institution providing state subsidised student loans in Slovakia. Tertiary students are eligible for the loan application from the Education Support Fund. All European countries realize that tertiary education is one of the driving forces of economic growth. The empirical part of the paper consists of the financial statement analysis focused on the performing ratios. Ratio analysis is one of the most widely used fundamental analysis technique. The most significant opportunity that emerged from our analysis is to reach the positive net profit as the evidence of financial sustainability and stability. We have identified the net interest margin, the loan-to-assets ratio, and the return-on-assets (ROA) ratio as the most reliable ratios for the financial performance comparison. In recent years, the slightly increasing values of the performing ratios have shown the financial stability of the Education Support Fund.*

Keywords: student loans, financial ratios, Education Support Fund

JEL codes: G23, G29, G32

1 Introduction

Education has long be seen as a crucial tool for national development, with various education initiatives designed to work towards eliminating poverty, increasing the health of a population or enhancing local economies, among others. Strengthening the social dimension of higher education is still a key political goal on the European level. To expand the knowledge base and foster progress, an increasing number of European citizens require high level knowledge and competences. One of the key challenges in developing quality mass higher education systems is to ensure that students have the necessary material conditions to study and fulfil their potential. The question of how this is ensured at national level is a key aspect of the social dimension of higher education, and student fee and support systems are thus important tools of national policies.

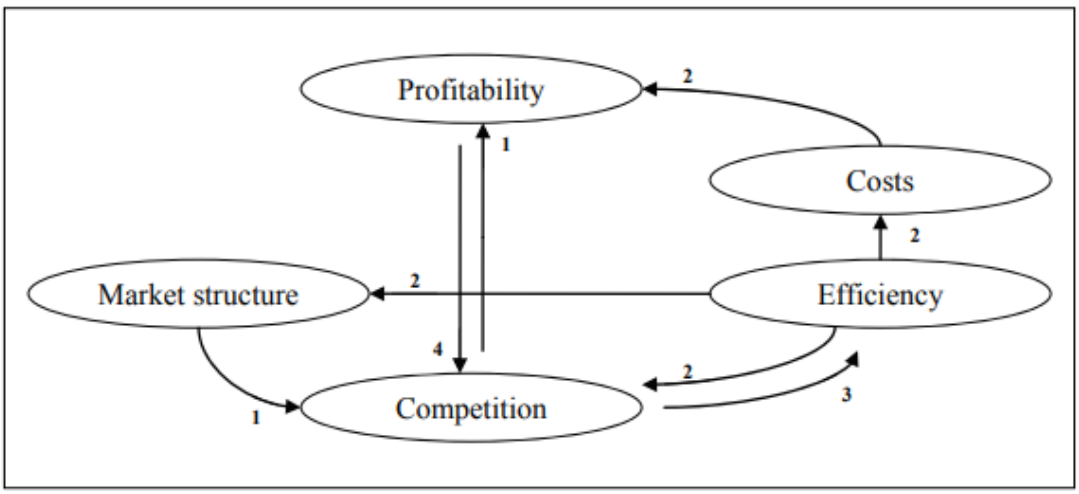
To assess the Education Support Fund's financial performance we use the financial analyses indicators. Various performance aspects cannot be observed directly whereas they are economically important. While stockholders will view performance in terms of the profits made on their behalf, whether or not adjusted for risks taken, this article focuses on performance in a broader sense, that is, the contribution financial institutions make to the common wealth, on behalf of consumers and businesses. They will be mainly interested in whether financial products are not too expensive and whether the quality is sufficient. This raises the issue of, on the one hand, the efficiency of financial institutions (i.e. whether unnecessary costs are made in bringing a product to market) and, on the other, the level of competition in the relevant markets (i.e. whether profit margins are not unnecessarily high).

Adequate performance of financial institutions is of crucial importance to their customers. Prices and quality of their products are determined by efficiency and competition. Since efficiency and competition cannot be observed directly, various indirect measures in the form of simple indicators or complex models have been devised and used both in theory and in practice (Bohdalová and Greguš, 2017).

As the main role of the Education Support Fund is the student loan providing, we compare the Fund's performance with the results reached by the banking sector in Slovakia. The banking sector's aggregate profit generated in Slovakia has come under severe pressure from falling interest margins. Although the sector's profit increased in 2016 by 19.8%, year on year, that growth was driven by several one-off and exceptional factors. Excluding their impact, the overall profit dropped by 11%. The sector's total capital ratio increased slightly, to 18% (The National Bank of Slovakia, 2016).

Relation 1 describes the influence of competition to profitability of the financial institution and market structure to competition at the market (see Figure 1). Competition also affects financial innovations, Fund's financial health, financial stability and the accessibility of the Fund's services to clients (Bikker, 2010). More efficient financial institutions will translate lower costs into either increased profits or price reductions – the latter in order to improve their competitiveness and increase their market share (indicated by a relation '2' in Figure 1). Efficiency thus is not an effect but a determinant of market structure. It has been generally assumed that competitive pressure forces financial institutions to become more efficient (indicated by a relation '3'). Excess profits enable financial institutions to lower their prices and become more competitive in order to increase their market share (indicated by a relation '4').

Figure 1 Relations Between Profitability, Efficiency and External Environment



Source: Bikker, J. A.

Section 2 describes the Education Support Fund as the unique Slovak student loan provider. Section 3 discusses methodology used in this paper and the main sources of data. The financial analysis focused on the various performance ratios is a part of section 4. Section 5 concludes.

2 The Education Support Fund

The Education Support Fund was established on 1 January 2013 by Act No. 396/2012 Coll. on the Education Support Fund as the legal successor of the Student Loan Fund and Loan Fund for Starting Educators. The main activity of the Education Support Fund is to provide loans to university students, teaching staff, professional school employee and doctoral study programme students in the full-form of studies (Education Support Fund, 2017).

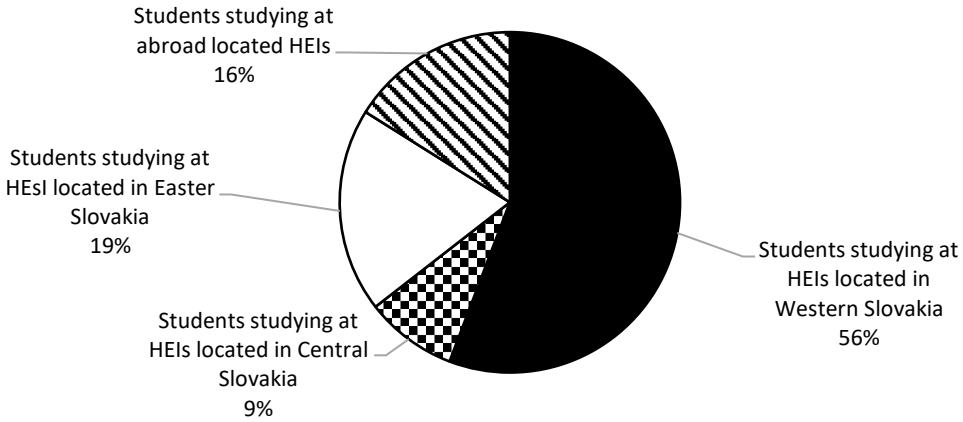
The applicant must also meet the following requirements:

- Have a permanent residence in the territory of the Slovak Republic; or
- Have the status of a Slovak living abroad; or
- Be a citizen of the European Union with the right to permanent residence in the territory of the Slovak Republic or a family member of such person with the right to permanent residence.

Loans represent the primary earning asset at the Education Support Fund. Loans provided by the Education Support Fund are dedicated for the students studying at the higher education institutions (HEIs) and are purposeless (Education Support Fund, 2018).

Figure 2 shows distribution of the approved student loans in the academic year 2017/2018. As one can see, more than 55 % of the supported students are studying at HEIs located in Western Slovakia. Just around 16 % of all supported students are studying abroad.

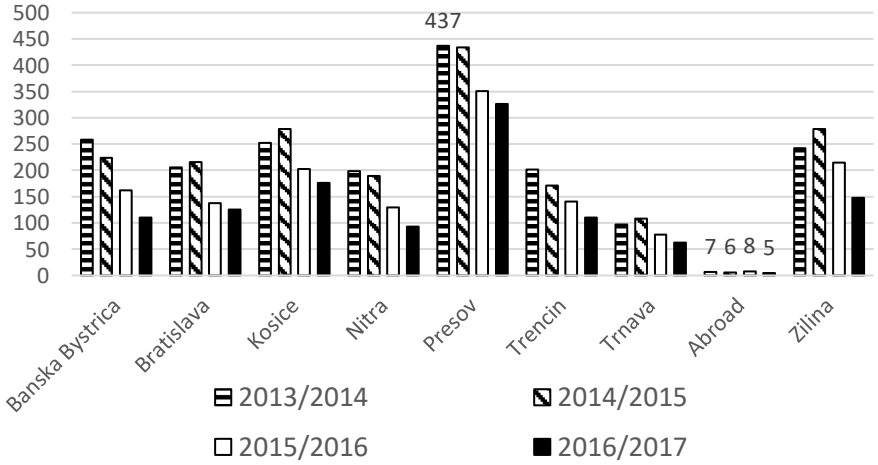
Figure 2 Approved Student Loans Distribution in the Academic Year 2017/2018



Source: The Education Support Fund, own calculations

Reducing disparities will require increasing the labor utilization ratio and improving the structural and policy determinants of productivity in the eastern regions of Slovakia (Fadoš and Bohdalová, 2017). Toll for the increasing labor utilization ratio is also the social support for tertiary students. In the long term, the biggest group of the supported students are coming from the following regions: Presov (eastern Slovakia), Kosice (eastern Slovakia) and Zilina (northern Slovakia). The smallest group in the number of approved loans are students coming from abroad (Figure 3).

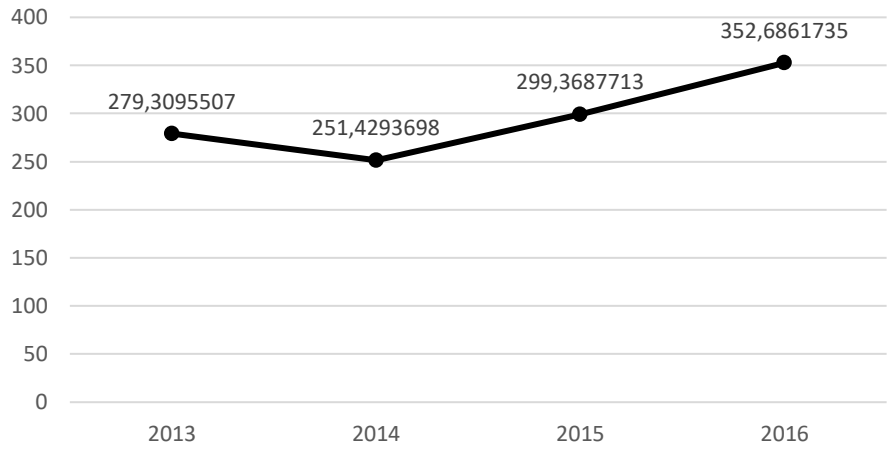
Figure 3 Amount of Supported Students in the Academic Year 2013/2014 – 2016/2017 by the Place of Residence



Source: The Education Support Fund, own calculations

Total costs per student loan include all expenses related to providing the loan and paid from the budget of the Education Support Fund divided by the number of approved student loans. The decreasing number of provided loans caused increase of the total costs per student loan reported in 2016 (Figure 4).

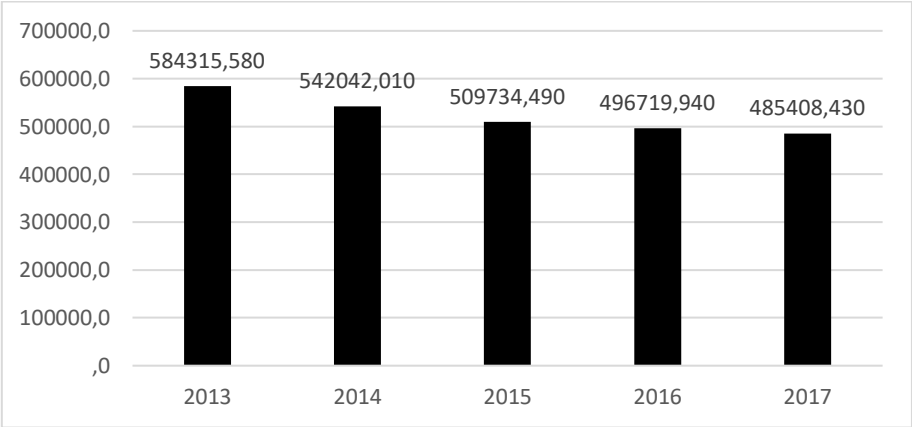
Figure 4 Total Costs per Provided Student Loan (2013 - 2016)



Source: The Education Support Fund, own calculations

The operational efficiency is the capability of an institution to deliver services to its customers in the most cost-effective manner possible while still ensuring the high quality of its services. Figure 5 shows development of the operational expenditures from the Fund's establishment to 2017. Amount of the operational expenditures decreases every year and the total value is under the legal limit. The operational expenses may not exceed 3.5% of the outstanding principal of loans per year as of 31 December the previous year (Act No. 396 of 2012 Coll. on the Education Support Fund). The operational efficiency still increases.

Figure 5 Development of the Operational Expenses from 2013 to 2017



Source: Education Support Fund, own calculations

Efficiency based on the transformation of costs into benefits as measured. Efficiency is a measure of how economically resources/inputs (funds, expertise, time, etc.) are converted to results. These ratios enable the management to measure the effectiveness or usages of the resources at the command of institution.

3 Methodology and Data

Since the purpose of this research is to gain a better insight into the determining and presenting the relationship of items or group of items in the financial statement of the Education Support Fund.

We have identified the net interest margin (NIM), the return-on-assets (ROA) ratio, the return-on-equity (ROE) ratio, Equity multiplier (EM), Burden/Total Assets ratio, Current ratio and Quick ratio as the most reliable ratios for the financial performance analysis.

EM indicator presents the ratio between the financial assets of the banking sector and their equity (Matuszaka and Rozanska, 2017). This can be used alongside other measurements of the financial leverage of this sector to ascertain its overall financial stability and to analyse its financial health.

Return on equity (ROE) analysis provides a system for planning as well as analyzing financial institution performance. The profit margin allows the analyst to develop a pro forma income statement (Gavurova et al., 2017). That is, net income is equal to revenues less expenses. Thus, the financial planner can determine the revenue level necessary to achieve the net income target. The total asset turnover ratio allows the analyst to project the total asset level necessary to generate the projected revenue level. The total asset requirement can be used to project the pro forma levels of all of the asset accounts (Chorvatovičová and Saxunová, 2016). The fundamental equation of accounting is that assets equal liabilities plus owners equity. Thus, the equity multiplier ratio can be used to project the pro forma financial needs and the financial structure of the financial institution.

We draw on data from:

- Database of The National Bank of Slovakia,
- OECD database,
- The Education Support Fund's database to track how the performance indicators evolved between 2016 and 2017.

The financial reports of the Education Support Fund are the main sources of data in this paper.

4 Results and Discussion

This session introduces fund financial statements and provides a traditional, ratio-based procedure for analyzing fund financial performance using historical data. It demonstrates the interrelationship between the income statement and balance sheet and describes the risk and return trade-off underlying management decisions.

Table 1 Balance Sheet in EUR - Year 2016 and 2017

	2016	**2017**
A. Invested Assets	33 957 079	32 857 561
B. Current Assets	4 175 857	5 489 992
C. Prepayments and Accrued Income	1 029	1 318
Total Assets	**38 133 965**	**38 348 871**
D. Equity	38 071 437	38 287 084
E. Provisions	0	0
F. Liabilities	62 528	61 787
G. Accrued Expenses and Deferred Income	0	0
Total Liabilities	**38 133 965**	**38 348 871**

Source: The Education Support Fund

Investment decisions affect the left-hand side of the balance sheet through asset purchases (Del Giudice et al., 2016). Investment decisions determine the type of assets used by the Education Support Fund, the industry in which the fund operates, and the degree of operating leverage of the fund. Financing decisions affect the right-hand side of the balance sheet, which shows the financial structure of the fund through security issues and retained earnings. Financing decisions determine the capital structure of the fund and the degree of financial leverage.

The Education Support Fund's income statement reflects the fact that most assets and liabilities are financial (Table 2). Revenue consists primarily of interest income and interest payments on liabilities represent the primary expense. The statement format starts with

service revenues then subtracts operational expense. The next step is to subtract provision for loan losses, which represents management's recognition that some revenues will be lost due to bad loans. The format continues by adding interest income then subtracting interest expense and taxes to produce net income.

Table 2 Income Statement in EUR - Year 2016 and 2017

	2016	**2017**
Service Revenues	136 373	134 219
Operational Expenses	560 557	550 801
Other Revenues	58 299	113 295
Other Expenses	20 817	19 745
Trading Loss	**- 386 702**	**- 323 032**
Interest Income	937 813	896 146
Interest Expenses	382 150	347 640
Financial Profit	**555 663**	**548 506**
Profit on Ordinary Business Profit	**168 961**	**225 474**
Profit/Loss on Extra Ordinary Events	**0**	**0**
Net Profit before Tax	**168 961**	**225 474**
Tax Liability	1 670	1 441
After Tax Profit	**167 709**	**224 033**
Net Profit per Balance Sheet	**167 709**	**224 033**

Source: The Education Support Fund

The following analysis uses data from Table 1 and Table 2 to calculate and interpret the various profitability ratios. The profitability ratio formulas are:

$$ROE = \frac{Net\ Income}{Total\ Equity\ Capital} \quad (1)$$

$$ROA = \frac{Net\ Income}{Total\ Assets} \quad (2)$$

$$EM = \frac{Total\ Assets}{Total\ Equity\ Capital} \quad (3)$$

$$NIM = \frac{Net\ interest\ income}{Earning\ Assets} \quad (4)$$

The liquidity ratio formulas used in this paper are following:

$$Current\ ratio = \frac{Current\ Assets}{Current\ Liabilities} \quad (5)$$

$$Quick\ ratio = \frac{Cash\ equivalents + Marketable\ securities + Accounts\ receivables}{Current\ Liabilities} \quad (6)$$

Return on equity (1) equals net income divided by stockholders' equity and thus measures the percentage return on stockholders' investment (Ray and Mitra, 2018). The higher the return the better, as management can pay higher dividends and support greater future growth. Return on equity reached in 2017 just 0.59 %.

ROE is tied to ROA (2) through a fund's equity multiplier (EM), which equals total assets divided by stockholders' equity. EM (3) measures a fund's financial leverage, or its amount of liabilities compared with equity. The greater are aggregate liabilities, the greater is financial leverage and EM (OECD, 2018).

Net interest margin (4) equals net interest income divided by earning assets and thus represents the net interest return on income producing assets. The results of the profitability analysis are shown in Table 3. Almost every profitability ratio of the Education Support Fund was miserable low and very far from set targets. In year-to-year comparison, profitability ratios as ROE, ROA, NIM and Burden/Total Assets attained better values.

Table 3 Profitability Indicators in 2016 and 2017 and Profit Targets

	2016	2017	Target
ROE	0.51%	0.59%	>18.00%
ROA	0.51%	0.58%	>1.25%
EM	1.00	1.00	>12.5X
NIM	1.70%	1.80%	>4.50%
Burden/Total Assets	1.00 %	0.90%	< 2.00%

Source: Own calculations, Bikker, J.A., The Education Support Fund

As one can see, Burden/ Total Assets ratio reached in both years is better than the recommended target (Table 3).

The current ratio (5) measures the ability of a company to cover its short-term liabilities with its current assets. Table 4 contains the financial results focused on the current liquidity position and the liquidity targets. A quick ratio is ineffectively greater than industry average. The current liquidity position of the Education Support Fund is really good and sustainable. The reached values in both cases are influenced by the operating cycle of the student loans provisioning.

Table 4 Liquidity Indicators in 2017 and Liquidity Targets

	2017	Target
Current ratio	132,22	>1.00
Quick ratio	130,51	>1.20

Source: The Education Support Fund, own calculations

The quick ratio (6) is more conservative than the current ratio because it excludes inventory and other current assets, which generally are more difficult to turn into cash. A higher quick ratio means more liquid current position (The National Bank of Slovakia, 2017).

5 Conclusions

It has been established that with the help of a combination of appropriate indicators – we could make a good deal of headway towards a better understanding of the Education Support Fund's financial performance. Aggregate profitability among financial institutions measured by ROE and ROA has varied very slightly from year to year.

The main purpose of the Education Support Fund is to provide student loans with the favorable interest rate. However, profitability is the primary goal of all businesses. Without profitability the business will not survive in the long run. So measuring current and past profitability and projecting future profitability is very important. The most of profitability ratios showed that the Education Support Fund is not profitable and confirmed the social dimension of the student loans provisioning in Slovakia.

The current liquidity position of the Education Support Fund is very favorable in comparison to set targets. Generally, companies would aim to maintain a current ratio of at least 1 to ensure that the value of their current assets cover at least the amount of their short term obligations. The value of the current and quick ratio reached in 2017 more than 130.

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Life Insurance in the Czech Republic: New Challenges?

Karina Benetti

Technical University of Liberec
Faculty of Economics, Department of Economic Statistics
Studentska 1402/2, 461 17 Liberec, Czech Republic
E-mail: karina.benetti@tul.cz

Abstract: *Do the life insurance products offered on the Czech insurance market provide adequate insurance protection? Life insurance over the last decade has changed greatly, not only in the offer of products. Originally this type of insurance resulted to cover the consequences of the risk of death and life expectancy risk. Products of life insurance covering the risk of death should provide family of in case of death of the breadwinner, products aimed at the risk of life expectancy were mainly-saving products which should primarily secure the individual in old age. It was also possible to arrange a product called endowment assurance. It is worth mentioning that there are various modern variations and possibilities of arranging the different kinds of insurance within the life insurance of people. The product development is escalated in investment life insurance product, which has its strengths, but also weaknesses. It is a question if the situation on the Czech life insurance market with regard to the development and importance of the products of the investment life insurance for the insurance or especially financial market the opportunity or the threat.The main objective of this paper is to capture the main trends of gross life insurance premium, focusing on changes in gross premiums written by individual types of life insurance products including the analysis of selected parameters (number of insurance contracts, insurance penetration and other selected indicators). The software STATGRAPHICS Centurion will be used for this analysis.*

Keywords: life insurance, development, gross premium written

JEL codes: G18, G22

1 Introduction

The main roles of life insurance in the financial services system are gradually changing. According Ducháčková (2016) the life insurance is considered to be an instrument to cover the needs of people, on the one hand, a tool of covering the consequences of the risk (death and other risks - accident, invalidity, illness etc.), and on the other hand, a tool for savings to cover the needs of people in post-productive age. At present, many factors affect the development of life insurance and especially its efficiency. In the use of life insurance as a means of addressing the needs of people in old age is in the last period on the Czech insurance market a number of problems. The problems, according Ducháčková (2016) arise from the form of life insurance products, from regulatory approaches in life insurance, from approaches to selling life insurance contracts. However, life insurance is a standard tool of the insurance (financial) market (Ducháčková, 2015). Its role, significance and form are changing throughout its development in relation to changing conditions of life insurance. It is characteristic for the recent period that life insurance has been going through modifications, in particular the typical increase in the share of unit linked life insurance which is representing in particular the product of the investment life insurance. Life insurance and especially unit linked life insurance have been recently facing a few challenges. Some of them resulted from changing financial markets and others were connected with the conclusion of life insurance policies.

The aim of the paper is to analyze the development of the gross premium written of life insurance in the Czech Republic and the basic groups of life insurance products by analyzing selected indicators for the period 1995 to 2017.

In the following part research methods and data for analysis will be characterized.

2 Methodology and Data

In the research were particular used scientific methods: induction, comparative analysis, synthesis of partial knowledge, elementary statistical analysis and dependence analysis.

For elementary statistical analysis the following selected indicators were used (Hindls, et al., 2000):

- the first difference
$$\Delta_t^{(1)} = \Delta_t - \Delta_{t-1}\,. \tag{1}$$
- the second difference
$$\Delta_t^{(2)} = \Delta_t^{(1)} - \Delta_{t-1}^{(1)} \tag{2}$$
- the growth coefficient
$$k_t = \frac{y_t}{y_{t-1}} \tag{3}$$
- the growth rate
$$\delta_{y_t} = T_{y_t} - 100 \tag{4}$$
- the increase rate
$$T_{y_t} = k_t \cdot 100 \tag{5}$$
- the average absolute gain and
$$_1\bar{\Delta} = \frac{\sum_{t=2}^{n} {}_1\Delta_t}{n-1} = \frac{y_n - y_1}{n-1}, \tag{6}$$
- the average growth coefficient
$$\bar{k} = \sqrt[n-1]{\frac{y_n}{y_1}} \tag{7}$$

where n is the number of values (in this paper n = 23).

For regression analysis was used software STATGRAPHICS Centurion XVI. For the analysis secondary data from Czech National Bank (2018) were used.

According to the results of an elementary statistical analysis a suitable model for trend analysis will be chosen. The results of trend analysis will be evaluated based on their individual indices:

- RMSE (root mean squared error);
- R_M^2 modified index of determination;
- p-value (of parameters and model) of significance, according to which the robustness of a particular model is evaluated at the 5% significance level;
- t-test,
- F-ratio of model.

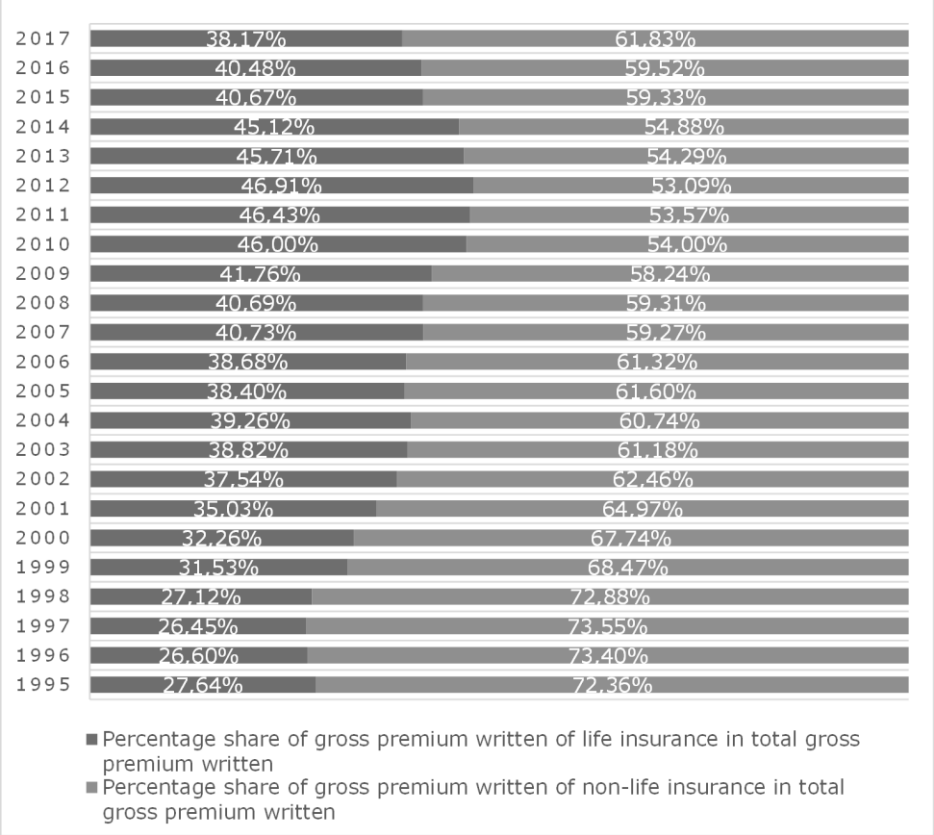
Other indicators that will assess the development of life insurance in the Czech Republic will include, in particular: development of number of insurance contracts, insurance penetration, gross premium written in life insurance per capita and the ratio of the individual life insurance groups (insurance relate to an investment fund, wedding insurance or child-care insurance, accident insurance or sickness insurance, retirement insurance, death and survival insurance) to the total prescribed life insurance in the Czech Republic.

3 Results and Discussion

The results of elementary statistical analysis, by selected characteristics, of development of gross premium written in life insurance are given below. The development of the

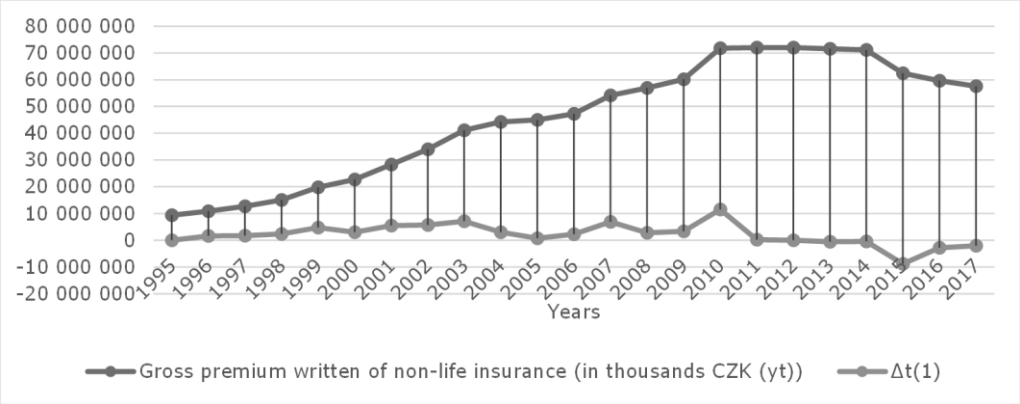
percentage ratio of gross premium written in life insurance versus non-life insurance is illustrated in Figure 1. This figure shows the importance of life insurance on the Czech insurance market. It should be added that this ratio is reversed on average across the EU (see Eurostat data). The basic development of gross premium written in life insurance of its first difference illustrated Figure 2 and Table 1.

Figure 1 Development of The Percentage Ratio of Gross Premium Written in Life Insurance Versus Non-life Insurance



Source: own from Czech National Bank (2018)

Figure 2 Development of Premium Written in Life Insurance with Development of its First Difference



Source: own from Czech National Bank (2017)

According to the development of the values specified in Figure 1 can be deduced that the observed characteristics recorded growth till 2014. For this reason, does not make sense to describe the examined values other statistical characteristics (such as e.g. coefficient growth, growth rate and increase rate). For a basic overview of the development of the

examined values sufficient to indicate the results of absolute average gain and average growth coefficient.

The result of average absolute gain is for gross premium written in life insurance CZK 2 192 694 (for year 2016 was CZK 2 392 810 520, Benetti (2017)).

The result of average growth coefficient is for gross premium written in life insurance 1.086181458 (for year 2016 it was 1.092248, which corresponds to 9.23 %, Benetti (2017)).

Table 1 Elementary Characteristic Development of Gross Premium Written in Life Insurance

Years (t)	Gross premium written of non-life insurance (in thousands CZK (y_t))	$\Delta_t^{(1)}$	$\Delta_t^{(2)}$	k_t	T_{yt}	δ_{yt}
1995	9 341 715	×	×	×	×	×
1996	10 937 216	1 595 501	×	1.170793157	0.170793157	17.08%
1997	12 692 286	1 755 070	159 569	1.16046771	0.16046771	16.05%
1998	15 089 372	2 397 086	642 016	1.188861644	0.188861644	18.89%
1999	19 793 331	4 703 959	2 306 873	1.311739879	0.311739879	31.17%
2000	22 770 132	2 976 801	-1 727 158	1.15039414	0.15039414	15.04%
2001	28 281 966	5 511 834	2 535 033	1.242064209	0.242064209	24.21%
2002	34 036 346	5 754 380	242 546	1.203464639	0.203464639	20.35%
2003	41 128 802	7 092 456	1 338 076	1.20837889	0.20837889	20.84%
2004	44 201 009	3 072 207	-4 020 249	1.074697216	0.074697216	7.47%
2005	44 954 269	753 260	-2 318 947	1.017041692	0.017041692	1.70%
2006	47 233 389	2 279 120	1 525 860	1.050698633	0.050698633	5.07%
2007	54 128 225	6 894 836	4 615 716	1.145973773	0.145973773	14.60%
2008	56 909 094	2 780 869	-4 113 967	1.051375581	0.051375581	5.14%
2009	60 209 323	3 300 229	519 360	1.057991241	0.057991241	5.80%
2010	71 764 862	11 555 539	8 255 310	1.191922753	0.191922753	19.19%
2011	72 009 104	244 242	-11 311 297	1.003403365	0.003403365	0.34%
2012	72 049 292	40 188	-204 054	1.000558096	0.000558096	0.06%
2013	71 577 033	-472 259	-512 447	0.993445335	-0.006554665	-0.66%
2014	71 186 464	-390 569	81 690	0.994543375	-0.005456625	-0.55%
2015	62 415 277	-8 771 187	-8 380 618	0.876785747	-0.123214253	-12.32%
2016	59 590 736	-2 824 541	5 946 646	0.954745999	-0.045254001	-4.53%
2017	57 580 983	-2 009 753	814 788	0.966274	-0.03373	95.47%

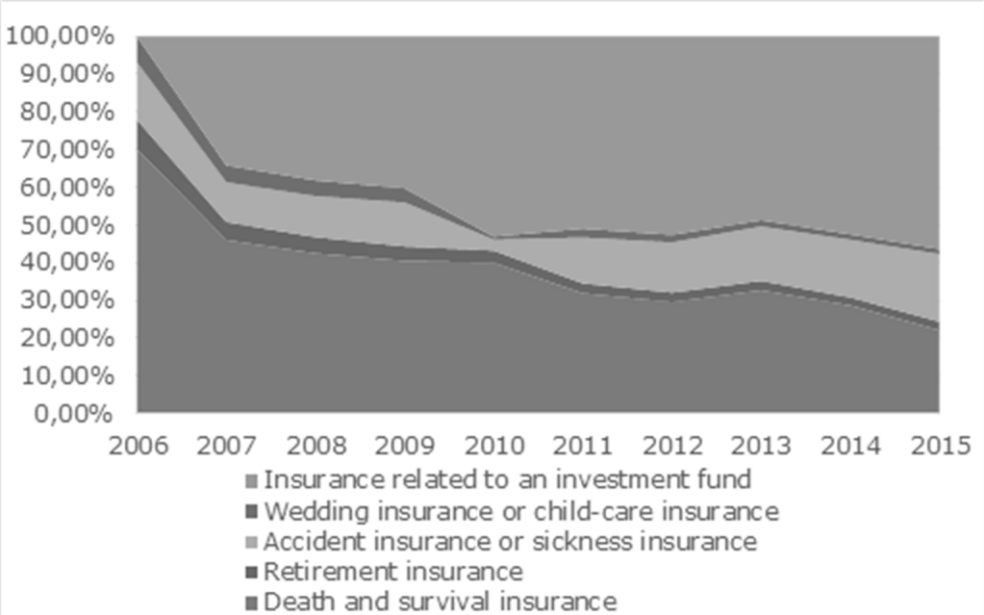
Source: own elaboration Czech National Bank (2018)

From Table 1 it is clear that the largest increase was recorded in the surveyed quantity in 2010, on the contrary, the largest decline in 2015. The question is which life insurance group this increase / decrease was caused. This will be the focus below.

The results of the ratio of the individual life insurance groups (insurance relate to an investment fund, wedding insurance or child-care insurance, accident insurance or sickness insurance, retirement insurance, death and survival insurance) to the total prescribed life

insurance in the Czech Republic are shown in the Figure 3. The data for ends of years 2016 and 2017 was not published.

Figure 3 The Development of the Ratio of the Individual Life Insurance Groups to the Total Premium Written in Life Insurance in the Czech Republic



Source: own elaboration from Czech National Bank (2018)

From Figure 3 it is clear that the increase in the total life insurance premium written in 2010 was driven by an increase in subscribed life insurance premiums linked to the investment fund. On the other hand, the decline in total life insurance premiums written in 2015 was due to a decline in written life insurance premiums in the event of death and survival, as well as a partial decline in gross written premium written linked to the investment fund.

The results of development of number of insurance contracts, insurance penetration and gross premium written in life insurance per capita see in Table 2.

The number of the insurance contract has a decreasing trend over the reference period, except 2012. However, the gross premium written per insurance contract has a volatility development period. This means that with the decreasing number of contracts, the gross premiums written not decreases. Premium per capita increases in the period 2006 to 2011, and in the following year, since 2012, it has declined. In the case of this indicator, it is highly desirable for its value to have a growth tendency. The decreasing trend of this indicator indicates the low use of the product by the population of that country. Insurance penetration a growing tendency in 2006 to 2010, with a downward trend in the following period since 2006, indicating the unfavorable development of the indicator.

Another research question is how to develop gross premiums written in life insurance in the future this will be used to analyze time series and software STATGRAPHICS Centurion XVI. The trend in time series can be described by trend functions unless the development of time series corresponds to a particular function of time (for example: linear, quadratic and exponential).

Table 2 The Results of Selected Indicators

	2006	**2007**	**2008**	**2009**	**2010**
Number of insurance contracts	10 010 546	10 119 438	10 104 445	9 349 600	8 919 070
Gross premium written per insurance contract	4 718	5 349	5 631	6 442	8 046
Premium per capita	4 601	5 243	5 456	5 741	6 824
Insurance penetration	1.35%	1.41%	1.42%	1.54%	1.82%
	2011	**2012**	**2013**	**2014**	**2015**
Number of insurance contracts	8 675 566	9 357 769	8 060 735	7 740 318	7 392 770
Gross premium written per insurance contract	8 300	7 699	8 880	9 197	8 443
Premium per capita	6 860	6 856	6 810	6 764	5 920
Insurance penetration	1.79%	1.77%	1.75%	1.65%	1.37%
	2016	**2017**			
Number of insurance contracts	5 996 463	5 865 132			
Gross premium written per insurance contract	9.937.65	9 817.51			
Premium per capita	5 640	5 427			
Insurance penetration	1.25%	1.14%			

Source: own elaboration from (Czech Statistical Office, 2017a and 2017b), (Czech National Bank, 2018)

Linear trend function (line) has the following form (Arlt et al, 2002):

$$T_t = \beta_0 + \beta_1 t \tag{8}$$

Quadratic trend function (parabola) has the following form (Arlt et al, 2002):

$$T_t = \beta_0 + \beta_1 t + \beta_2 t^2 \tag{9}$$

Exponential trend function has the following form (Arlt et al, 2002):

$$T_t = \beta_0 \beta_1^t \tag{10}$$

To evaluate the suitability of the trend have been identified and assessed values of trend function forecast, values of the root mean squared error (RMSE) and values of modified index of determination (R_M^2).

RMSE (Arlt et al, 2002):

$$\text{RMSE} = \sqrt{\frac{1}{T}\sum_{t=1}^{T}(y_t - \hat{y}_t)^2} \tag{11}$$

where $\hat{y}_t$ is modeled values at time t.

Determination modified index (R_M^2), (Arlt et al, 2002):

$$R_M^2 = R^2 - \frac{(1-R^2)(k-1)}{T-k} \tag{12}$$

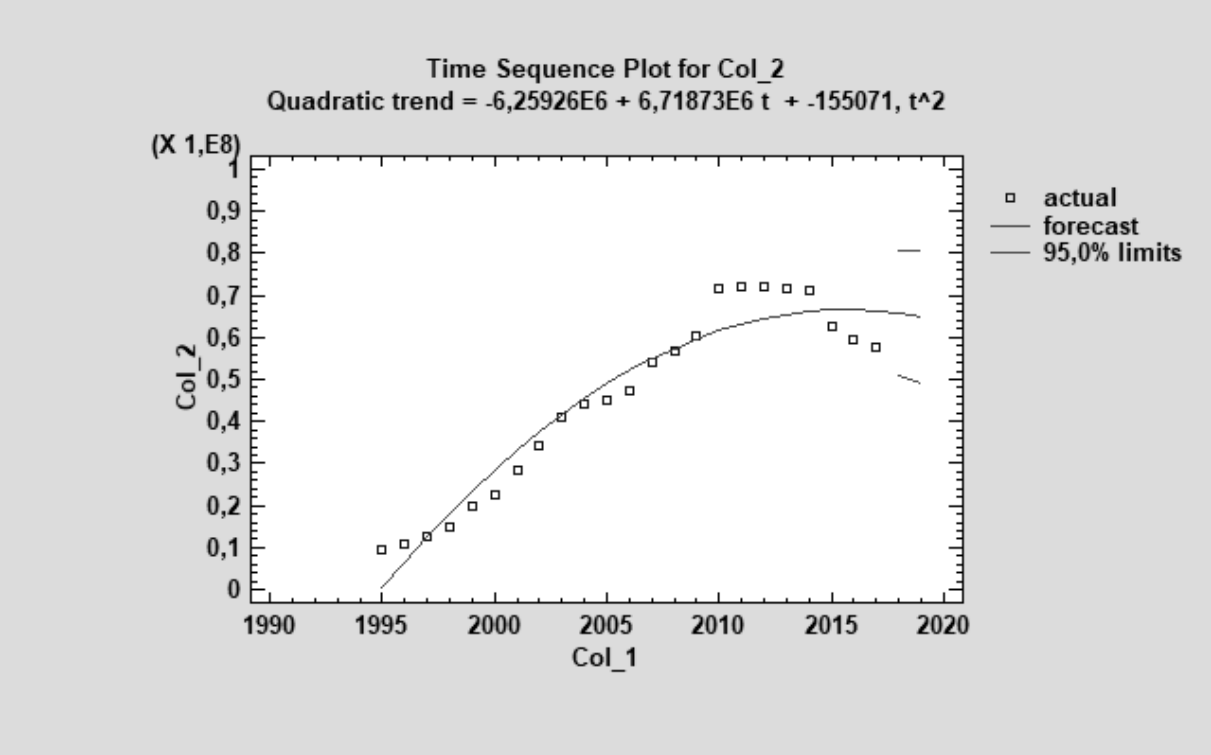
Other indicators used for trend analysis include: p-value, t-test and F-ratio. Based on the results of these indicators, using the software STATGRAPHICS Centurion XVI was selected the best model – quadratic trend.

Trend function forecast is: $\widehat{T_t} = -6\,259\,260\,000 + 6\,718\,730\,000t - 155\,071t^2$.

Forecast for next two periods is – point for year 2018 CZK 65 669 400 000 (interval CZK: 50 955 300 000 – 80 038 360 000) and point for year 2019 CZK 64 789 700 000 (interval CZK: 49 183 000 000 – 80 396 400 000). Compared with results of previous published

analysis (Benetti, 2018) the point estimation was for year 2017 CZK 70 511 000 000 (interval CZK: 56 552 400 000 – 84 471 300 000) and point for year 2018 CZK 70 729 300 000 (interval CZK: 55 850 200 000 – 85 608 400 000). The estimation for year 2017 was 13 148 317 000 higher.

Figure 4 Time Series Equalization by Quadratic Trend and Forecast of Development for Next Two Years



Source: own elaboration

4 Conclusions

The predicted development of the gross premiums written in life insurance according to the selected time series model for the following two periods **–** 2018 and 2019 **–** has a decreasing tendency. If the model prediction would be fulfilled, it would indicate a positive development in the use of life insurance products. However, it is questionable whether declining trends in the use of traditional life insurance products, death and survival insurance, rather than suggesting a change in clients' interest in other products **–** such as the life insurance product linked to the investment fund. On the contrary, the increase in the use of life insurance products that are linked to the investment fund does not necessarily imply a positive development in the use of life insurance products, as the investment life insurance products are not the classic investment products but rather the investment instrument (when the reasonable amount for the risk of death is not met). This could be a basic research question for further research. From the above results, it can be assumed that the development of written life insurance has unhealthy development on the Czech insurance market. The situation with the investment life insurance product is very unstable. From the results above, it can be assumed that the development of written life insurance has unhealthy development on the Czech insurance market. The situation with the investment life insurance product is very unstable. Already in the press, information was received in the press that many clients of insurance companies are suing for the invalidity of the investment product life insurance product. Not only from this point of view can the product of investment life insurance be more a threat than a market opportunity.

Acknowledgments

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Corporate Bankruptcies in the Czech Republic: The Development Over the Last Decade

Karina Benetti

Unicorn College s.r.o.
V Kapslovne 2767/2, 130 00 Praha 3, Czech Republic
E-mail: benetti.kari@gmail.com

Abstract: *This paper deals with the analysis of development of corporate bankruptcies in the Czech Republic over the last decade. Corporate bankruptcies are an inherent element of the market economy. In the Czech Republic in 2006 was published a law no. 182/2006 Coll., On Bankruptcy and Its Resolution (Insolvency Act), which came into effect from January 1st, 2008. This law came into effect just at a time when the new financial crisis started getting stronger. This crisis has affected the development of corporate bankruptcies not only in the Czech Republic but also in other countries. Corporate Bankruptcies (Mączyńska, 2009) are the necessary selection mechanism in the world of business and have an important rationalizing function – they rid the market of entities that are unable to meet the appropriate efficiency requirements. The aim of this paper is to analyze the development of corporate bankruptcies – the comparison between the development of corporate insolvency proposals and corporate bankruptcies (using total and monthly data) in the Czech Republic over the last decade – in the period 2008 to 2017 with a forecast for 2018. The software STATGRAPHICS Centurion will be used for this analysis. The data needed to analyze the development of corporate insolvency proposals and corporate bankruptcies has been taken over from the company Creditreform, s.r.o. Czech Republic.*

Keywords: corporate bankruptcy, corporate insolvency proposals, development, financial health.

JEL codes: G31, G33

1 Introduction

From January 1st, 2008 the law no. 182/2006 Coll., On Bankruptcy and Its Resolution (Insolvency Act), which was published in 2006 came into effect. This law regulates not only bankruptcies of companies, but also personal bankruptcies. In the Czech Republic Bokšová and Randáková (2015), Bokšová et al (2014), Hospodka et al (2015) and Maixner et al (2014) published analysis results of personal bankruptcies in recent years. In this view bankruptcy models (Čámská, 2012) and basic characteristics of enterprises, which are in insolvency (Čámská, 2013), are very important. The analysis of the business property's changing trends of the entity should be one of the most important tasks of the financial analysis for the assessment of the financial situation of the enterprise (Pakšiová, 2017). Detailed analysis of corporate insolvency during the crisis years (with data analysis from 2008 to 2013) were published by Kislingerová and Schoenfeld (2014), Benetti (2016 a, 2016 b and 2017) and forecasts of corporate insolvencies for the period 2013–2017 were published in 2013 by Kislingerová (2013), Benetti (2017). However, no one has engaged in research of corporate bankruptcies within individual regions in the Czech Republic and their effects on their development (or economic performance).

The aim of this paper is to analyze the development of (using total and monthly data) corporate bankruptcies – the comparison between the development of corporate insolvency proposals (it means according to the law no. 182/2006 Coll., at the insolvency court filed a petition to initiate insolvency proceedings) and corporate bankruptcies (it means according to the law no. 182/2006 Coll., the debtor is in bankruptcy, if he has more than one creditor, a pecuniary obligation for more than 30 days after maturity, and he is not able to repay at the same time) in the Czech Republic over the last decade – in the period 2008 to 2017 with a forecast for 2018. The software STATGRAPHICS Centurion will be used for this analysis. The data needed to analyze the development of corporate insolvency

proposals and corporate bankruptcies has been taken over from the company Creditreform, s.r.o. Czech Republic.

2 Methodology and Data

In the research, scientific methods were particular used: induction, comparative analysis, synthesis of partial knowledge, elementary statistical analysis and dependence analysis.

For elementary statistical analysis were used the following selected three indicators (Hindls, et al, 2000):

- the first difference (absolute gain, $_1\Delta_{t\ IN}$ – for corporate insolvencies and $_1\Delta_{t\ BA}$ – for corporate bakruptcies) (1)

$$_1\Delta_t = \Delta_t - \Delta_{t-1} \ . \tag{1}$$

- the average absolute gain (2) and

$$_1\overline{\Delta} = \frac{\sum_{t=2}^{n} {}_1\Delta_t}{n-1} = \frac{y_n - y_1}{n-1}, \tag{2}$$

- the average growth coefficient (3)

$$\overline{k} = \sqrt[n-1]{\frac{y_n}{y_1}} \tag{3}$$

where n is the number of values (in this paper n = 120).

For the dependence analysis, the software STATGRAPHICS Centurion XVI was used. For the analysis were used secondary data from Creditreform (2017).

3 Results and Discussion

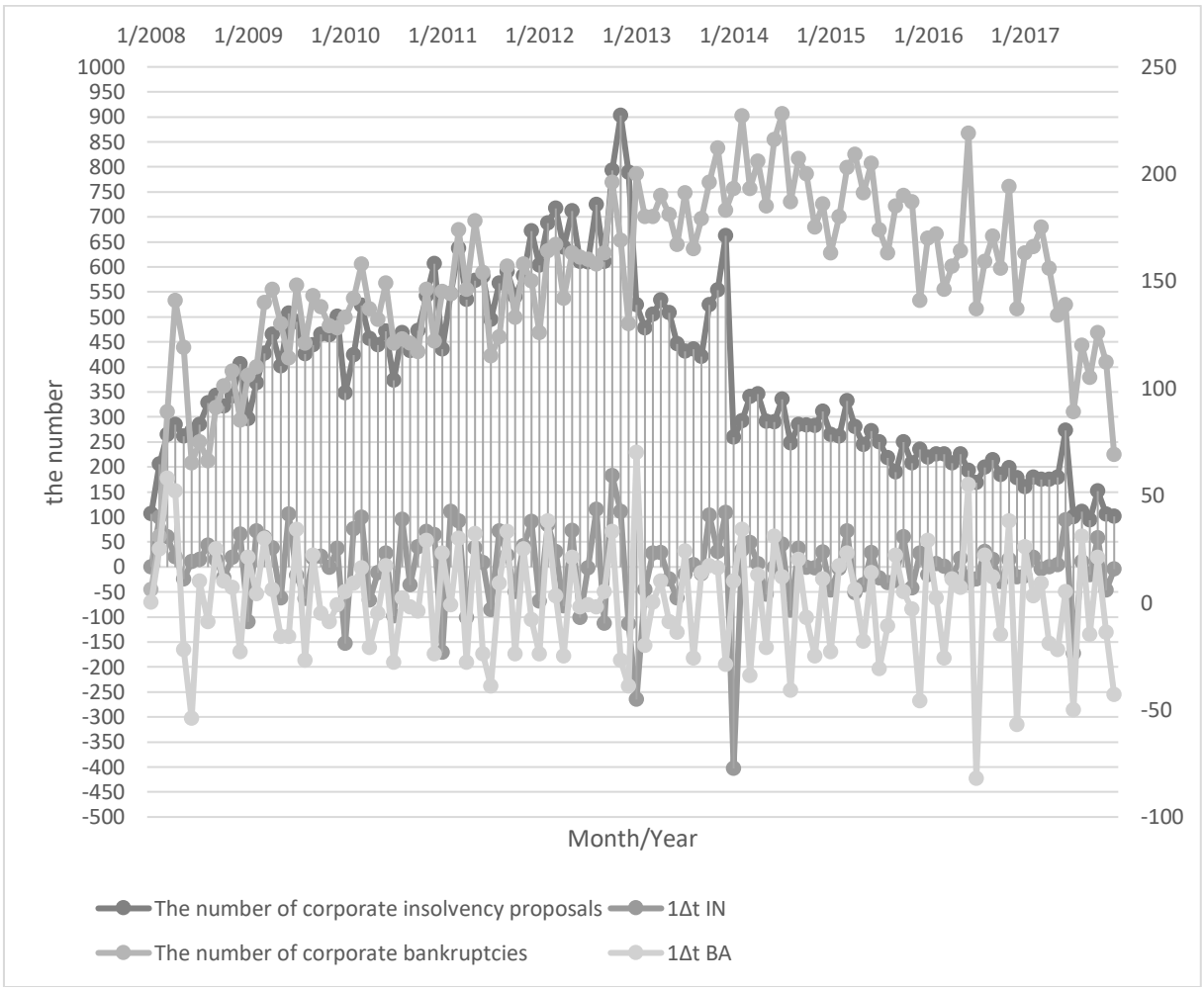
The results of elementary statistical analysis, by selected three characteristics, of development of number of corporate insolvency proposals and corporate bankruptcies are given below. The basic development of number of corporate insolvency proposals and corporate bankruptcies with development of its first difference illustrates Figure 1.

According to the development of the values specified in Figure 1 can be deduced that the observed characteristics were examined over a period of very fluctuating development. For this reason, does not make sense to describe the examined values other statistical characteristics (such as e.g. coefficient growth, growth rate and increase rate). For a basic overview of the development of the examined values sufficient to indicate the results of absolute average gain and average growth coefficient.

The result of average absolute gain is for corporate insolvencies proposals –0.04202 and for corporate bankruptcies 0.529412.

The results of average growth coefficient are for corporate insolvencies proposals 0.999594 (which corresponds to –0.0406%). and for corporate bankruptcies 1.020736 (which corresponds to 2.0736%).

Figure 1 Development of Number of Corporate Insolvency Proposals and Corporate Bankruptcies with Development of its First Difference



Source: author from Creditreform (2018)

The automatic forecasting function was used for the forecasting of the corporate insolvency proposals and corporate bankruptcies in Czech Republic. The ARIMA (0,1,2) model was selected for the forecasting of the corporate insolvency proposals by the results of the p-value, the standard error, the root mean squared error (RMSE), the mean absolute error (MAE), the mean absolute percentage error (MAPE), the mean error (ME) and the mean percentage error (MPE). The results of selected indicators for different ARIMA models see in Table 1. Forecasted values of number of corporate insolvency proposals for the Czech Republic for January 2018 was point value 113.219 and from February to June 2018 was 115.449. The number of corporate insolvency proposals which was reported (Creditreform, 2018) for January 2018 was 121. The forecast by the selected model was accurate only 95.04 %, which corresponds to the selected confidence interval. The number of corporate insolvency proposals which was reported for February was 112 and for March 131 (Creditreform, 2018). The forecast by the selected model was 97.39 % for values in February, which corresponds to the selected confidence interval. The forecast by the selected model was accurate only 85.7 % for values in March, which does not corresponds to the selected confidence interval. If we change in the program Statgraphics the analysis options – by the ARIMA models we not optimize model order and not optimize parameters. By the using of function of automatics forecasting options we have another result – the ARIMA (2,2,2) model was selected with forecasting for January 2018 in value 111, for February 2018 in value 100 and for March 2018 in value 97. The forecast by the selected model was accurate only 90.99 % for values in January, 88.00 % for values in February and 64.95 %, which does not corresponds to the selected confidence interval.

Table 1 Results of Selected Indicators for Different ARIMA Models

MODEL	RMSE	MAE	MAPE	ME	MPE
ARIMA(0,1,2)	71.2976	51.2254	14.9138	-0.51787	-3.39436
ARIMA(1,1,1)	71.7079	51.248	14.8673	-0.47211	-3.383
ARIMA(2,1,0)	71.9718	49.4441	14.562	-0.20137	-2.99306
ARIMA(2,1,1)	71.4841	50.8454	14.7782	-0.51198	-3.33274

Source: author

For the forecasting of the corporate bankruptcies was by the results of the p-value, the standard error, the root mean squared error (RMSE), the mean absolute error (MAE), the mean absolute percentage error (MAPE), the mean error (ME) and the mean percentage error (MPE) selected ARIMA (0,2,2) model. Results of selected indicators for different ARIMA models see in Table 2.

Table 2 Results of Selected Indicators for Different ARIMA Models

MODEL	RMSE	MAE	MAPE	ME	MPE
ARIMA(0,2,2)	22.4576	16.9632	12.5779	–3.29357	-3.93513
ARIMA(0,1,1)	22.7724	17.2389	12.6029	1.45102	–0.556413
ARIMA(0,1,2)	22.6982	17.1836	12.4361	1.55363	–0.407813
ARIMA(1,1,1)	22.7337	17.1974	12.4608	1.57738	–0.393204

Source: author

Forecasted values of number of corporate bankruptcies for the Czech Republic in January 2018 was point value: 100, for February 2018 was 98, for March 2018 was 95. The number of corporate bankruptcies which was reported for January 2018 was 83, for February was 84 and for March 120 (Creditreform, 2018). The forecast by the selected model was accurate only 83.00 % for values in January, 85.7 % for values in February and 79.2 % for values in March, which does not corresponds to the selected confidence interval. If we change in the program Statgraphics the analysis options – by the ARIMA models we not optimize model order and not optimize parameters. By the using of function of automatics forecasting options we have another result – the ARIMA (2,2,2) model was selected with forecasting for January 2018 in value 88, for February 2018 in value 83 and for March 2018 in value 76. The forecast by the selected model was accurate only 95.40 % for values in January, 98.81 % for values in February and 79.2 %, which corresponds to the selected confidence interval. For values in March was the forecast by the selected model accurate only 63.33 %, which does not corresponds to the selected confidence interval.

For dependence analysis will be used monthly data. Firstly, was conducted multiple variable analysis, summary statistics illustrated Table 3, results from correlations show Table 4 and Figure 2.

The Table 1 shows summary statistics for each of the selected data variables. It includes measures of central tendency, measures of variability, and measures of shape. Of particular interest here are the standardized skewness and standardized kurtosis, which can be used to determine whether the sample comes from a normal distribution. Values of these statistics outside the range of -2 to +2 indicate significant departures from normality, which would tend to invalidate many of the statistical procedures normally applied to this data.

Table 3 The Summary Statistics from Multiple Variable Analysis

	The Number of Corporate Insolvencies Proposals	**The Number of Corporate Bankruptcies**
Count	120	120
Average	385.1	151.35
Standard deviation	177.151	39.4337
Coefficient of variation	46.0014%	26.0547%
Minimum	94.0	6.0
Maximum	903.0	228.0
Range	809.0	222.0
Standard skewness	2.02242	-3.26109
Standard kurtosis	-1.02139	2.61712

Source: own elaboration

Table 4 Correlation

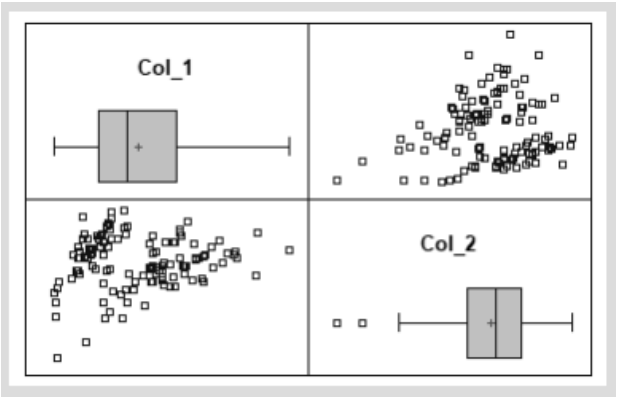
	The Number of Corporate Insolvencies Proposals	**The Number of Corporate Bankruptcies**
The Number of Corporate Insolvencies Proposals		**0.1337** (Correlation)
		(120) (Sample Size)
		0.1454 (P-Value)
The Number of Corporate Bankruptcies	0.1337 (Correlation)	
	(120)	
	0.1454	

Source: own elaboration

The Table 4 shows Pearson product moment correlations between each pair of variables. In this case is Pearson product moment correlation 0.1337. Pearson product moment correlation coefficients range between -1 and +1 and measure the strength of the linear relationship between the variables. Also shown in parentheses is the number of pairs of data values used to compute each coefficient. The third number in each location of the table is a P-value which tests the statistical significance of the estimated correlations. P-values below 0.05 indicate statistically significant non-zero correlations at the 95.0% confidence level. None form the analyzed pairs of variables have P-values below 0.05. This is the reason, why is for this case the Pearson product moment correlations indicator not correct, we must use for example Spearman correlation coefficient.

However, the results shown in Table 4 cannot be properly assessed without visualization - see Figure 2.

Figure 2 Scatterplot Matrix



Source: own elaboration

Note:

Col_1 = The Number of Corporate Insolvencies Proposals

Col_2 = The Number of

From the results in the Figure 2 it is evident that between variables is no correlation. Certainty as to whether between variables is or is not correlation will bring a result of the Spearman rank correlation, the results are given in Table 5.

Table 5 Spearman Rank Correlations

	The Number of Corporate Insolvencies Proposals	**The Number of Corporate Bankruptcies**
The Number of Corporate Insolvencies Proposals		**0.0650** (Correlation)
		(120) (Sample Size)
		0.4781 (P-Value)
The Number of Corporate Bankruptcies	0.0650 (Correlation)	
	(120) (Sample Size)	
	0.4781 (P-Value)	

Source: own elaboration

This table shows Spearman rank correlations between each pair of variables. These correlation coefficients range between –1 and +1 and measure the strength of the association between the variables. In contrast to the more common Pearson correlations, the Spearman coefficients are computed from the ranks of the data values rather than from the values themselves. Consequently, they are less sensitive to outliers than the Pearson coefficients. Also shown in parentheses is the number of pairs of data values used to compute each coefficient. The third number in each location of the table is a P-value which tests the statistical significance of the estimated correlations. P-values below 0.05 indicate statistically significant non-zero correlations at the 95.0% confidence level. None from the analyzed pairs of variables have P-values below 0.05.

From the above analysis results, it is clear that it has not been proved dependence between the number of corporate insolvencies proposals and the number of corporate bankruptcies.

4 Conclusions

This paper had as objective: firstly, to describe the development of the number of corporate insolvencies proposals and the number of corporate bankruptcies in the Czech Republic over the last decade – in the period 2008 to 2017 with a forecast for 2018. Secondly, analyze the dependence between these examinees variables. From the results of the analysis, it is clear that the development of the examined variables during the monitored period was highly variable (fluctuating). Dependence between examined variables could not be prove.

For further research is recommended detailed analysis of corporate insolvencies proposals and corporate bankruptcies by region and then also in terms of business sectors.

Acknowledgments

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Retirement Decisions of Seniors in Poland in the Light of the Qualitative Research

Kamila Bielawska

University of Gdansk
Faculty of Management, Department of Banking and Finance
Armii Krajowej 101, 81-824 Sopot, Poland
E-mail: kamila.bielawska@ug.edu.pl

Abstract: *Although the Polish economy, labour market and retirement system have been going through serious changes over the last thirty years, the effective retirement age in Poland is still relatively low. The aim of the paper was to evaluate if the main reasons to retire among Polish pensioners have been changing through time. The analysis is based on the qualitative research carried out in November 2017 in a form of individual in-depth interviews (IDI) with seniors in different age groups (65-74; 75-84; 85+) for whom the old-age pension is a main source of income. Preliminary results have shown that seniors, despite of their age, tended to retire as soon as possible. Respondents aged 65-74 often indicated that during retirement they were continuing economic activity for a few years and some of them, who quickly retired and did not continue their work, expressed the opinion that from the perspective of time it was a wrong decision. Seniors in older ages (75+) reported disability or health problems as an important reason of early retirement and leaving the labour market (transition from disability pension to old-age pension was treated as a natural path). This factor was less visible in opinions of younger retires. Few of them pointed out that they retired as they wanted to take the advantage of a leisure time. A retrospective look at pension decisions indicated as the results of the conducted study may provide some interesting conclusions for public policies in the field of pension systems.*

Keywords: retirement, decisions, Poland, effective retirement age

JEL codes: D1, H55, J22, J26

1 Introduction

The process of inactivation of older workers is complex and influenced by different factors: individual features (health status, competencies, values and motivations) and institutional determinants of working lives, i.e. statutory retirement age (see i.e.: Barnes-Farrell, 2003; Chłoń-Domińczak, 2017; Riedel and Hofer, 2013). The institutional factors, as recognized in many studies (see i.e.: Blondal and Scarpetta, 1998; Duval, 2003; Bassanini and Duval, 2006), were important obstacles in prolonging working lives of workers.

Since the early nineties of 20th century, Polish pension system has faced several reforms, of which the most important was the reform of 1999. This reform changed the structure (from mono to multi-pillar system), pension formula and methods of financing pensions (Bielawska et al., 2015). There are still few subsystems for military service, judges, prosecutors and farmers but the main mandatory retirement scheme covers most economically active people in Poland (non-agricultural workers, contractors and self-employed). The pension formula has been changed from DB to DC (NDC in the first public pillar) but in fact it is a hybrid solution as it still provides the guarantee of the minimum pension in its mandatory part for insured persons having minimum period of insurance (20 years women and 25 years men). The early retirement has been successively phased out and limited to miners. The NDC formula was expected to keep people longer in employment and more eager to postpone retirement as it increases pension wealth (Palmer, 1999; Holzmann, 2017). For full-career workers with average earnings it provides adequate pensions, but those with shorter employment records or with breaks in careers due to the childbirth or family care which are not sufficiently compensated, increases the likelihood of relative poverty (Chłoń-Domińczak et al., 2012).

Most of the institutional factors of early retirement in Poland has been successfully phased-out. Additionally for a limited period of time, from January 2013 to September 2017, the retirement age started to increase by 3 months each calendar year from the level of 60 years for women and 65 years for men, to reach 61 years 3 months and 66 years 3 months respectively for women and men. Since October 2017 the retirement age in Poland was brought to the 2012 levels, what caused the increase in number of pensioners by 500 thousands). The consequences of decreasing the retirement age in Poland have been widely discussed in the literature also in terms of adequacy of future benefits (Szczepański, 2017).

In this paper, the author investigates the motives determining the retirement decisions of seniors in different age groups in the light of institutional changes in Polish pension system. The paper aims to evaluate ex-post retirement decisions and seeks the answer for the questions if this retrospective view on timing the retirement has been changing through the decades.

2 Methodology and Data

To understand the motives of people in older ages determining their retirement decisions a qualitative research has been conducted in a form of individual in-depth interviews (IDI). Respondents were asked about the date of the retirement and the factors which influenced their retirement decisions. The interviewed persons were asked if they used any social transfers prior to the retirement, if they were entitled to early retirement and had they considered postponing the date of the retirement. The IDI scenario also contained the questions about the financial situation on the retirement, economic activity combined with taking the old-age pension. The qualitative research allowed to investigate the different reasoning leading to retirement decisions. The research also provided the opportunity to get a retrospective overview of undertaken decisions, what according to the knowledge of the author of the paper, is the first attempt of a such kind for the retirees in Poland.

IDI's were conducted between October and November 2017 with 45 seniors, in three age categories:

- 65 - 74 (17 interviews)
- 75 - 84 (16 interviews)
- 85 and more (12 interviews)

For all respondents, the public pension was the main source of income of their households. Seniors who took part in interviews were additionally differentiated by sex, area of residence (urban and rural areas) and number of people in the household. The structure of interviewed seniors reflected a wide range of years spent on retirement that is from 2 to almost 30.

Outcomes of the IDI study presented in this paper are a part of the project titled "Retirement Risk in the Light of the Forecasted Changes of the Demand for Consumption Goods and Services of Seniors in Poland" financed by National Science Centre, Poland (UMO-2016/23/B/HS5/03768).

3 Results and Discussion

The oldest interviewed seniors retired at the beginning of the nineties of the 20th century, the youngest - two or three years ago. The time in which the respondents were approaching or reaching retirement age had an influence on making decisions about retirement.

The main observations from the research indicate that most of the interviewed seniors decided to retire as soon as possible. For many of them it was natural consequence of the disability (especially for the oldest respondents, who were granted the disability pension prior to the retirement). Others linked the moment of retirement (acceleration or delay of the transition from work to retirement) with the level of income, health status, family relationships, as well as external factors, such as possibility to keep the employment in the coming years, bridging programs for people in pre-retirement age, etc.).

Those who had retired in early nineties, indicated that when they met the retirement qualifying conditions, they used them immediately. It was a natural response to the unstable situation on the labour market and the growing number of bankruptcies of enterprises (also these owned by the state). Within this group of the interviewed seniors the invalidity also played a role in retirement decisions. Up to 1997 the criteria for the invalidity pension were liberal and constituted a part of the social and economic policies in the beginning of transition from centrally-planned to market-orientated economy. The disability pensions replaced the invalidity pensions in 1997 and required the evaluation not only the general health status but its influence on the employment possibilities. Therefore, the oldest respondents were pushed into retirement mainly by the situation on the labour market and the health status. In general, they were reconciled with the fact of retirement, then and now they have not seen any other possibility at that time. Some of them also underlined the role of the pressure of the employers and other (younger) workers to leave the workplace. This aspect occurred in the opinions of respondents (also younger ones) despite their professional status, education level or material status. An illustration of this phenomenon may be the following statement of one of the interviewed women: "I had been working in a company in a managerial position. Because of my age (60), an atmosphere in the company was difficult to accept. I felt it seriously harmful".

Between the younger respondents who retired 10-15 years ago the situation was more differentiated. There was a numerous group of retirees who declared that they wanted to use the early retirement or bridging programs to get the benefit as soon as possible, what underlines the institutional factors influencing the retirement. It is worth to mention that early retirement had put restrictions on the possibility to continue employment by the level of income earned. Seniors with poor health or having the relatives with health problems treated the early retirement path as natural. But those with relatively good health often regretted that they left the labour market, because the reemployment was often impossible due to the lack of the competencies in the new workplaces.

Interestingly, a few women participating in the interviews, who resigned from work to take care of their grandchildren, in the ex-post evaluation of timing of retirement indicated that they could continue employment and support their children financially (i.e. by funding the babysitter). This view confirms the hypothesis that the ex-post evaluation of the retirement timing may change among younger cohorts of retirees.

Seniors who retired solely by their will, just to have "time to rest" were a few. There are some necessary conditions, which have to be fulfilled to fully enjoy the retirement, of which the most important are: sufficient income and good health status.

The research indicates that youngest retires tend to continue employment on full or part-time formal or informal basis even up to reaching the age of 70 or higher. It is an interesting observation as the official statistics of the Social Insurance Institution show that reported periods of employment during retirement last for maximum 24 months after retirement (ZUS 2017). Seniors, who combine the retirement with employment usually are more satisfied with their life, not only in terms of better financial situation. Those who retired when reaching statutory retirement age, as they were pushed into retirement by the younger workers, more often treated it as a loss of opportunities for both sides. They reported that they could share experiences, give advice to younger workers.

It is worth to mention, that the health problems or disability as a main reason for retirement between the youngest respondents was pointed out very rarely.

To provide a broader context for retirement decisions of seniors in Poland, Table 1 presents the changes in effective retirement age. Since the 1999 it has been systematically increasing, what was the result of phasing-out the early retirement and the episode of increase in retirement age (January 2013 – September 2017).

Table 1 Effective Retirement Age in Poland 2000-2016 (Social Insurance System)

Effective retirement age	2000	2005	2010	2015	2016
Men	58.9	58.4	60.1	62.8	63.3
Women	55.9	56.0	59.5	60.1	61.0

Source: Social Security Institution (ZUS)

Over the last seventeen years the effective retirement age increased by 4.4 years for men and 5.1 years for women. This tendency may be stopped by the decrease in statutory retirement age in Poland effective from October 2017. In the end of 2017 the representatives of the government argued that decrease in retirement age was positive as 40% of people who applied for the old-age pension (approximately 200 out of 500 thousands people) were not economically active before claiming a pension. Therefore the earlier access to old-age pension allowed for protection against poverty (old-age pension was higher than other social transfers especially for those, who met the criteria for the minimum guaranteed pension).

In this context it is worth to mention, that the recent study on unemployment of the workers age 50+ in Poland proves, that being close to the point at which they are eligible to receive pension benefits leads individuals 'wait' to fulfil these eligibility criteria instead of making an effort to maintain and facilitate their competencies on the labour market (Gałecka-Burdziak and Góra 2017). Reversing the increase in retirement age may support this attitude and cause the serious consequences for further generations. The latest Ageing Report (European Commission 2018) confirms, that under "no policy change" scenario the participation rates of men and women in the labour market in all age categories will be lower that EU averages. In the NDC scheme it means that the replacement rates and benefit rates for retires in Poland may be one of the lowest in the EU.

4 Conclusions

Although the effective retirement age in Poland is still relatively low, the outcomes of individual in-depth interviews with seniors in three age groups show the changing attitude to the retirement. Despite the fact, that interviewed retires most often indicated that they retired as soon as it was possible, the reasoning for retirement timing and further economic activity is different in particular age groups. Between the oldest respondents, who spent on the retirement 30 years or more, there is a belief that in that time there was no other way for them then early retirement. These decisions were taken in unstable economic environment and were also connected with the health problems (disability).

In the younger groups of respondents the issue of health status was not predominant. They more often declared to continue economic activity on the retirement for 5-10 years. Those of them, who quickly retired and did not continue their work, expressed the opinion that from the perspective of time it was a wrong decision, and few underlined it even though they resigned from work to take care over their grandchildren. It is worth to mention, that the respondents pointed out that still some employers and younger employees are not prepared for the changes in age structure of the labour force and tend to push older workers into retirement.

The results shown in the paper indicate that young retires are more able and willing to work longer with the respect of their needs and capabilities. There is a need to strengthen the public policies in the area of inclusion the older workers on the labour market and informing about the consequences of early retirement with the NDC formula.

When they lose their earning capability, the low level of pension deriving form relatively early retirement may be not sufficient to cover for basic expenses and thus put a pressure on the increase in other public spending.

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Determination and Verification of the Key Assessment Indicators for the Insurance Market by Applying the Decomposition Multi-attribute Methods and Regression Analysis

Martina Borovcová[1], Adéla Špačková[2]

[1] VŠB – TU Ostrava
Faculty of Economics, Department of Finance
Sokolská třída 33, 702 00 Ostrava, Czech Republic
E-mail: martina.borovcova@vsb.cz

[2] VŠB – TU Ostrava
Faculty of Economics, Department of Finance
Sokolská třída 33, 702 00 Ostrava, Czech Republic
E-mail: adela.spackova@vsb.cz

Abstract: *The insurance industry is one of the most important sectors of the economy. The insurance market is very much intertwined in the financial markets, therefore assessment of its level is important. The assessment and analysis of the insurance market is done by using selected indicators. The aim of the article is determination and verification of the key assessment indicators for the insurance market by applying the decomposition multi-attribute methods and regression analysis. This paper is focused on the description, verification and application of the multi-attribute decomposition methods AHP and ANP based on the Saaty pair comparison approach. The AHP and ANP methods are described, including the computation procedure. The applicability of the methods is presented at the preferences determination. The linear AHP and nonlinear ANP methods are applied. These methods are applied for insurance market assessment, particularly, for determination of preference indicators for the assessment of the insurance market. We consider importance of setting the ratio for evaluation indicators of the development of the insurance market by applying Saaty methods in the framework of decomposition methods AHP and ANP (insurance penetration ratio, claims frequency ratio, concentration ratio, premium indicator, benefit indicator, number of insurance company indicator and more). Subsequently, a custom regression model is created.*

Keywords: multi-attribute methods, AHP, ANP, Key Assessment Indicators, Saaty Pair Comparison Approach, regression analysis

JEL codes: *C02, C4, G2, G11*

1 Introduction

Multicriteria decision-making is one of options, how to choose optimal variant of certain sets of variants. Only very rarely it is possible to find the very optimal variant which meets all specified criteria. The solution of decision-making problem is more often a compromise variant, which meets just the most important criteria, while it does not meet all the specified criteria the best.

It is preferable to take into account more than one decision-making criterion when making the decision. Although may arise a situation, where the choice of options has been used only a single evaluation criteria. Conditions for the quantitative nature of the criteria would then be enough to organize a variant according to the values of the criteria and the variant with the highest or the lowest value would be the best (optimal) option. However, there are relatively a few decision-making problems with monocriterial character. More and more frequently, it is possible to meet with problems, when the solution variants should be assessed using a larger number of evaluation criteria. Such decision-making problems then have the character of multicriteria decision-making. It is necessary to determine the goals of decision-making for the application of methods of function evaluation of variants and criteria of decision-making.

The aim of the article is to describe the multi-attribute methods AHP (analytic hierarchy process) and ANP (analytic network process), and their applications to verify the simplified example of determining weights partial indicators of the evaluation of the development of the insurance market. Qualitative, quantitative and other indicators of the level of the insurance market are considered in the study.

2 Methodology Description of the multicriteria decision making evaluation of alternatives

The aim of the application of the multi-criteria decision making evaluation of variants is primary finding the best (optimal) variant and layout of these variants from the best to the worst. The best option is usually a variant of the compromise. The compromise solution is the least distant one from the ideal variant, or the furthest away from the variants of basal, while the ideal option is the one that has all the criteria with the best possible value. On the contrary, variant with the worst values of the criteria is the basal variant. Ideal and basal variants are usually hypothetical. If the ideal variant really existed, it would be at the same time, a variant of the optimal solution. However, this situation usually does not occur and therefore any selected solution is the solution to the compromise. Compromise variant must be undominated in all tasks, which means that there is no dominating variant among decision-making variants (Ramík, 1999).

Criteria and methods of determining the values of the criteria

Alternatives are specified by using variants and the measurement of satisfaction depends on each variant. Determination of the criteria is difficult process, which requires certain knowledge of the area. The criteria used to selection of the most appropriate variants can be classified according to several aspect. Firstly it's possible to divide criteria as maximizing (income, profit) or minimizing (cost, loss) according to the level of desirable values. According to the type Secondly it is possible to divide criteria into qualitative and quantitative. These are expressed in the units of measurement.

For calculations and comparison it is usually desirable for specified criteria values yij to be normalized the unit interval, i.e.

$$x_{ij} \in [0;1] \tag{1}$$

Generally it is possible to obtain these values of the criteria from the sub-functions of the utility (value) as

$$x_{ij} = u(y_{ij}) \tag{2}$$

Utility of the criteria, which acquire the worst values is equal to 0 or close to 0, and the utility of the criteria with the best value is equal to 1.

Saaty method AHP and ANP will be used in the application part of the study, therefore the following description will be focused on these methods.

Saaty's method of pairwise comparison

The Saaty's method of weights determination of the criteria can be divided into two steps. The first step consists of a pairwise comparison when finding the preferential relations of criteria pairs. It is presented as so-called Saaty's matrix S. This matrix is symmetric with elements sij. It is possible to determine also the size of this preference expressed by a certain number of points from the selected point scale in addition to the direction of the preference of pair of criteria. Scale of relative importance (descriptors) was recommended by Saaty and it is shown in Table 2. Other values can be used to express sub-preferences. The strength of preferences is expressed in the interval $s_{i,j} \in [0;9]$. The result of this step is to obtain the right upper triangular part of the matrix size preferences (Saaty's matrix). The diagonal element have to be $s_{i,j} = 1$ and for the inverse elements (in the lower left triangular part of matrix) is true the following:

$$s_{i,j} = \frac{1}{s_{j,i}}. \tag{3}$$

The elements $s_{i,j}$ Saaty matrix are estimated shares of weights of criteria v_i and v_j, so:

$$s_{i,j} \cong \frac{v_i}{v_j}. \tag{4}$$

The scales can be obtained in the following manner:

$$\min F = \sum_{i}^{n}\sum_{j}^{n}\left(s_{i,j} - \frac{v_i}{v_j}\right)^2, \tag{5}$$

with the condition $\sum_{i}^{n} v_i = 1.$

Because of difficulty it is possible to obtain the weights using an algorithm based on the geometric average.

$$\min F = \sum_{i=1}^{n}\sum_{j>i}^{n}\left[\ln s_{i,j} - \left(\ln v_i - \ln v_j\right)\right]^2, \tag{6}$$

with the condition $\sum_{i}^{n} v_i = 1.$

The final solution is based on the geometric mean of rows (Saaty, 2010):

$$w_i = \frac{v_i}{\sum_{i}^{N} v_i} = \frac{\left[\prod_{j}^{N} s_{i,j}\right]^{\frac{1}{N}}}{\sum_{i}^{N}\left[\prod_{j}^{N} s_{i,j}\right]^{\frac{1}{N}}}, \tag{7}$$

Table 1 Recommended Point of Scale with the Descriptors by Saaty

The number of points	Descriptor
1	Element A and B are equally important
3	Element A is moderately more important than element B
5	Element A is strongly more important than element B
7	Element A is very strongly more important than element B
9	Element A is extremely more important than element B

Source: Saaty (2006), own processing

The sign of relevant evaluation is the consistency of Saaty's matrix, in other words when the elements satisfy the condition of transitivity the most. It should be emphasized that in many methods this aspect is not accounted. Consistency can be measured using the coefficient of consistency CR (Consistency Ratio). The coefficient for consistent evaluation should be $CR \leq 0{,}1$. Consistency ratio is calculated as following $CR = \frac{CI}{RI}$, where $CI = \frac{\lambda_{\max} - N}{N-1}$, (Saaty, 2010). The characteristic number of the matrix $\lambda_{\max}$ can be

determined by various procedures. One option is $\lambda_{\max} = \frac{1}{N}\sum_{i}^{N}(S \cdot w)_i / w_i$, while w is a vector and $(S \cdot w)_i$ is the *i*-th element of the vector. Furtherly RI (Random Index) is derived from an empirical examination and reaches the following values depending on the number of criteria, see in Table 3.

Table 2 The Value RI According to the Number of Criteria

N	1	2	3	4	5	6	7	8	9	10
RI	0,00	0,00	0,52	0,89	1,11	1,25	1,35	1,40	1,45	1,49

Source: Saaty (2009), own processing

Multi-attribute methods AHP and ANP

Weights or values of criteria are in the case of decomposition tasks set by gradual decomposition from the goal, global groups of criteria, sub-groups, to the the initial sub-criteria and variants. For AHP method these linkages may be linear and for ANP method in the shape of a pyramid or nonlinear with feedbacks. Evaluation of preferences (weights) of the criteria is carried out using the Saaty's method of pairwise comparison.

Local weights (preferences) of the subgroups or indicators with regard to the specified purpose are determined by using Saaty's method of pairwise comparison. The next step is calculation of the global weights including the initial sub-weights. The sum of all sub-weights is equal to one.

In AHP method can be used analytical procedure and also method of supermatrix. In the ANP, it is possible to calculate global weights by using only the method of supermatrix (Saaty, 2010).

For analytical method AHP the indicator subgroup weights are obtained as follows, $w_{i,j} = v_i \cdot v_{i,j}$ where $w_{i,j}$ is global weight of *j*-th indicator and *i*-th group, v_i is local weight of *i*-th group and $v_{i,j}$ is local weight of *j*-th indicator and *i*-th group. By this way we can gradually get all the global weights of primary indicators.

The procedure for the calculation of sought weights in case of AHP and ANP **supermatrix method** can be divided into three steps:

- First step is determination of default supermatrix W In Fig. 1 is shown supermatrix. The local weights $v_{i,j}$ are typed to the columns inside this supermatrix W. The weights of criteria are highlighted from $e_{2,1}$ to $e_{2,n2}$ according to the purpose (criteria) $e_{1,2}$ in Table 1.
- Subsequently the default supermatrix is transformed into the weighted supermatrix $\overline{W}$ so, that sums of columns are equal 1.
- The last step is the calculation of limit (final) supermatrix $\overline{W}^{\infty}$. This supermatrix can be calculated like acyclical weighted matrix as following $\overline{W}^{\infty} = \lim_{k\to\infty} \overline{W}^{k}$,where $\overline{W}^{\infty}$ is limit (final) supermatrix, $\overline{W}^{k}$ is weighted supermatrix without existence cycle, and this supermatrix is *k* times amplified. Global weights are found in the first column considering the goal.

3 Determining the preferences of the indicators assessment of the level insurance market according to the AHP and ANP

We consider a task to set the weights (preferences) of evaluation indicators of the development of the insurance market to apply Saaty's method in the framework of decomposition methods AHP and ANP.

Decomposition for AHP and ANP

Decomposition is designed in two ways from the goal, categories of indicators and each indicator of the assessment of the level of the insurance market is. The first way is linear system of AHP, see Figure 1, and subsequently the second is nonlinear system ANP with typical feedbacks. The intention is to determine the weights of individual indicators of the assessment of the level of the insurance market by using AHP method and ANP method. Analytical procedure and supermatrix method can be used in the case of AHP method.

Qualitative and quantitative indicators of the assessment of the level of the insurance market are taken into account for the purposes of the article. Following indicators are included among qualitative indicators according to the subjective opinion of an expert: insurance penetration (IP) and claims frequency (CF). Following indicators are included among quantitative indicators: gross premium (GP), insurance benefit (IB), number of concluded insurance contracts (IC), average insurance premium on one insured contract (ØIP), number of settled insurance claims (SIC), the average insurance benefit on one insured contract (ØIB), number of employees (NE), number of commercial insurance companies (CC), concentration of the insurance market (CM).

Solution and the result for the method of supermatrix AHP and ANP

Local and global weights based on Saaty's method of paired comparison are calculated in this subchapter. At first the local weights are established and then the global weights. Global weights are calculated by both AHP and ANP method. Analytical procedure and supermatrix method were used in case of AHP. In the second case ANP, was used the only possible way and it was supermatrix method.

Table 3 The Result of AHP and ANP

Goal	Local	Groups	Global - analytical method	Global - supermatrix method	
			AHP	AHP	ANP
Qualitative	75,00 %				
Quantitative	25,00 %	0			
Insurance penetration	33,33 %		25,00 %	**25,00 %**	**19,44 %**
Claim frequency	66,67 %	75,00 %	50,00 %	**50,00 %**	**38,89 %**
Gross premium	28,36 %		7,09 %	**7,09 %**	**11,81 %**
Insurance benefit	23,24 %		5,81 %	**5,81 %**	**9,68 %**
The number of concluded insurance contracts	14,81 %		3,70 %	**3,70 %**	**6,17 %**
The average insurance premium	10,58 %		2,64 %	**2,64 %**	**4,41 %**
The number of settled insurance claims	9,31 %		2,33 %	**2,33 %**	**3,88 %**
The average insurance benefit	5,17 %		1,29 %	**1,29 %**	**2,15 %**
The number of employees	1,83 %		0,46 %	**0,46 %**	**0,76 %**
The number of commercial companies	4,02 %		1,00 %	**1,00 %**	**1,67 %**
Concentration of the insurance market	2,69 %	25,00 %	0,67 %	**0,67 %**	**1,12 %**

∑	100,00 %	100,00 %	100,00 %	100,0 %	

Source: own processing

Determination of regression model

Multi-criterial assessment is a subjective method, where the preferences are divided into the subjective feelings of decision-maker. Final order of idicators assessment of the insurance market level using AHP and ANP method was verified by regression analysis.

Using regression analysis it is possible to study not only the relationship between dependent and independent variable, but also to find out the strenght of this relationship. In this part the indicators were divided into the same two groups qualitative and quantitavive, where subsequently for each group the regression model is created. The model was estimated without constant, because of more accurate results.

To the qroup of qualitative indicators have been included insurance penetration and claim frequency. In this step it is necessary to choose dependet variable. As the most suitable indicator appears claim frequency. Independent variable remains insurance penetration. The results of model estimation it is advisable to test by F-test. The model was verified using F-test, which is used for verification of statistical significance of the model as a whole. According to the results of this test, see Table 5, the model is statistically significant.

Table 4 The Result of F-test

ANOVA[a,b]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	4,973	1	4,973	637,809	,000[c]
	Residual	,125	16	,008		
	Total	5,097[d]	17			

Source: own processing

In the case of the quantitative indicators the selection process was more complicated. The quantitative indicators is nine. As dependent variable was selected indicator of gross premium and other indicators are independent variables. Dependend variable was chosen based on their statistical significance.

In modelling process and the gradual inslusion of explanatory variables can be used three ways. First option is called forward stepwise, it is the upward selection, when it starts to estimate empty model and gradually comes to adding statistically significant variables. The second opposite way is called backward elimination, where all statistically significant variables are included and gradually exclude insignificant variables. The third and last wy is, that first occurs to estimate coefficients by one-dimensional analysis and then the suitable variables are included in model. For the purposes of this paper the second way is choosen.

In this part the regression model was estimated with dependent variable gross premium and others explanatory variables. Statistical significance was verified by F-test, the same like in previous model. According to the results of this test, it is possible to confirm the statistical significance of the model as a whole. The results of F-test, see Table 6.

Table 5 The Result of F-test

ANOVA[a,b]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	277737851214752832,000	8	34717231401844104,000	21740,991	,000[c]
	Residual	14371704054231,875	9	1596856006025,764		

	Total	277752222918807072,000[d]	17
a. Dependent Variable: GP			

Source: own processing

In the framework of the evaluation the materiality of indicators was taken into account the value of significance, which is determined by the statistical significance of each variable. The value of significance should be maximum around 0,05 for a significance level 95 %. When the value is higher than 0,05, the indicator is considered statistically insignificant and should be excluded from the model.

Table 6 Final Regression Model

Coefficients[a,b]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	IB	1,806	,088	,999	20,519	,000
	IC	5,211	,227	,958	22,925	,000
	ØIP	25102,442	1388,655	1,055	18,077	,000
	SIC	-56,205	2,776	-1,074	-20,248	,000
	ØIB	-4216,859	250,568	-,931	-16,829	,000

Source: own processing

The final order of variables was created by correlation matrix of these independent variables and response variable. The final order of the indicators was determined on the basis results of the correlation matrix. Correlation analysis is shown on Table 7.

Table 7 Correlation matrix of variables

Correlations							
		GP	IB	IC	SIC	ØIP	ØIB
GP	Pearson Correlation	1	,882**	,976**	,784**	,841**	,871**
	Sig. (2-tailed)		,000	,000	,000	,000	,000
	N	17	17	17	17	17	17
IB	Pearson Correlation	,882**	1	,906**	,901**	,623**	,950**
	Sig. (2-tailed)	,000		,000	,000	,008	,000
	N	17	17	17	17	17	17
IC	Pearson Correlation	,976**	,906**	1	,789**	,708**	,895**
	Sig. (2-tailed)	,000	,000		,000	,001	,000
	N	17	17	17	17	17	17
SIC	Pearson Correlation	,784**	,901**	,789**	1	,589*	,725**
	Sig. (2-tailed)	,000	,000	,000		,013	,001
	N	17	17	17	17	17	17
ØIP	Pearson Correlation	,841**	,623**	,708**	,589*	1	,624**
	Sig. (2-tailed)	,000	,008	,001	,013		,007
	N	17	17	17	17	17	17
ØIB	Pearson Correlation	,871**	,950**	,895**	,725**	,624**	1
	Sig. (2-tailed)	,000	,000	,000	,001	,007	
	N	17	17	17	17	17	17
**. Correlation is significant at the 0.01 level (2-tailed).							
*. Correlation is significant at the 0.05 level (2-tailed).							

Source: own processing

Based on the results of the regression analysis, it is clear that the order of qualitative indicators is the same as in the case of multicriterial decision making, but the order of quantitative indicators is slightly different.

Table 8 Final Order of the Key Assessment Indicators

Indicators	Order
Claims frequency	1.
Insurance penetration	2.
Gross premium	3.
The number of concluded insurance contracts	4.
Insurance benefit	5.
The average insurance benefit	6.
The average insurance premium	7.
The number of settled insurance claims	8.
Concentration of the insurance market	9.
The number of employees	10.
The number of commercial insurance companies	11.

Source: own processing

4 Conclusions

The aim of this paper was to determine the preferences of indicators of evaluation of the level of insurance market using multi-attribute methods AHP and ANP on the basis of Saaty's method of paired comparison. Methods including multi-attribute decomposition AHP and ANP on the basis of Saaty's method of paired comparison were described. Subsequently analytical method and supermatrix method AHP were applied on the example of determination of preferences of indicators assessment of the level of insurance market. It was found that both approaches AHP and ANP lead to the same results and at the same time, that the results obtained on the basis of linear methods of AHP and non-linear method ANP differ significantly.

Subsequently, the final order was verified by regression model. In the framework of the regression analysis were estimated of total two models. At first was estimated the model with qualitative variables, where the dependent variable was claim frequency. The second regression model was estimated using quantitative indicators, where dependent variable was gross premium. The results showed that the final order according to AHP and regression analysis for qualitative indicators was the same, but the order of quantitative indicators were slightly different.

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Fractal Dimension vs. Non-fractal Risk Measures – Correlation Analysis

Rafał Buła

University of Economics in Katowice
Faculty of Finance and Insurance, Department of Investment and Real Estate
1 Maja 50, 40-287 Katowice, Poland
E-mail: rafal.bula@ue.katowice.pl

Abstract: *In the presented paper the relationships between fractal dimension and chosen non-fractal measures of risk are analyzed and discussed. The main objective of the study is to reveal the nature of these dependencies. Moreover, the article is aimed at analyzing whether the abovementioned relations are stable independently of the length of investment horizon considered and of period chosen. In the article prices of shares listed on the Warsaw Stock Exchange are studied using methods of correlation analysis (various correlation coefficients). Calculated values and results of various statistical tests enable to draw a few conclusions. First of all, it must be noticed that the main scientific hypothesis in case of risk measures like standard deviation ought to be rejected, while e.g. for the omega or Farinelli-Tibiletti ratio we are unable to do it. Moreover, it must be concluded that this regularity is valid independently of the length of the investment horizon and analyzed period of time.*

Keywords: fractal dimension, risk measurement, correlation analysis

JEL codes: G17

1 Introduction

This study is devoted to the quantification of investment risk with particular emphasis on the relationships between risk measures. The inspiration for undertaking the presented research was the observation that, until now, the problem of existing relationships between the fractal dimension and other measures used in the quantification of investment risk has not been properly addressed. What's more, there are virtually no studies focusing on the identified problem. The analysis of the literature justifies the conclusion that the outlined problems are relatively poorly examined.

Among various risk measures, the fractal dimension (*box-counting dimension*) should be considered as particularly interesting. It ought to be noted that this measure has not been proposed *ad hoc*, but its use is a logical consequence of attempts to replace the existing paradigm in finance science based on the use of Brownian geometric motion to modelling asset prices with the fractal market concept. As the basic idea behind this concept is to describe the observed prices by self-similar stochastic processes, the natural consequence of its adoption is the use of adequate instruments to allow for the analysis of the nature of this self-affinity. Thus, the fractal dimension is not so much gaining the right to exist in the world of self-similar trajectories of prices or rates of return, but rather becomes indispensable for the correct measurement of investment risk. Its use is therefore justified on theoretical grounds.

The main purpose of the presented study is to analyze the correlation relationship between the possibly broad spectrum of measures used in the quantification of investment risk and the fractal dimension in relation to shares listed on the Warsaw Stock Exchange.

In addition, the goal of the paper is to examine whether the length of the investment horizon for which risk measures are estimated influences the relationships between them and the fractal dimension.

The third goal of the study is to analyze the time consistency of previously identified relations.

The main research hypothesis is that there are no significant relationships between the fractal dimension and the non-fractal measures of investment risk, regardless of the length of the investment horizon for which they are calculated.

As part of the second research hypothesis, it was supposed that the postulated relations are relatively stable over time.

While conducting the research, the author adopted appropriate statistical methods. The obtained results allowed for a comparative analysis in relation to the strength of the correlation relationship between individual risk measures and the fractal dimension as well as its stability over time. The studies were based on share prices originating from the Warsaw Stock Exchange. All quotations used come from the stooq.com website. The author used the MS Excel spreadsheet and the Visual Basic for Applications language for the calculations.

The present state of knowledge

Conducting the literature research, the author noticed that the problems raised in this study are virtually absent in the literature. Although the concept of a fractal dimension and a new paradigm based on the theory of the fractal market are present in the scientific discourse (Mandelbrot and Hudson, 2004), the issues of relationships between investment risk measures and the fractal dimension remain unexplored.

In one of the first studies devoted to fractal empirical analysis of quotations from the Polish stock market, Zwolankowska (2001) used the quotations of 21 companies and the WIG index levels in the years 1994-1998. She estimated both standard deviations of the logarithmic return rates and the fractal dimension of the price series. The results for the same group of companies, however, referring to the logarithmic and cumulative logarithmic rates of return, were presented in one of her papers (Zwolankowska, 1999). The summary results for the entire period 1994-1998 are presented in the chart below (Figure 1).

As Zwolankowska concludes, in the light of the presented data, it is difficult to postulate the existence of significant relationships between the fractal dimension and standard deviation. This statement, however, was not supported by any in-depth analysis or statistical test, but only by a subjective assessment of ordering the indicated values.

Analogous considerations regarding stock exchange indices published by the Warsaw Stock Exchange were carried out by Orzeszko (2010). It should be noted that although he calculated the standard deviations for the rates of return (though he did not specify them), the fractal dimension (using the Zwolankowska method) – for index levels. The results are collected in the chart below (Figure 1).

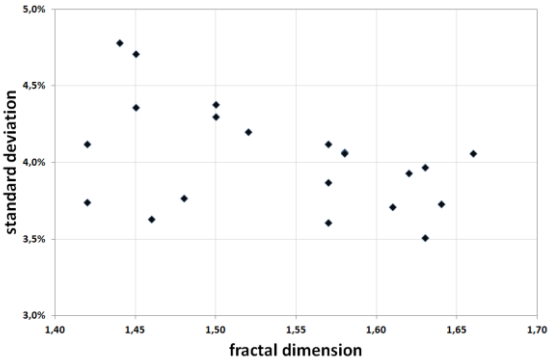
On the basis of the obtained results, Orzeszko formulates the conclusion that the fractal dimension and standard deviation lead to the ordering of the examined indices in a similar way, and then analyzes them in sub-periods. It should be noted that also in this case no formalized statistical inference methods were used, and the sample is very small.

A similar analysis was presented by Zeug-Żebro (2015, 2016, 2017) and Miśkiewicz-Nawrocka (2016) with reference to the standard deviation and taxonomic measure of investment attractiveness based on the Hellwig method (1968). The results obtained in the graphical form are summarized below (Figure 1).

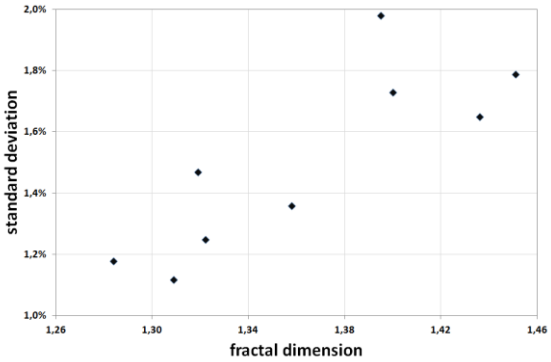
In further analyzes, the Authors do not analyze the relationship between the fractal dimension and other measures in a formalized way (because it is not the purpose of their work), but adopt the subjective assessment of rankings prepared for the presented companies. However, they point out to the small grounds for identifying possible dependencies.

As indicated, there are no in-depth analyzes of the relationship between commonly used investment risk measures and the fractal dimension. For this reason, it was considered appropriate to carry them out, as discussed below.

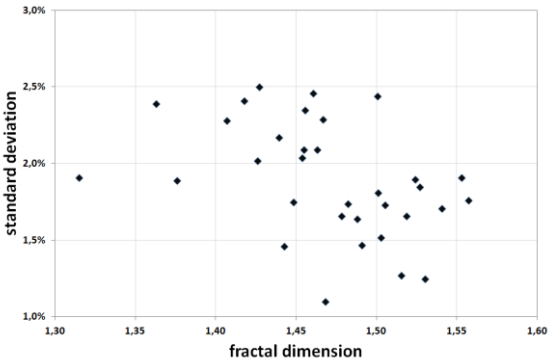
Figure 1 Fractal Dimension and Standard Deviation
Estimated for Various Companies and Indices



Selected companies and the WIG index
(Zwolankowska, 1999)



Selected stock indices
(Orzeszko, 2010)



Selected companies and indices
(Zeug-Żebro, 2015, 2016)

Source: Own elaboration based on Zwolankowska (1999), Orzeszko (2010), Zeug-Żebro (2015, 2016)

2 Methodology and Data

An important issue faced by the author was selection of quantities from among the existing risk measures which can be adopted in further research. While making the choice, several criteria were adopted. In the first place, all measures taking into account in their structure apart from the risk also the level of expected income, were excluded from further considerations. Due to the fact that the goal of the study is to analyze dependencies between the fractal dimension and measures reflecting the riskiness of investments only, using the quantities comparing the income and risk does not seem justified (Bacon, 2013).

Moreover, when making a choice, special attention was paid to measures of a universal nature, the use of which involves the adoption of relatively few additional assumptions. In particular, attempts were made to avoid measures requiring *a priori* assumption of the type of probability distribution or the stochastic process describing the observed rates of return.

In addition, the function measures were removed from the examined quantities. For this reason, the analyzed set did not include variance or semi-variance of the rate of return, or, for example, the kappa coefficient (as functionally related to the omega coefficient) (Frey, 2017, Michalska and Kopańska-Bródka, 2015).

Due to the fact that the paper analyses the quotations of stock prices, the measures specific to fixed-income instruments (such as *duration*) or derivative instruments (such as *the Greeks*) have been eliminated.

In further considerations, the analyzed risk measures have been appropriately grouped due to the similarities resulting either from their construction, or due to the use of certain

probability distribution properties to measure them. The author finally identified 8 groups of risk measures by the way of a subjective assessment and they are compiled in Table 1.

Table 1 An Adopted Division of Selected Investment Risk Measures

Group	Measure	Group	Measure	Group	Measure
A	R	**C**	$VaR_{0,95}$	**F**	*Loss frac.*
	s		$GaR_{0,95}$		$BR(0)$
	d		$DVaR_{0,95;0,95}$		$BR(\mu)$
	d_p		$CVaR_{0,95}$		g_1
	Q		$CGaR_{0,95}$	**G**	$\Omega(0)$
	Δ'		$R_{0,95;0,95}$		$FT_2^2(0)$
	Δ	**D**	$\overline{D}$		$FT_2^2(\mu)$
	g_2		D_{lar}	**H**	$\dim_B(X)$
B	$LPM_2(R,0)$		$D_{\max}$		
	$LPM_2(R,\mu)$		$DaR_{0,95}$		
	$LPM_1(R,0)$		DD		
	$LPM_1(R,\mu)$		UI		
	$UPM_2(R,0)$		PI		
	$UPM_2(R,\mu)$		LR		
	$UPM_1(R,0)$		PR		
	$UPM_1(R,\mu)$	**E**	β_{Sharpe}		
	$LSD_2(R,0)$		$\beta_{+Sharpe}$		
	$LSD_1(R,0)$		$\beta_{-Sharpe}$		
	$GSD_2(R,0)$		BTR_{Sharpe}		
	$GSD_1(R,0)$		β_{CAPM}		
	$LSD_2(R,\mu)$		β_{+CAPM}		
	$LSD_1(R,\mu)$		β_{-CAPM}		
	$GSD_2(R,\mu)$		BTR_{CAPM}		
	$GSD_1(R,\mu)$		*Syst.risk*		
			Spec.risk		

Source: own elaboration

The time series of closing prices for shares listed on the Warsaw Stock Exchange were analyzed based on the quotations provided by the stooq.com website. One of the initial problems was to determine the set of companies for the analysis and the length of time series used in further research. The only assumption that was adopted prior to the initial data analysis was the premise that the time series should represent the same period, so that the comparable risk measures could be obtained. In addition, it was considered desirable to have series with a similar number of observations.

Based on the analysis of the data obtained, it was decided to qualify for further research companies for which the average number of quotations in the year was not less than 227 (with an average of 252 quotations in a year), and the maximum interval in days between quotations was no more than 21 days. The adoption of less strict criteria does not lead to a significant increase in the number of surveyed companies, while the acceptance of more

strict ones results in a drastic reduction in the number of entities analyzed. Finally, in further research, the quotations of 58 companies (1 January 1998 – 31 October 2017, investment horizon length varied from 1 to 252 trading days), 87 companies (1 January 2003 – 31 October 2007, 1 to 189 trading days) and 207 companies (1 January 2008 – 31 October 2017, 1 to 126 days) were used.

In the next step, the logarithmic and cumulative logarithmic rates of return for each investment horizon were calculated. If quotes of a particular company were not available for a given day, then they were replaced with the last available quote. Next, previously indicated risk measures were calculated for each investment horizon. As a result, in relation to the period from 1 January 1998 to 31 October 2017, 14,364 sequences of risk measures were available (each with 58 terms), for the period from 1 January 2003 to 31 October 2007 – 10,773 (each with 87 terms), while for the period from 1 January 2008 to 31 October 2017 – 7182 (each with 207 terms).

When estimating the measures related to the Sharpe diagonal model or CAPM, it was necessary to select a market factor and an instrument playing the role of a risk-free instrument. In the first case, the broad market index was used, which is the Warsaw Stock Exchange Index, while in the latter, the WIBID TN rate (transformed into a logarithmic rate) was used.

The main purpose of the paper is to analyze the relationships between the non-fractal measures of risk and the fractal dimension. For this reason, the focus has been on methods enabling the study of the strength and direction of potential dependencies. To this end, standard correlation analysis methods were employed. Different correlation coefficients were used, i.e. Pearson correlation coefficient, Spearman's correlation coefficient, Kendall's tau and correlation ratio (Domański, 1990), (Kendall, 1962). Due to the possibility of statistically insignificant correlations, in the next step, the hypothesis of the null correlation coefficient between individual risk measures was verified with the use of appropriate statistical tests. The level of significance was assumed 0.05 in all the tests.

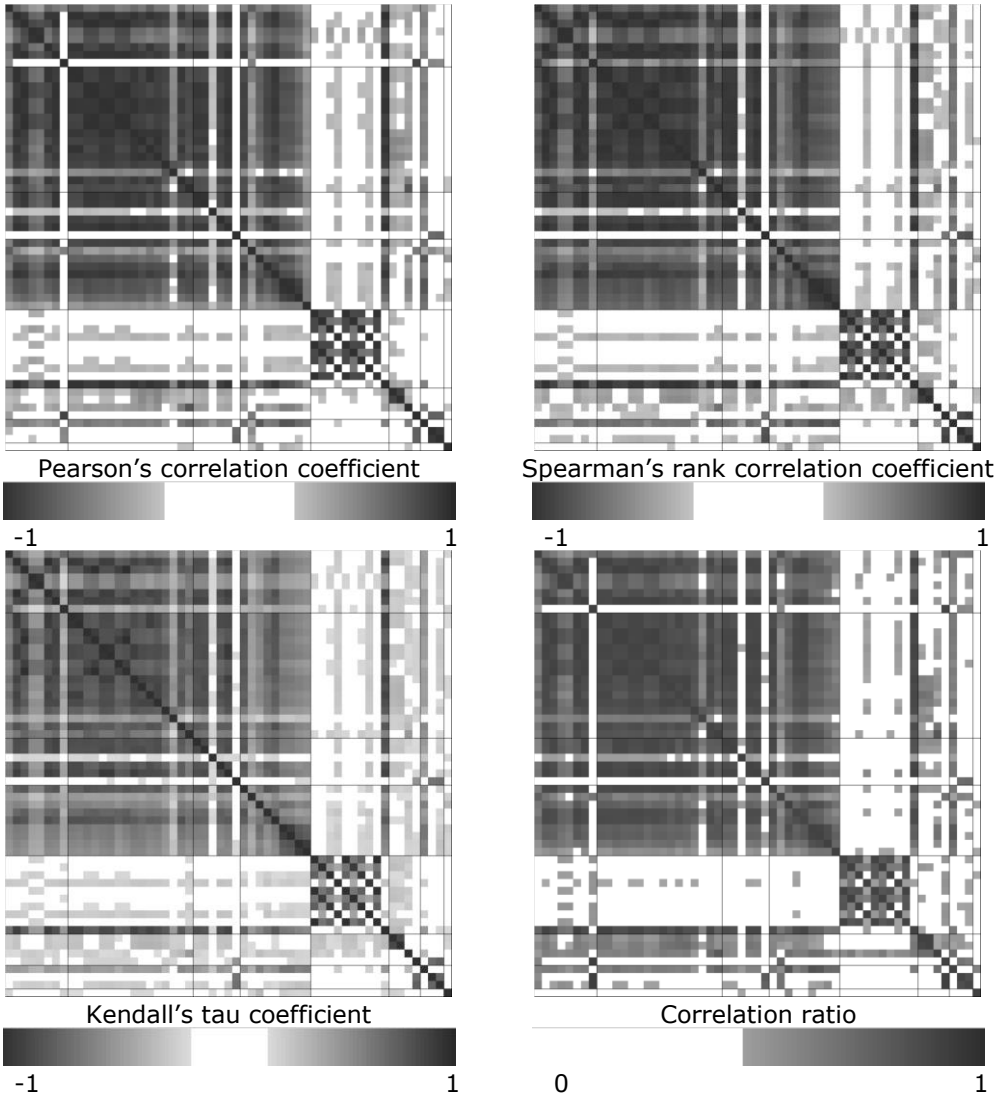
3 Results and Discussion

First of all, all the presented risk measures were calculated. If these measures were defined in relation to a certain threshold value, such as partial moments, the zero and the mean value were taken as the limit value. Because in addition to the relationship between the fractal dimension and the level of classical risk measures, the relationship between the fractal dimension and their fluctuations in time is also significant, additionally available for different time intervals, the measures were scaled by dividing them by the appropriate risk measure calculated for a time interval equal to one session. Both primary and scaled data were analyzed.

In the next step, correlation coefficients were calculated and the null hypothesis was verified. Below, a graphic illustration for the investment horizon length of 1 session is presented (Figure 2).

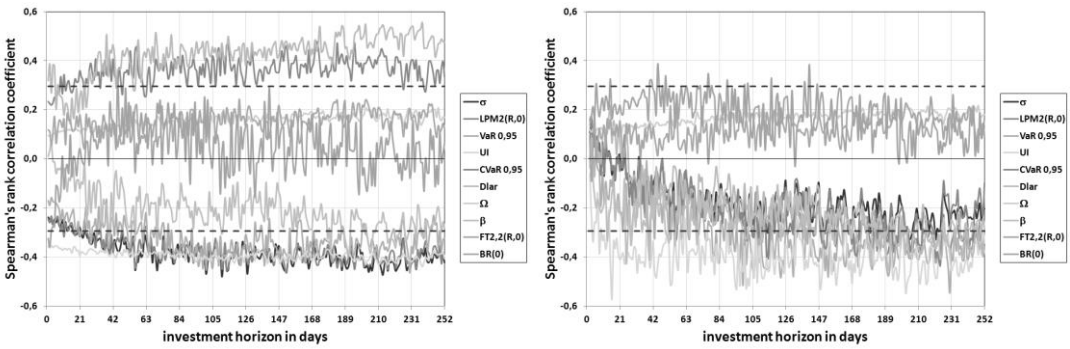
Since the analysis of the correlations between all the measures used and the fractal dimension would not be possible due to the limited size of this paper, it was decided to limit it to presenting a few of the most important ones. Guided by the importance and common use of a given quantity, it was decided to analyze the relationship between the fractal dimension and: standard deviation, standard semi-deviation (relative to zero), value-at-risk, ulcer index, conditional value-at-risk, largest individual drawdown as well as omega, beta coefficient for the classical Sharpe model, Farinelli-Tibiletti ratio to zero and bias ratio (Figure 3).

Figure 2 Correlation Coefficients and Correlation Ratio Between Selected Investment Risk Measures for 1-Session Logarithmic Return Rates on Shares of Selected Companies in the Period from 1 January 1998 to 31 October 2017



Source: own elaboration

Figure 3 Spearman's Rank Correlation Coefficient Between the Fractal Dimension and the Selected Risk Measures in the Period from 1 January 1998 to 31 October 2017



Primary data Rescaled data

Source: own elaboration

When analyzing the calculated values, several regularities can be noticed. Firstly, the quotient measures (bias ratio, omega, Farinelli-Tibiletti ratio) show little or no relation to the fractal dimension, both before and after the re-scaling. Secondly, the measures referring to extreme events (largest drawdown, conditional value at risk) are relatively strongly correlated with the fractal dimension in terms of their absolute level, while the scaled ones show rather negative relationships. Thirdly, classical volatility and stress measures (standard deviation, second partial moment, value at risk) are negatively correlated with the fractal dimension, both at their relative and absolute levels. A similar trend is shown by the beta coefficient and ulcer index.

4 Conclusions

The considerations carried out and analysis of empirical data give some ground to formulate a number of conclusions.

Examining the relationship between the fractal dimension and other risk measures, it has been shown that in relation to the shares listed on the Warsaw Stock Exchange, the nature of these dependencies varies depending on the measure chosen. In the case of measures that can be described as measures comparing the shapes of the probability distribution with respect to a certain cut-off level (such as bias ratio, omega or Farinelli-Tibiletti ratio), the analysis shows that the fractal dimension is not linked with these measures. Lack of dependence is revealed in both static and dynamic aspects. Thus, irrespective of the length of the considered investment horizon, the information provided by these measures is different, and therefore simultaneous use of the fractal dimension and indicated quantities is expedient. The obtained result is also a natural consequence of the essence of the fractal dimension, which refers to the variability rather than the shape of the distribution describing the prices or rates of return. It should be noted that the main hypothesis was confirmed with reference to the above-mentioned measures.

With respect to volatility and stress measures, such as standard deviation, standard semi-deviation, but also value-at-risk or ulcer index between the fractal dimension and the mentioned values, dependencies were found both in relation to their absolute and relative level – in both cases of negative nature. At the same time, the indicated relationships seem to get stronger along with the extension of the investment horizon, which is an additional confirmation of the hypothesis made by the author (Buła, 2013), (Buła and Pera, 2015), (Buła, 2017) namely that for short periods the increase in the fractal dimension means an increase in the risk level *ceteris paribus*, while for the lengthening investment horizons – its decrease – *ceteris paribus*. This study confirms the said hypothesis not only for a static but also a dynamic approach. Thus, for the indicated measures, the main research hypothesis should be rejected.

For risk measures relating to extreme events, i.e. conditional value at risk or the largest drawdown, the conclusions are identical to the conclusions for the previously described group. The only difference is due to the fact that in the case of the indicated measures, their fall is considered to be equivalent to increasing the riskiness of investments, thus the direction of dependence is reversed (i.e. positive). The essence of things remains the same, which again confirms the hypothesis, but for a completely different set of risk measures.

Having presented the nature of the relationship between individual risk measures and the fractal dimension, it should be noted that despite some variability resulting either from the number of companies surveyed or the number of available quotations, the relations are relatively stable over time, as demonstrated by comparative analysis carried out for the analyzed risk measures calculated for three periods: twenty-year, fifteen-year and ten-year. It is true that the analyzed periods were not separable, but in the author's view, the need to have an adequate set of quotations justifies the decision made. Thus, confirmation of the second research hypothesis was obtained. At the same time, it can be stated that the objectives set out by the author have been fully attained.

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Measuring Efficiency in Clinical Departments Using the DEA Approach - A Case of the Polish Hospital

Małgorzata Cygańska[1], Magdalena Kludacz-Alessandri[2], Dimitrios Syrrakos[3]

[1] University of Warmia and Mazury in Olsztyn
The Faculty of Economics, Department of Finance and Banking
Oczapowskiego 4, 10-719 Olsztyn, Poland
E-mail: m.cyganska@uwm.edu.pl

[2] Warsaw University of Technology
The College of Economics and Social Sciences
Łukasiewicza 17, 09-400 Płock, Poland
E-mail: Magdalena.Kludacz@pw.edu.pl

[3] Manchester Metropolitan University
Business School Building
All Saints
Manchester M15 6BH
United Kingdom
E-mail: D.Syrrakos@mmu.ac.uk

Abstract: *Evaluating hospitals' efficiency in Poland is vital considering in the light of limited public funds dedicated to healthcare. As such, employing a mechanism capable of identifying inefficiencies by hospital administrators would be conducive to the quality of the services delivered. The aim of this article is to ascertain the merits of efficiency measures as instruments of monitoring and distributing resources, by focusing on the clinical departments of provincial specialist hospital in Olsztyn in Poland. The hospital under perspective, provides diagnostics, therapy, care, specialist advice, education prevention and health promotion. Efficiency of hospital departments was measured using Data Envelopment Analysis (DEA). The distribution of efficiency and the ranking of clinical departments was compared across surgical and non-surgical departments' profile. Input and output data was collected from the hospital database for 19 578 patients admitted to 14 departments between January and June 2017. The research shows that only 5 clinical departments (35.71%) run efficiently. These were the Departments of Hematology, Gynecology, Vascular Surgery, Rehabilitation and Ophthalmology. Most of them provide surgical procedures. The least efficient was the Department of Transplantology and General Surgery. The paper's findings could potentially inform manager's choices in relation to increasing efficiency. Since hospital managers have more control over their inputs, they may devote more attention to the examination of total inefficiencies generated by excessive input usage.*

Keywords: clinical department efficiency, data envelopment analysis (DEA), input, output

JEL codes: M41, C67, I19

1 Introduction

Hospital health care occupies a special place in all health care systems, and it is the biggest consumer of health care financial resources in Poland and in most other developed countries. For instance, a considerable share (16–48%) of total health expenditure in OECD countries is devoted to the hospital sector. Hospitals are increasingly under pressure to improve their efficiency of operations, as well as improving the quality of the health services provided. This is due to the growing expectations of patients and the huge costs caused by demographic changes. On the other hand, the health care sector is characterized by limited inflow of financial resources whose rules of spending are subject to detailed regulations and supervision. Decision makers are increasingly presented with the challenge of reconciling the growing demand for health care services on the one hand, and the limited financial resources on the other (Nakagawa et al., 2011).

Public institutions' activities are not subject to normal competition rules and are not profit oriented. As governments' subsidies to public hospitals have been decreasing, more efficient use of available resources becomes essential for hospital administrators. As a result, the distribution of financial resources should be linked to the effectiveness of hospitals and other entities providing medical services (Grzesiak and Wyrozębska, 2014).

Efficiency is amongst the most pressing issues in health care and hospital efficiency is one of the key indicators of hospital performance. Efficiency is concerned with the relation between resource inputs (e.g. costs, in the form of labour, capital, or equipment) and either intermediate outputs (e.g. numbers of treated patients, waiting time) or final health outcomes (e.g. life years gained, quality adjusted life years - QALYs) (Palmer and Torgerson, 1999). From a measurement perspective, efficiency can be divided into technical and economic efficiency. In the theory of production and costs of organization, the third aspect of efficiency is also often used - allocative efficiency. Quite often when defining efficiency the authors make only the distinction between technical and allocative efficiency measures, which together comprises the overall (economic) efficiency, and scale efficiency (Varabyova and Schreyögg, 2013).

Economic efficiency implies an economic state in which every resource is optimally allocated to serve each individual or entity in the best possible way while minimizing waste and inefficiency. In health care, economic efficiency implies that society makes choices which maximize the health outcomes gained from the resources allocated to healthcare. Inefficiency means that resources could be re-allocated in a way that would increase the health outcomes produced. Technical efficiency refers to the physical relation between resources (input) and health outcomes (output). It refers to the ability to obtain the maximum possible improvement in outcome (maximum output) from a given set of resources (inputs) or to minimize input factors to achieve a given outcome. (Ludwig, 2008). This paper analyzes only technical efficiency.

In practice, various methods can be used to precisely determine which hospitals and their departments are more active and effective, and to indicate the factors affecting this efficiency. The methods of measuring effectiveness can be broadly divided into three basic groups (Suchecka, 2009):

- ratio analysis - it is a quantitative analysis used to evaluate various aspects of an operating and financial performance,
- parametric methods - e.g. Stochastic Frontier Analysis (SFA), Thick Frontier Approach (TFA), Distribution Free Approach (DFA),
- non-parametric methods - Free Disposal Hull analysis (FDH), Data Envelopment Analysis (DEA).

Nonparametric methods are used to measure the technical efficiency of hospitals and enable the analysis of inputs and results (Vincova, 2005). Data envelopment analysis (DEA) is receiving increasing importance as a tool for evaluating efficiency and improving the performance of manufacturing and service operations for a wide variety of industries and institutions. In recent years, DEA has gained great popularity in healthcare branches and it has been extensively applied in productivity measurement, performance evaluation and benchmarking of organizational units, like hospitals, which use numerous resources to produce multiple products (Cook et al., 2014). There are many contributions in the literature regarding DEA effectiveness in health care sector. The scale of conducted research differs, e.g. research on the efficiency of hospitals within larger units (e.g. administrative) or research on health systems of individual countries. Areas of DEA application in health care sector also include physicians, nursing homes, and health maintenance organizations.

An application of DEA in health care offers several advantages over other techniques. Comparison of three performance methodologies (a ratio analysis, regression analysis, and data envelopment analysis) showed that DEA is superior to other methods because it incorporates an optimizing principle rather than an averaging principle (Nyhan et al., 2000). The DEA approach offers also other advantages over the other ratio methods, such as:

- it combines multiple ratios into a single ratio of productive efficiency;
- it outperforms other methods in identifying sources and amounts of inefficiencies;
- it compares each DMU (e.g. hospitals) to its peers and identifies benchmark facilities for inefficient hospitals (Chilingerian, 1990).

Data envelopment analysis (DEA) is a linear-programming-based technique, established for measuring the relative efficiencies of units delivering similar services, which are called decision making units (DMUs). The input and output data of the units under analysis show what is achieved with the technology presently available. The aim of the DEA is to establish the relative efficiency of each DMU within a sample and identify which units operate efficiently and therefore belong to the efficient frontier, and which of them operate inefficiently. Increasing efficiency of inefficient DMUs is possible by making appropriate adjustments in their outputs or inputs (Ancarani et al., 2009). DEA has the advantage of being able to deal with multidimensional nature of input/output variables and measures efficiency for when multiple outputs and inputs are simultaneously present and provides a single (relative to best) productivity index that is generally referred to as relative efficiency.

This paper employs the envelopment analysis (DEA) as a tool for evaluating the relative technical efficiency of hospital wards at the Polish public hospital in Olsztyn. This method provides a single measure of efficiency of each ward and allows hospital managers to make comparisons of hospital departments using the same set of criteria (inputs and outputs).

2 Methodology and Data

This section introduces the key principles of the DEA as a productivity analysis tool for a hospital. Single efficiency scores have been calculated and compared using hospital wards as decision-making units (DMU). To the authors' knowledge the calculation of ward-specific efficiency scores is not often the unit of non-parametric efficiency analysis, and thus the studies of efficiency within the hospitals, are very limited. The majority of studies make use of the hospital as the decision-making unit, rather than the hospital ward (e.g. Steinman and Zweifel, 2003). The rationale for not using hospital wards as the preferred units of analysis is that intermediate outputs (e.g. discharges and patient days) and inputs (e.g. medical equipment) are very heterogeneous across the departments representing various medical fields. This implies that differences among wards as DMUs due to specialty may be confused with differences in technical efficiency (Ancarani et al., 2009).On the other hand, the study of hospital wards' efficiency could shed further light on managerial and organizational aspects of the central management policy concerning capacity. The organizational structure of hospital may vary, but departments serve as the core units of a hospital. The decisions made in the clinical departments will determine the use of resources. This justifies viewing each clinical department as a single decision making unit (DMU).

This model provides the efficiency score in the presence of multiple input and output factors defined as:

$$Efficiency = \frac{weighted\ sum\ of\ outputs}{weighted\ sum\ of\ inputs} \tag{1}$$

Assuming that there are *n* DMUs, each with *m* inputs and *s* outputs, the relative efficiency score of a test DMU *p* is obtained by solving the following model proposed by Charnes et al. (1978):

$$\max \frac{\sum_{k=1}^{s} v_k y_{kp}}{\sum_{j=1}^{m} u_j x_{jp}} \tag{2}$$

$$s.t. \frac{\sum_{k=1}^{s} v_k y_{ki}}{\sum_{j=1}^{m} u_j x_{ji}} \leq 1 \ \forall_i \tag{3}$$

$$v_k u_j \geq 0 \ \forall_{k,j}$$

where
$k = 1$ to s,
$j = 1$ to m,
$i = 1$ to n,

y_{ki} = amount of output k produced by DMU i,
x_{ji} = amount of input j utilized by DMU i,
v_k = weight given to output k,
u_j = weight given to input j.

The fractional program shown as (2, 3) can be converted to a linear program as shown in (4,5). For more details on model development see Charnes et al. (1978).

$$\text{ax } \sum_{k=1}^{s} v_k y_{kp} \tag{4}$$

$$\text{s.t. } \sum_{j=1}^{m} u_j x_{jp} = 1 \tag{5}$$

$$\sum_{k=1}^{s} v_k y_{ki} - \sum_{j=1}^{m} u_j x_{ji} \leq 0 \ \forall_i$$

$$v_k, u_j \geq 0 \ \forall_{k,j}$$

The above problem is run n times in identifying the relative efficiency scores of all the DMUs. Each DMU selects input and output weights that maximize its efficiency score. In general, a DMU is considered to be efficient if it obtains a score of 1, and a score of less than 1 implies that it is inefficient. We used Data Envelopment Analysis Program (version 2.1) to examine the data.

The DEA analysis was conducted in a Polish specialist hospital. The hospital under consideration provides diagnostics, therapy, care, specialist advice, education prevention and health promotion. The unit of analysis was the hospital ward (DMU). Inputs and outputs data was collected from the hospital database and concerns 19 578 patients admitted to 14 departments between January and June 2017. DEA analysis has been performed on DMUs which produce only inpatient care in order to control their potential heterogeneity. The literature (Ancarani et. al., 2009) considers that the main source of heterogeneity among the DMUs is the one between units producing inpatient care versus those producing outpatient care.

Hospitals treat a variety of patients using several different inputs. Inputs and outputs for the DEA analysis were derived based on previous healthcare studies (Kirigia, 2002). Most often, operating costs, the number of hospital beds and Full Time Equivalent (FTE), the number of personnel, total assets (assets), complexity of services measured by the number of clinical services offered, number of doctors and the number of beds are used as inputs. Whereas outputs include: the number of days of hospitalization, the number of surgical procedures, weighted admissions, number of surgical interventions. The input measures used in other studies regarding hospital wards were: doctors' and nurses' gross wages, total personnel costs and materials and energy consumption, whereas the output measures were: the number of in-patients and outpatients, bed productivity, and average turnover interval, number of bed-days, DRG points and income from medical activity (Al-Shayea, 2011; Grzesiak and Wyrozębska, 2014).

Finally, four input measures and two output measures were selected to measure the efficiency for each department. In this paper, medical wages (1), drugs (2) diagnosis tests (3) and the numbers of departments' beds are used as inputs. They are presented in table 1. The first three inputs were measured by costs. Costs in PLN were converted to Euros on the basis of average exchange rate of Polish National Bank (NBP) from 07.05.2018 (1€ = 4,2513).

The largest department, in terms of beds, is Gynecology-Obstetrics and Oncological Gynecology Department. In relation to of medical wages the most expensive is the Cardiac Surgery Department (1383,96€) and Anesthesiology and Intensive Care Department (1464,29€). The last one is also the most expensive in terms of drug costs (2494,34 €).

Table 1 Descriptive Statistics for Data Envelopment Efficiency Model Variables Inputs

Department of	Medical wages costs(€)	Drug costs (€)	Diagnosis tests costs (€)	Number of beds
		Mean (SD)		n
Rehabilitation	273,70 (138,33)	48,48 (76,24)	5,75 (18,63)	5
Transplantology and General Surgery	158,53 (328,41)	185,10 (629,23)	97,88 (142,14)	20
Anesthesiology and Intensive Care	1464,29 (1428,63)	2494,34 (4447,5)	227,26 (274,89)	15
Cardiac Surgery	1383,96 (1206,08)	637,91 (1397,4)	54,17 (60,91)	20
Endocrinology, Diabetology and Internal Diseases	75,13 (70,10)	132,29 (712,44)	36,84 (55,20)	18
Traumatic, Orthopedic Surgery and Spine Surgery	84,01 (65,71)	50,39 (98,66)	32,67 (60,73)	35
Neurosurgery	86,30 (83,41)	127,78 (309,87)	70,79 (150,62)	30
Gastroenterology	150,97 (166,61)	80,86 (239,85)	83,72 (89,70)	16
Neurology	124,07 (102,19)	141,56 (577,43)	98,92 (181,62)	24
Vascular Surgery	107,76 (140,81)	123,03 (315,38)	175,67 (257,34)	20
Ophthalmological	42,70 (41,31)	43,93 (84,76)	2,75 (16,56)	18
Hematology	153,60 (365,29)	563,38 (1015,5)	60,15 (212,40)	14
Cardiology	62,66 (96,60)	61,55 (214,69)	16,91 (39,64)	45
Gynecology-Obstetrics and Oncological Gynecology	70,25 (117,45)	81,98 (434,63)	12,98 (53,89)	76

Source: own elaboration

There is no consensus regarding the measurement of hospital outputs. Generally, the chosen output vector depends on available data and problem to be analyzed (Magnussen, 1996). In this paper we used as outputs number of bed days (1) and number of inpatients (2) that are presented in table 2.

Table 2 Descriptive Statistics for Data Envelopment Efficiency Model Variables Outputs

Department	Bed days Mean (SD)	Patients (n)
Rehabilitation	28,58 (11,66)	98
Transplantology and General Surgery	4,98 (5,00)	415
Anesthesiology and Intensive Care	12,04 (11,17)	458
Cardiac Surgery	9,32 (7,04)	472
Endocrinology, Diabetology and Internal Diseases	4,33 (3,14)	892
Traumatic, Orthopedic Surgery and Spine Surgery	4,16 (2,91)	934
Neurosurgery	5,05 (4,48)	1120
Gastroenterology	3,82 (4,29)	1122
Neurology	6,69 (5,11)	1412
Vascular Surgery	5,88 (7,54)	1528
Ophthalmological	2,41 (1,95)	1582
Hematology	3,19 (4,23)	1608
Cardiology	4,16 (3,38)	3094
Gynecology-Obstetrics and Oncological Gynecology	6,75 (5,22)	4843

Source: authors' own elaboration

The biggest clinical department in terms of number of patients is the Department of Gynecology-Obstetrics and Oncological Gynecology, accounting for almost 25% of all admitted patients to the hospital. The longest hospitalization took place at the

Rehabilitation Department (28,58 days) and at Anesthesiology and Intensive Care Department (12,04 days). On average, the shortest stay in hospital was in case of patients admitted to Ophthalmological Department (2,41 days).

3 Results and Discussion

The efficiency measures are summarized in table 3. It is important to note that efficiency scores range from 0 (totally inefficient) to 1 (100% efficient). Based on the paper's results out of the 14 departments included in the analysis, only 5 clinical departments (35,71%) run efficiently, while the remaining 9 (64,29%) were inefficient. Previous studies reported from 41,66 to 48,88% hospital departments run 100% efficient. For example Al-Shayea (2011) reported 4 out of 9 departments (44,44%) perceived as 100% efficient. In turn Hofmarcher et. al, (2002) reported that 20 of 48 operative departments and 22 of 45 non-operative departments had an efficiency level of 100%. We presume that these differences are related to the inputs and outputs used in DEA analysis, what is also confirmed in Magnussen and Nyland (2008) findings. Our study shows that the efficient departments with the highest score were the Departments of Hematology, Gynecology, Vascular Surgery, Rehabilitation and Ophthalmology. Among the efficient departments, 3 (60%) provide surgical procedures, which is similar to Al-Shayea (2011) findings which revealed that half of the 100% efficient departments were surgical (Obstetrics and Gynecology Department and Orthopedic Department). Among the inefficient departments, 1 department (11%) had an efficiency score between 91-99%, 6 (66%) between 70-90%, and 2 (22%) a score below 50%. The least efficient was the Department of Transplantology and General Surgery (38,10% E). Al-Shayea (2011) reported 66,66% of hospital departments with efficiency score below 50%. The reason for such a low efficiency in the departments of the last group (with their efficiencies values maintained below 50%) is the highest levels for input expenditures relative to their outputs. Therefore, in order to increase their efficiencies, the input expenditures for those departments must be decreased through cost control policy. The efficient wards on average admit more patients per year than inefficient wards. The exception is the rehabilitation department, which admits the least number of patients, but on the other hand it features the highest number of bed-days. The frequent explanation is that large amounts of fixed capital in efficient departments allows for the spreading of fixed cost across a greater volume of output. Increasing of efficiency in other wards is possible e.g. by better utilization of existing equipment, eliminating duplications of services and/or equipment, the sharing of overhead costs such as laboratory and diagnostic facilities.

Table 3 Efficiency Measures in Terms of Type of Department

Department	Efficiency (E)	Surgical/nonsurgical	Ranking
Rehabilitation	1,000	NS	1
Transplantology and General Surgery	0,381	S	10
Anesthesiology and Intensive Care	0,714	NS	8
Cardiac Surgery	0,467	S	9
Endocrinology, Diabetology and Internal Diseases	0,745	NS	6
Traumatic, Orthopedic Surgery and Spine Surgery	0,878	S	4
Neurosurgery	0,706	S	7
Gastroenterology	0,865	NS	5
Neurology	0,897	S	3
Vascular Surgery	1,000	S	1
Ophthalmological	1,000	S	1
Hematology	1,000	NS	1
Cardiology	0,924	NS	2
Gynecology-Obstetrics and Oncological Gynecology	1,000	S	1

Source: own elaboration

The DEA approach has demonstrated that 64,29% of clinical departments run inefficiently, and they thus need to either reduce their inputs or increase their outputs in order to be rendered efficient. While the clinical departments' managers/doctors may have limited impact on outputs, they can seek to affect inputs. Due to the nature of

health case involving a better control of inputs than outputs, the DEA input oriented model is used to identify potential improvements applicable in the inefficient departments in order to become 100% efficient. Total inputs reduction needed to make inefficient clinical departments efficient are presented in table 4.

Table 4 Total Input Reduction to Make Inefficient Clinical Departments Efficient

Department of	Medical wages costs (€)		Drug costs (€)		Diagnosis tests costs (€)	
	Original value	Predicted value	Original value	Predicted value	Original value	Predicted value
Rehabilitation	26822,45	26822,45	4750,90	4750,90	563,42	563,42
Transplantology General Surgery	65790,86	25072,76	76816,21	28384,74	40620,83	3872,42
Anesthesiology and Intensive Care	670645,30	70002,60	1142406,00	47070,34	104084,80	59314,15
Cardiac Surgery	653228,00	61111,61	301095,20	101370,70	25567,54	11946,31
Endocrinology, and Internal Diseases	67018,15	49913,74	118006,60	55515,91	32864,93	6846,83
Traumatic, Orthopedic Surgery	78464,29	54344,27	47064,70	41313,29	30510,37	2760,58
Neurosurgery	96654,09	68239,64	143119,80	77396,63	79288,69	10663,74
Gastroenterology	169386,30	71471,97	90726,20	78518,88	93933,37	57616,13
Neurology	175193,60	139030,50	199891,20	179368,00	139671,70	125331,60
Vascular Surgery	164657,50	164657,50	187986,40	187986,40	268430,50	268430,50
Ophthalmological	67553,54	67553,54	69493,22	69493,22	4358,43	4358,43
Hematology	246982,80	246982,80	905910,50	905910,50	96726,47	96726,47
Cardiology	193870,40	171897,10	190433,70	176030,20	52337,05	19389,24
Gynecology-Obstetrics	340242,90	340242,90	397060,30	397060,30	62878,10	62878,10

Source: own elaboration

In this table, the predicted value of an input variable represents the amount to which a given DMU can decrease its consumption of that specific variable. It is noticed that the Departments of: Transplantology and General Surgery; Anesthesiology and Intensive Care; Cardiac Surgery; Endocrinology; Traumatic, Orthopedic Surgery, in addition to departments in Neurosurgery; Gastroenterology; Neurology and Cardiology have to decrease all their input expenses by specific amounts in order to reach the targeted level shown in order to be efficient. If inefficient wards can reduce their inputs to the corresponding predicted target value, then, they would become efficient. In general, nine departments need to reduce their wage costs, drug costs and diagnosis tests costs in order to become efficient. The savings that can be achieved are considerable and in many cases exceed 90%. In the case of Cardiac Surgery Department medical wages should be lower by 91%, which would allow for savings in the amount of 592 thousand Euros. The largest suggested savings for drug costs relate to the Anesthesiology and Intensive Care Department (96%), and for diagnosis tests costs for Traumatic, Orthopedic Surgery and Spine Surgery Department (91%).

4 Conclusions

Clinical departments beside administrative and technical support and ancillary services are core units of a hospital (Magnussen, Nyland, 2008). Because hospital departments are the largest component of the hospital, to a large degree, efficiency of the clinical departments determines the hospital efficiency. The DEA analysis provides information about the surface were inputs are wasted and not utilized in production of hospital services.

With this information, managers will be able to make informed choices in relation to an increased efficiency path. Since hospital managers generally have more control over their inputs, they may devote more attention to the examination of total inefficiencies generated by excessive input usage. However, examinations of output inefficiencies can also provide strategic direction for the hospital by indicating where to increase its efficiency. The DEA is more informative than the other efficiency measurement methods

and can be successfully implemented in situations in which multiple inputs are used for producing multiple outputs. Hospital managers can use DEA results as inputs in decision-making processes involving resource planning, allocation, and utilization. By analyzing output inefficiencies and excess inputs, managers can attempt to make hospital and health systems rational and efficient.

The DEA not only allows for the identification of areas of improvement, but also indicates the realisation of the development. It also addresses questions regarding the strengths and weaknesses of the units and their optimal size. Systematic evaluation of units in the health care sector can bring considerable benefits to hospitals. The analysis and the results derived enhance the understanding of the effectiveness of various departments in comparison with other units. The results also indicate achievable results, scale of possible savings and factors that have the greatest impact on the units' efficiency.

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The Impact of Educational Expenditures and Higher Education Attainment on Employment in V4 Countries

Darya Dancaková

Technical University of Kosice
Faculty of Economics, Department of Banking and Investment
Němcovej 32, 04001 Košice, Slovak Republic
E-mail: darya.dancakova@tuke.sk

Abstract: *This paper provides an empirical analysis of the relationship between government expenditures on education and employment rates within V4 countries by comparison with European top performer: Germany. It is generally known that education is nowadays the most important weapon of nations, recognized as the key driver of productivity and economic growth in the knowledge-based economies. A framework for developing and well-skilled/educated workforce can be achieved through the motivation in the public sector to create, share and transmit knowledge. We start with the assumption that the higher level of education of the working age population may cause an employment growth and thus can have a significant impact on economic growth overall, since the sustainable development of economy and society is closely related to education. The goal of this study is to point out the relationship between government expenditures on education and employment growth with aim to estimate whether government spending on education and the higher level of educational attainment have a significant impact employment rates in selected countries.*

Keywords: employment rate, education level, education, government expenditures on education

JEL codes: I22, I23, J21, J24, H52

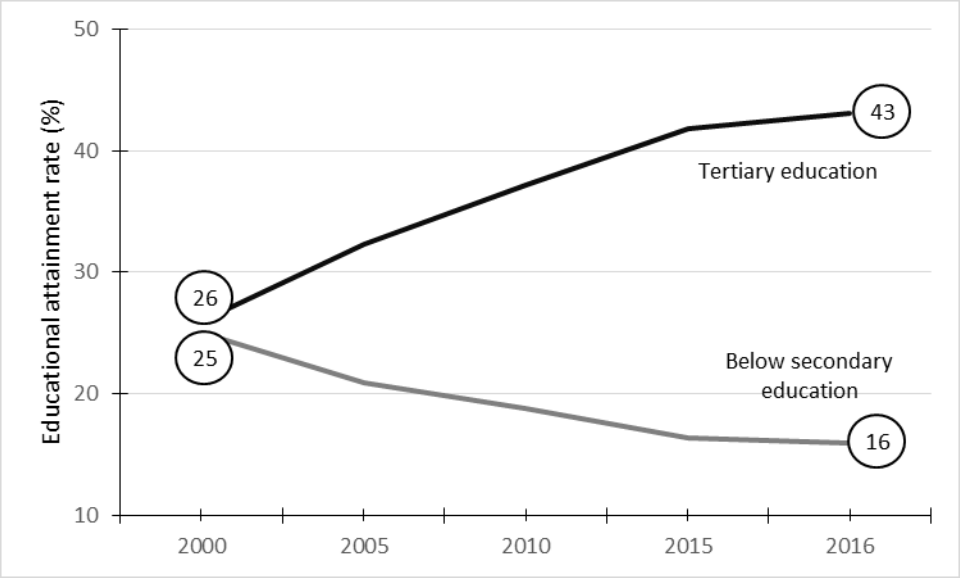
1 Introduction

In contemporary society the meaning of education has changed dramatically. Now we are witnessing the growing demand for intellectual activities related to knowledge production in all spheres of social and economic life. The question of relationship between education and employment has been a subject of discussions for a long time. The essential link between education and economic development of the country has been revealed already during the industrial age by such economists like W. Petty, A. Smith, or J.S. Mill (Youngson,1959). From an economic perspective, education can be viewed as an investment in knowledge and skills of population. Speaking about investing in education, it is necessary to mention Schulz (1960), who proposed to treat education as an investment in individual that becomes an integral part of a person receiving it, and therefore it consequences shall be handled as a form of capital referring to the human capital. The human capital theory was popularized by Becker (1992) and it became one of the most important theories of modern economics. It puts emphasis on education of individuals, since the well-skilled labour promotes economic growth, individual wellbeing and poverty reduction. Vawda (2003) suggested that investing in people in form of government spending is critical for economic and social development of the country, since it may help to achieve greater equity and efficiency in education among young people. According to the Dissou, et al. (2016), expenditures on education, schooling and training will raise labour productivity, earnings, improve general welfare and foster economic growth. Never-ending learning equips people with new skills, enabling them to express themselves and critically evaluate the world around. Some researchers have also demonstrated that higher education makes employees more productive for carrying out their work (Ng & Feldman, 2009; Kotur & Anbazhagan, 2014). Moreover, the schooling promotes individuals to think creative and makes them able to come up with new ideas and to think out of the box. Additionally, better educated people can benefit from a higher income from their work and they are less at risk of unemployment. This fact has been pointed out by Mincer (1991), as he stressed that better educated workers can enjoy several advantages over less

educated people in the labour market: higher wages, greater upward mobility in income and carrier opportunities, and, finally, greater employment stability. Among other things, Hanushek (2009) asserted that education is an essential element in a global economic competition and investments in human capital will directly affect the improvements in productivity and national income, because national income rises directly with earnings from workers with more qualification and better skills. Promoting and supporting education should be, therefore, one of the top priority areas of government´s development policy around the world. Relationship between higher level of education and employment has been demonstrated by Berger & Parkin (2009), as they found out that graduates with post-secondary and higher education are more likely to be employed in comparison to those who did not continue their studies after attaining a high school.

The recent study "Education at a glance" prepared by OECD (2017), has shown an upward trend towards a higher education in OECD and partner countries. The Figure 1 demonstrates the educational attainment rates (%) among 25-34-year-olds across OECD countries.

Figure 1 Educational Attainment Rate Among Young Adults in OECD



Source: Own elaboration from „Education at a glance 2017", OECD

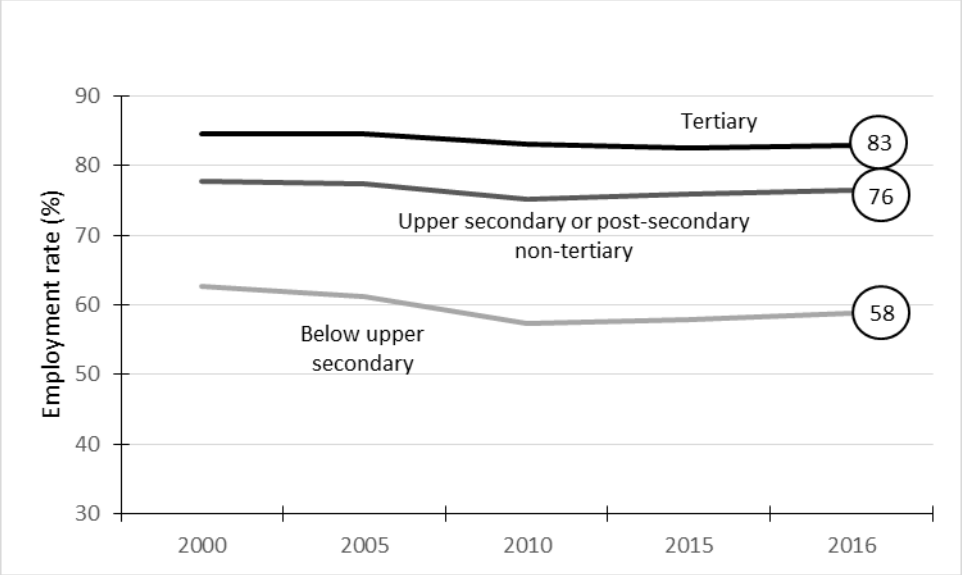
Since 2000, the labour force has become more educated across OECD and partner countries. The share of young people and adults with only one level of education, below secondary education, has tended to decrease over the monitored period and reached only 16 % in 2016 on average across OECD countries. By contrast, we are witnessing the steady growth trend in demand for higher education. The share of young adults with tertiary education has increased over the period, from 26% in 2000 to the new high of 43 % in 2016.

The educational situation in V4 countries has been following the similar trend. The proportion of young adults with tertiary education increased from 11% to 33% in Czech Republic. At the same time, the number of young people with below secondary education hasn't changed dramatically over the mentioned period, from 8% in 2002 to 7% in 2016. Educational patterns in Slovak Republic followed the same trend as observed in Czech Republic. The change in educational attainment rates was slightly bigger in Hungary than in Czech Republic and Slovakia. The share of higher educated young adults has increased rapidly, from 15% in 2000 to 30% in 2016. This trend was followed by a declining number of young population with educational level below secondary education, from of 19 % to 15%. The pattern of Hungarian educational attainment rates can be compared to the pattern in Germany, where the number of less educated people has fallen from 15% to 13%, and the proportion of those with higher education have risen from 22% to 31% over

the whole period. The most striking change in higher education attainment rates among 25-34-year olds was observed in Poland, where numbers have significantly increased since 2000-16, from 14% to 43% and have reached an OECD´s average. The share of young adults with lower education has also decreased dramatically, from 11% to 6%.

Educational attainment is often used as a measure of the skills and knowledge available at the job market. It provides an initial information of employee´s potential capabilities, which a prospective employer will use to decide whether or not the new employee will be hired. The fact that the level of education has a significant impact on the employment rates has been statistically demonstrated by OECD in Figure 2.

Figure 2 Employment Rate by Educational Attainment in OECD



Source: Own elaboration from „Education at a glance 2017", OECD

On average across OECD countries, employment rates for people with tertiary education tend to be higher than for those with lower than secondary education. The latest research has shown that 83% of the population among 25-34-year-olds with tertiary education is employed. The OECD average falls to 76 % for young adults with upper secondary or post-secondary non-tertiary education and to 58% for those without upper secondary education. This implies that individuals with tertiary education have greater chances to be employed in comparison with those who haven't attained a tertiary education. In the current context the economies and labour markets are highly dependent on sufficient supply of well-educated workforce. In Germany, on average employment rates are more than 30 percentage points higher for those with tertiary education than for those who have not completed an upper secondary education. In Czech Republic on average 46 % among 25-34-year-olds with educational level below upper secondary is employed, those who have completed secondary education and those with tertiary have almost the same chance to be employed with employment rate on average of 78%. The employment rates by education level have followed the similar pattern in Germany, Hungary, Poland and Slovakia. The share of young adults with upper secondary and post-secondary non-tertiary education who are employed is on average 75% in selected countries. The proportion of those with tertiary education is on average about 84 %. Graduates with education level below upper secondary have greater opportunities in the labour market in Germany, with average rate of 56%. By contrast, the lowest employment rate of less educated people was observed in Slovakia, on average about 36%. Employment rates development across V4 and Germany confirms the trend that higher education leads to higher employability among 25-34-year olds.

Gylfason (2001) insisted that faster economic development requires better education of population, and consequently it should be accompanied with higher spending on schooling

and training. At the same time, government spending on education and direct job creation could be viewed as a potential engine for generating employment and thus reducing poverty and inequity, as argued by Abdulah, Harun & Jali (2017). Likewise, Pirim, Ownings & Kaplan (2017) examined the impact of educational expenditures on unemployment rates and public health, and concluded that investment in human capital has positive economic outcomes, since the higher spending on individual s education has been associated with decrease in unemployment rates, and hence increase in employment rates.

2 Methodology and Data

The methodology of this study is mostly based on the model proposed by Grimaccia and Lima (2013). Authors confirmed a hypothesis of the positive impact of government educational expenditures on employment growth. To test their assumption, they have designed a model, as shown below:

$$EMPL = f\,(GDP, EDU, UNIV), \text{ where} \quad (1)$$

EMPL is employment rate of working age population (%); EDU is GDP per capita; EDU is government expenditure on education (primary, secondary, tertiary total % of GDP); and INIV is a share of working age population with tertiary education (%).

The model used in this study was based on the model proposed by Grimaccia and Lima (2013), with adding an addition variable to the model: government expenditure on direct job creation. To estimate the effect of selected variables on the employment rate in countries of Visegrad Group and Germany, the ordinary least squares (OLS) method on the panel data in Gretl was used. The annual data was obtained from the OECD database for the period of 2000 to 2014. The base model was specified in the following functional form:

$$\mathrm{EMP} = \alpha + \beta_1 \mathrm{GDP}_{it} + \beta_2 \mathrm{GEXPEDU}_{it} + \beta_3 \mathrm{TEA}_{it} + \beta_4 \mathrm{GEXPJOB}_{it} + \varepsilon_i, \quad (2)$$

where EMP is for dependent variable: employment rate of working age population (%); GDP_{it} is independent variable for GDP growth (%); $GEXPEDU_{it}$ is independent variable for government expenditure on education (primary, secondary, tertiary, total, % of GDP); TEA_{it} is independent variable for a share of working age population between 25-64-year-olds with tertiary education (%); $GEXPJOB_{it}$ is independent variable for government expenditure on direct job creation (% of GDP).

3 Results and Discussion

The main goal of this study was to test the hypothesis of the positive impact of the government educational expenditures on employment rates in selected countries. The second aim was to estimate an impact of tertiary education attainment and government expenditures on education and direct job creation on employment rate. Therefore, the multivariate ordinary least squares regression model including all selected explanatory variables have been built. The growth of GDP was selected as a control variable in the model. However, not all explanatory variables appeared to be significantly related to the employment rate. Hence, the insignificant variables with p-value > 0,05 have been removed from the base model. Table 1 shows the empirical results of the final model:

Table 1 The Final Model of Pooled OLS V4 Countries

Variable	Coefficients	p-value
Constant	79,0949	$2{,}10e^{-31}$ ***
GEXPEDU	-5,36007	$6{,}16e^{-10}$ ***
TEA	0,274341	0,0112 **

Note: ***, **, * denote significance levels on 1%, 5% and 10% respectively. R-Squared is 0,499551. According to White´s test, there is a heteroscedasticity presented in the model, LM = 17,3087. Residuals are not distributed normally, Chi-square=7,3732.

Source: own elaboration

Based on the OLS analysis, the total government expenditure on education and the share of population with tertiary education would appear to be significantly related to the employment rate in V4 countries. However, each unit increase in government expenditure on education is being associated with a decrease of 5,36007 units in employment rates. Consequently, the hypothesis of the positive impact of government educational expenditures on employment rates should be rejected. On the other hand, the tertiary education attainment of working age population positively affects the employment rates in V4 countries with each unit increase in tertiary education attainment being associated with 0,274341 units increase in employment rates.

According to the F-statistic of overall significance, the final model showed in the Table 1 is statistical significant, with p-value = $3{,}82e^{-9}$ and R-Squared value of 0,499551, which indicates that the model explains approximately 50% percent of the variation in the dependent variable - employment rate. To determine whether the residuals follow a normal distribution, the p-value of a normality test was compared to the significance level of 0,05. The p-value = 0,025057 is less than the significance level, so the decision is to reject the null hypothesis (H_0: error is normally distributed) and conclude that residuals do not follow a normal distribution. The heteroskedasticity test showed the presence of heteroskedasticity with p-value=0,00395002, so the null hypothesis (H_0: heteroskedasticity not present) is to be rejected. The diagnostic test of cross-sectional dependence showed that the data is cross-sectional independent, with p-value=0,4503 the null hypothesis (H_0: no cross-sectional dependence) is not rejected.

Since not all assumptions of ordinary least squares approach have been fulfilled, to fix the problem with heteroskedasticity and non-normality of residuals, the logarithmic transformation of the model was made. Table 2 shows the empirical results of the final model:

Table 2 The Final OLS Model with Logarithmic Transformation V4 Countries

Variable	**Coefficients**	**p-value**
Constant	4,46572	$2{,}15e^{-46}$ ***
lnGEXPEDU	-0,413114	$3{,}61e^{-10}$ ***
lnTEA	0,0848173	0,00055 ***

Note: ***, **, * denote significance levels on 1%, 5% and 10% respectively. R-Squared is 0,508736. According to White´s test, there is a heteroscedasticity presented in the model, LM = 15,4833. Residuals are not distributed normally, Chi-square=7,68753.

Source: own elaboration

The data, shown in the Table 2, have been transformed using the logarithm function. As in the previous model, the total government expenditure on education and the share of population with tertiary education would appear to be significantly related to the employment rate in V4 countries. And again, the same counts: the hypothesis of the positive impact of government educational expenditures on employment rates is rejected, since each unit increase in government expenditure on education is being associated with a smaller decrease of 0,413114 units in employment rates. The positive effect of tertiary education on employment rates is being accompanied by 0,0848173 unit increase in employment rates with each unit increase in tertiary education attainment of working age population.

This model is statistical significant with p-value of overall significance =$2{,}27e^{-9}$ and it explains approximately 50% of the variation in the employment rates with R-Squared = 0,508736. The data are cross-sectional independent with p-value of the cross-sectional dependence test =0,751942. However, the logarithmic transformation did not fix the issue of heteroskedasticity presence (p-value=0,0084851) as well as non-normality of residuals (p-value=0,0214128). To fix the problem with heteroskedasticity and non-normality was decided to use weighted least squares method (WLS), which yields greater efficiency than OLS. To identify what explanatory variable causes heteroskedasticity, the dispersion analysis was made. The variable tertiary education attainment has the highest dispersion

among other variables, so it has been chosen as a weight in WLS model. The results of the WLS analysis are shown in the Table 3:

Table 3 The Final WLS Model V4 Countries

Variable	Coefficients	p-value
Constant	78,8942	$1,18e^{-30}$ ***
GEXPEDU	-5,31577	$1,28e^{-9}$ ***
TEA	0,274287	0,0083 ***

Note: ***, **, * denote significance levels on 1%, 5% and 10% respectively. R-Squared is 0,488343. There is no heteroskedasticity presented. Residuals are not distributed normally, Chi-square=7,53149.

Source: own elaboration

Results from the WLS analysis are very similar to the previous two approaches. The significant negative impact on employment rates across V4 countries has government expenditure on education with β coefficient = -5,31577, which means decrease in employment rates associated with each unit increase in government expenditure on education. Contrariwise, employment rates will increase by 0,274287 units, if tertiary education attainment among working age population increases by one unit.

The WLS approach removed heteroskedasticity from the model. According to the F-statistic of overall significance, the WLS model is significant with p-value of $7,10e^{-9}$ and it explains approximately 48,8% of the variation in the employment rates with R-Squared = 0,488343. There is no collinearity between explanatory variables presented. However, the residuals are not normally distributed at significance level = 0,05 with p-value =0,0231504.

The same methodology was applied to estimate the unknown parameters in a linear regression model of employment rate in Germany. The results of logarithmic OLS model, which fixed the issue with heteroskedasticity, are shown in the Table 4:

Table 4 The Final Logarithmic OLS Model Germany

Variable	Coefficients	p-value
Constant	3,87392	$1,83e^{-16}$ ***
lnGEXPJOB	-0,0433545	0,0008 ***
lnGDP	0,00606478	0,5278

Note: ***, **, * denote significance levels on 1%, 5% and 10% respectively. R-Squared is 0,733965. According to Breusch Pagan´s test, there is no heteroscedasticity presented in the model, LM = 4,62606. Residuals are distributed normally, Chi-square=1,35977.

Source: own elaboration

After removing all insignificant explanatory variables, the only variable that appeared to be significant was government expenditures on direct job creation. One would expect that the expenditure on job creation would have a positive impact on the employment rate, but in fact the reverse is true. Each unit increase in government expenditure on direct job creation is being associated with 0,0433545 decreases in employment rate. For comparison only: this variable did not appear to be significant in V4 countries and vice versa the significant variables in V4 models did not appear to be significant in model for Germany.

According to the F-statistic, the model is significant as a whole, with p-value=0,002584 and it can explain approximately 73% of the variation in the employment rate. Diagnostic tests showed that residuals are following the normal distribution (p-value = 0,506676); there in no heteroskedasticity presented in the model (p-value =0,0989611).

Based on the results from the OLS model in Germany, it is not possible to confirm the hypothesis that the model proposed by Grimaccia and Lima (2013) is suitable for explaining the relationship between government educational expenditures and employment rates, as well as to identify the impact of other variables (tertiary education attainment, government expenditure on direct job creation) on the employment rates in selected countries.

4 Conclusions

The main objective of this study was to identify the relationship between government expenditures on education and employment rates within V4 countries and European top performer Germany. The study was based on the model of the employment rate proposed by Grimaccia and Lima (2013). Based on the results of this study, the hypothesis of the positive impact of government educational expenditures on employment rates has been rejected. The effect of government educational expenditures has proved to be negative for employment rates in V4 countries, and even its impact has not been proven in Germany. This fact may be caused by several aspects: the model thus defined is not specified correctly, this means that such combination of selected variables does not make sense from the statistical point of view, or there is no direct relationship between the government expenditures on education and employment rates. Therefore, it seem to be inappropriate to presume that employment rate can be directly affected by the expenditures on education. Moreover, this model did not appear to be well suited for determining the relationship as mentioned above, for several reasons: there was a huge problem with heteroskedasticity and non-normality in the residuals at significance level of 0,05, what means that the amount of error in the model is not consistent across the full range of the observed data. Consequently, the amount of predictive ability in explanatory variables is not the same across the full range of the dependent variable. Thus, the model does not fully explain the behavior of the system as a whole.

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Sustainable Finance Instruments' Risk - Green Bond Market Analysis

Karolina Daszyńska-Żygadło[1], Jakub Marszałek[2], Krzysztof Piontek[3]

[1] Wroclaw University of Economics
Faculty of Management, Computer Science and Finance, Institute of Financial Management
118/120 Komandorska Street, 53-345 Wroclaw, Poland
E-mail: karolina.zygadlo@ue.wroc.pl

[2] University of Lodz
Faculty of Management, Department of Finance and Strategic Management
22/26 Matejki Street, 90-237 Lodz, Poland
E-mail: jmarszalek@uni.lodz.pl

[3] Wroclaw University of Economics
Faculty of Management, Computer Science and Finance, Institute of Financial Management
118/120 Komandorska Street, 53-345 Wroclaw, Poland
E-mail: krzysztof.piontek@ue.wroc.pl

Abstract: *Sustainable finance opportunities for retail investors such as green bonds are the example of instruments that are dedicated to transition of economy towards more sustainable model and are serving as a source of financing for large-scale investments. The paper aims at verification of volatility behaviour of green bond market and relationship of green bond market volatility and conventional bond market volatility. Our study sheds additional light to previous findings and extends the perspective, going beyond analysis of behaviour of S&P green bond index. Our study was conducted on a wider range of available green bond indices in order to draw more general conclusions. We studied daily rates of return in the period of 2014 – 2018 of the S&P Green Bond Index, Bloomberg Barclays MSCI Global Green Bond Index, ICE BofAM Green Bond Index, Solactive Green Bonds Index. Using multivariate GARCH framework we were able to verify and test volatility patterns and assess how the volatility of in the green bond market transmits to broader conventional bond market. Results of our study confirm that all green bond indices, experience large volatility clustering. We also found out that shocks in the overall conventional bond markets tend not to be echoed in the green bond market. Findings of this paper are significant from the perspective of providing informative insights for the investors risk and return characteristics. They also contribute to the development of sustainable finance and risk analysis of sustainable finance instruments.*

Keywords: green bonds, eco-investments, global market, climate change, GARCH

JEL codes: F21, G15, O13, O16, Q50

1 Introduction

Transition of economy towards more sustainable model requires financing of large-scale investments mitigating climate change therefore there is a growing need for dedicated sustainable finance instruments. Those large-scale investment projects face difficulties in assessing their profitability in standard way, social and environmental impact is hard to assess in money terms. Although pro-ecological projects encounter growing interests from investors it is still small in scale and in reference to all financial instruments at capital markets. On the other hand, the growing sustainability awareness of societies creates pressure on participants of capital markets and increases interest in such investments.

The most significant instruments of sustainable finance – green bonds – meet the needs of modern world, its challenges and the expectations of investors. This is a specific type of bond whose proceeds are invested in an environmentally friendly goals with projects producing sustainable benefits. A "green" bond differentiates from a "traditional" bond by its label. That means the obligation to exclusively use funds raised from the issue to finance or refinance new or existing eligible green projects or business activities. Due to the fact that pro-ecological investments are burdened with significant financial risk related to the

uncertainty of expected results and encounter a barrier to obtaining capital, many green bonds are issued by public entities or international financial and development organizations. Offered instruments are most often issued in a secured or guaranteed form (Morel, 2012). Green bonds are perceived as most important financial instruments supporting sustainability transition. They are deliberately emphasized as financial instruments that should be promoted among retail investors. Especially in Europe, where the driving force is European Commission and different public institutions, such as EU High-Level Group on Sustainable Finance (HLEG 2018).

The specificity of the instruments themselves and the projects for which they are issued prompts research into the profile of investors acquiring green bonds. The purpose of this article is to verify volatility behaviour of green bond market and relationship of green bond market volatility and conventional bond market volatility. Results of this research are significant from the perspective of providing informative insights for the investors risk and return characteristics. They also contribute to the development of sustainable finance and risk analysis of sustainable finance instruments. We studied daily rates of return in the period of 2014 – 2018 of the S&P Green Bond Index, Bloomberg Barclays MSCI Global Green Bond Index, ICE BofAM Green Bond Index, Solactive Green Bonds Index. Using multivariate GARCH framework we were able to verify and test volatility patterns and assess how the volatility of in the green bond market transmits to broader conventional bond market. The paper is organized as follows. Section 2 provides analysis of characteristics of green bond market risk. Section 3 presents the data, methodology and research results, while section 4 provides discussion of results and concludes.

2 Green bond market risk aspects

Green bonds are a relatively recent innovation in the debt markets. Since their debut in 2007 through next 11 years over USD 348.9 billion were issued. Green bonds are expected to play an important role in responding to the existential threats and enormous costs posed by climate change and other sustainability challenges that have emerged in recent years. This financial instrument could be tied to mitigating the effects of climate change (e.g. climate bonds) or to a specific environmental issue or technology, such as wind and solar energy efficiency projects, energy retrofits and clean transportation (e.g. renewable energy bonds, energy efficiency bonds and green transportation bonds) (Green bonds: victory ...., 2013). However, the observations of the existing allocation of funds derived from the issue of green bonds might be surprising. The analysis of the structure of the issue's purpose indicates that pro-ecological nature of green bonds is quite controversial (Marszałek and Daszyńska-Żygadło 2016). Only two thirds of issuers declare an environmental goal, but it is not determined impact on environment the project has. The degree of generality of the ecological nature of the purpose of the green bond issue absolutely does not prejudge the lack of connection with environmental protection activity. However, there is an impression that many companies, especially corporations, use the status of green bonds to improve the attractiveness of the issue offer.

Green bonds do not differ from standard bonds, except for the fact that funds obtained by the issues are dedicated to certain green projects. Rate of return of this instrument is connected to the risk related to the uncertainty of the expected results. Risk reduction is guaranteed by a public or international organization. If the issuer is a non-public company, it is often guaranteed by a public entity. A common solution is the securitization involving the separation of selected assets to the Special Purpose Vehicle (SPV). It is also possible to award bonds with a climate certificate, which is usually equivalent to the instruments being covered by a guarantee of a public or international unit. The green bond risk may also be limited by the means of using a hybrid bond (Lee, Zhong, 2015). It involves financing a number of pro-ecological investments. Thanks to the diversification of the project portfolio, the overall risk is lower, and thus the bonds are more attractive to investors. Yet another solution is to use the revenue bond structure. An example of such an instrument is a carbon revenue bond (Tang et al., 2012). In addition, this investment may be supported by the legal protection of the state in the scope of exclusivity of benefits

or exemption from public levies. In the case of combining a diversified investment portfolio with the structure of the revenue bond, an attractive debt instrument for long-term financing is obtained (Mathews, Kidney, 2012).

Current research on the risk of green bonds indicates that green bonds would be less easy to sell in panic (Atkins, 2015). Investors are more likely to be long-term traders holding them to maturity (Schroders, 2015). However, there are mixed research results on how green bonds perform compared to the standard ones. Some economists argue that despite the lower liquidity in the green bond market yields and pricing of both types are the same (Petrova, 2016). Others show that green bonds deliver a lower yield (Schroders, 2015). A comparison of the basic characteristics of green and non-green corporate bonds with the same ratings indicates a minor difference between those two groups of securities (Kuna-Marszałek and Marszałek, 2017). Green bonds have slightly lower YTM value. In the context of growing green bond market, it can be explained that investors are willing to pay the price for being more socially responsible. A similar relationship can be observed in the case of the issuers. Green bonds have on average a higher coupon value as well. It is worth noting that the issuers additionally bear extra costs on labeling the bond "green". They also issue them for a shorter time, which allows for more flexible management of the investor's portfolio. Moreover, the research results show a positive relationship between corporate social responsibility and financial performance (in terms of return on assets, return on equity and non/net interest income) of financial institutions being intermediaries on green bond market (Wu and Shen, 2013). This may explain the acceptance of lower bond yields and higher financing costs. Green bonds attract investors with additional positive signaling effects (Tiselius and Kronqvist, 2015). Possible involvement of public institutions further reduces transaction costs.

The geography of the green bond market is expanding and diversifying. However, it is still concentrated to a limited number of geographies and sectors. The green bonds are still a niche product within the broader global debt-security market, and account for a small fraction of the overall bond market (European Commission, 2016). That is why the integrity of the green bonds market so far remains robust. Over the last years increasing numbers of specialized green bond funds as well as institutional investors which have intended to increase green bond holdings could be observed. This should result in a relatively lower volatility in the valuation of these instruments, as investors are aware of their purchase will not sell them as often as ordinary bond buyers. However, relatively little is known about the volatility of the valuation of green bonds in the context of changes in the broad bond market. Volatility analysis of S&P GB Index, GPB Index and U.S. AB Index in period 2010-2015 gives evidence for time-varying volatility spill-over between the green bond market and the conventional bond market (Pham, 2016). The green bond market's volatility is positively correlated with the conventional bond market. While one might find results of Pham (2016) inconclusive for various reasons, one being time period of analysis. Results may not be credible due to the fact that S&P Green Bond index was established in 2014, so the actual behaviour of the index is analysed only for one year. Another analysis of yearly volatility of Solactive Green Bond Index and MVIS EM Aggregate Bond Index shows that volatility of green bonds index grows stronger and faster that the aggregated bonds index (Daszyńska-Żygadło and Marszałek, 2018). However, this volatility achieves higher level than aggregated bonds index. It indicates that risk of investing in green bonds index is slightly higher than of the aggregated one. The analysis of the sensitivity of green bonds index for the changes of the broader conventional bonds index using estimated beta coefficients shows that along with the development of green bonds market the Solactive Green Bond Index reflects reactions on the changes on overall bonds market.

In the context of the above information, the problem of the risk of green bond estimation and analysis can be formulated. The specific purpose of the investment, often based on new, unproven technologies, will support the increase of risk. It may be additionally increased by the lack of legislative regulations concerning a given ecological activity. On the other hand, the involvement of a state or international institution, guarantees granted or public issuance will mitigate the risk. Investments implemented by green bonds are in fact socially important and cannot be subject to the same assessment as commercial

projects. This does not mean, however, that these investments should not be assessed or compared to commercial ventures but it is hard not to notice their uniqueness. This activity involves an emotional charge of the investor, as it concerns the future of humanity, is modern and innovative. Both investment funds and individual investors will take this into account when estimating the expected rate of return. It will also determine their market behaviour and stabilize volatility. However, the results of few studies in this area are not consistent. They point to greater and lesser risk of investing in green bonds compared to conventional bonds. Similar opposites are observed in the case of profitability of both groups of bonds. The research carried out in this article is to broaden the knowledge in that field and to contribute to finding behaviour patterns rates of returns and volatility in green bond market.

3 Data, methodology and research results

Our study is based on the framework to model the volatility of a financial asset based on the multivariate Generalized Autoregressive Conditional Heteroskedasticity (GARCH) framework, a family of statistical models originally proposed by Bollerslev (1986) and Engle (2002). That have been widely used in the literature studying the relationship between different financial time series' volatilities (Engle 2002; Glosten et al., 1993).

We use the sample composed of rates of returns of the following pairs of bond indices in order to investigate the patterns of green bond market in relation to overall conventional bond market:

- Bloomberg Barclays MSCI Global Green Bond Index Total Return Index Value Unhedged USD (GBGLTRUU) – Bloomberg Barclays US AGG TOTAL RETURN VALUE UNHEDGED USD
- ICE BofAM GREEN BOND INDEX (GREN) – Bloomberg Barclays US AGG TOTAL RETURN VALUE UNHEDGED USD
- S&P GREEN BOND INDEX TOTAL RETURN (SPUSGRN) – S&P AGGREGATE BOND INDEX TOTAL RETURN
- Solactive Green Bonds Index (SOLGREEN) – S&P AGGREGATE BOND INDEX TOTAL RETURN

Due to the fact that not every aggregated conventional bond index has a corresponding green bond index a selection of matching pairs was made based on the assumption of broad representation of bonds in a conventional bond index according to sector, issuer, class of risk and geography. This was the reason why, for example Solactive index was matched with S&P aggregate bond index.

We used daily logarithm returns for the periods matching official launch of green bond index with corresponding returns of aggregate bond index. A widely used technique to in the literature studying the volatility of financial time series is GARCH, which uses an autoregressive structure to model the conditional variance of a time series, thereby allowing volatility shocks to persist over time (Bauwens,et al., 2006; Teräsvirta; 2009)[1].

One feature of the multivariate GARCH model is that it allows time-varying conditional variances of asset returns' as well as covariances between the returns of different assets. This allows the analysis of the volatility structure of individual assets as well as the interaction between various assets. In this paper, the specification of this multivariate model consists of two components. First, returns are modeled using a vector autoregression framework. Then, a multivariate GARCH model is used to model the time-varying variances and covariances by analogy as in the study of Pahm (2006). In order to find a common pattern of behaviour same analysis was conducted on a wider sample of green bond indices, based on the list of The Green Bond Principles report (2017) we cover four out of six existing indices of that type, missing only the ChinaBond China Green Bond Index and ChinaBond China Green Bond Select Index that was launched in April 2016 and

[1] Due to limited required length of the paper equations were not included in the paper, but are available upon request from interested readers.

data is not available nor in Thomson Reuters Datastream neither in Bloomberg. Table 1 summarizes the descriptive statistics of the indices' returns.

Table 1 Descriptive Statistics of All Analyzed Indices

	Solactive green	S&P	MSCI green	Bloomberg Barclays aggreg	ICE BofAM green	S&P green
Mean	1.9844e-005	7.8521e-005	5.2415e-005	6.1037e-005	2.8270e-005	-7.2707e-007
Median	0.00013806	0.00015128	6.7405e-005	0.00016264	6.7442e-005	5.2781e-005
Minimum	-0.016462	-0.0086641	-0.016023	-0.0098160	-0.016620	-0.013850
Maximum	0.016675	0.0057227	0.016000	0.0059110	0.016466	0.014043
Std. Dev.	0.0036330	0.0017214	0.0036450	0.0019741	0.0037696	0.0032891
C.V.	183.07	21.923	69.541	32.342	133.34	4523.8
Skewness	-0.19146	-0.22316	-0.21083	-0.32579	-0.18948	-0.19201
Ex. kurtosis	1.7673	0.80985	1.3658	0.89008	1.5518	1.3786
5% Perc.	-0.0059690	-0.0027682	-0.005874	-0.0033046	-0.0063739	-0.005246
95% Perc.	0.0058089	0.0028734	0.0059301	0.0031373	0.0060113	0.0053230
IQ range	0.0041133	0.0021299	0.0043557	0.0024371	0.0041945	0.0038501

Source: own elaboration

Among the four green indices Bloomberg Barclays MSCI Global Green Bond Index has the highest average returns while the ICE BofAM Green Bond Index has the highest standard deviation.

In majority of our time series of indices returns the effect of autocorrelation wasn't found, but in order to verify given assumptions and findings of previous studies we conducted analysis according to indicated GARCH framework. First, returns were modelled using a vector autoregression framework. Then, a multivariate GARCH model was used to model the time-varying variances and covariances.

Table 2 Results of DCC Models Parameters Estimation

Index		parameter	Index	parameter
w1		7,81E-08**		2,36E-08*
alpha1	Bloomberg	0,0155**		0,0166***
beta1	Barclays aggreg	0,9649***	S&P	0,9755***
w2		4,03E-07		6,59E-08
alpha2		0,0284*		0,0334**
beta2	MSCI green	0,9412***	Solactive green	0,9626***
corr		0,4643***		0,4037***
alpha		0,0991*		0,0773**
beta	pair	2,31E-06	pair	0,7825***
w1		9,17E-08*		4,47E-08*
alpha1	Bloomberg	0,018206***		0,018***
beta1	Barclays aggreg	0,959738***	S&P	0,9677***
w2		2,11E-07		1,83E-07**
alpha2		0,034484**		0,0283***
beta2	ICE BofAM green	0,950545***	S&P green	0,9551***
corr		0,390307***		0,4271***
alpha		0,060336*		0,0574*
beta	pair	0,796452***	pair	0,7943***

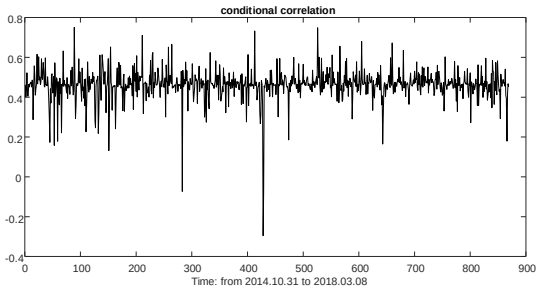
Source: own elaboration

Table 2 shows results of DCC model estimation. The conditional standard deviations for each individual series and the conditional correlations among the series were estimated using the DCC model as proposed by Engle (2002). Compared to other models, this model's flexibility in modeling time-varying conditional correlations has clear computational advantages as it allows for the estimation of very large correlation matrices (Pahm 2016).

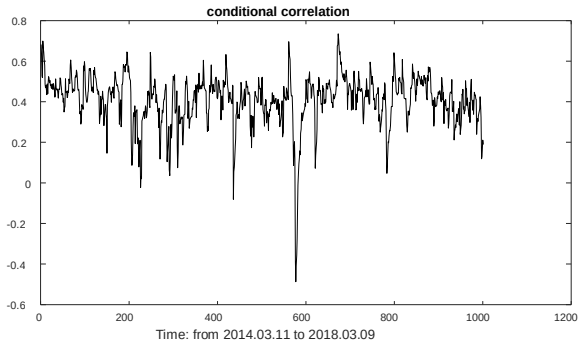
It indicates that majority of parameters for the indices are statistically significant. It also shows that conditional correlation average that is statistically significant for each pair is the highest for Bloomberg Barclays aggregate index and Bloomberg Barclays MSCI green bond index and the lowest for the pair of ICE BofAM green and Bloomberg Barclays aggregate index. Figure 1 plots daily formulation of conditional correlation.

Results show that conditional correlation of all green bond indices tends to circulate around 0,4 with minor periodical changes. That indicates that in case of every green bond index risk of investing is similar and rates of returns are positively correlated to conventional bonds indices. What is more we can initially state that shocks from conventional bonds markets are not being transmitted to green bond market. In times, for few days' periods, green bonds indices show negative correlation with conventional bonds, especially visible for each of the analysed indices during spring of 2016, presumably due to the Brexit vote, which was a big shock for the capital markets.

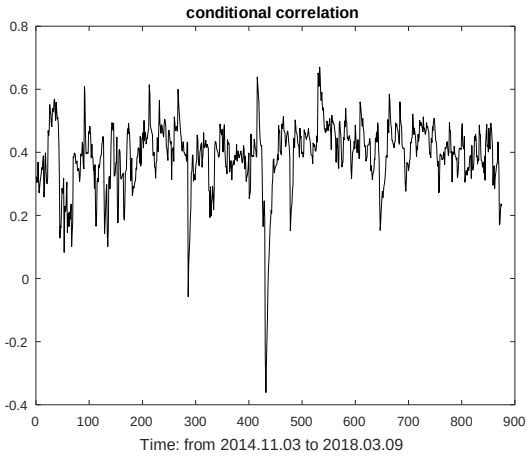
Figure 1 Conditional Correlation of Analyzed Indices



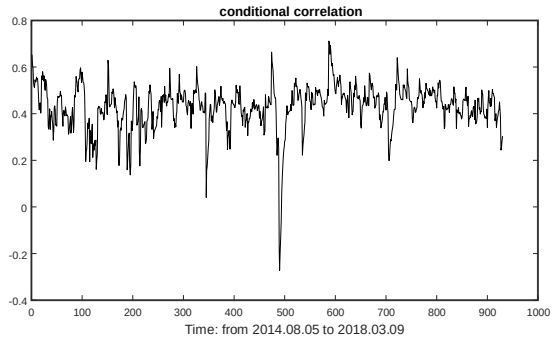
Model (a)*



Model (b)*



Model (c)*



Model (d)*

*Model (a) MSCI green, model (b) SOLGREEN, model (c) ICE BofAM Green, model (d) S&P Green
Source: own elaboration

While regression analysis for each green bond index shown that daily rates of return are explained with statistical significance by rates of return from previous day (-1 day) of the index and of the conventional bond index, only in the case of Solactive green bond index results were also depended on the rates of return from three days before, but not for two.

4 Discussion of results and conclusions

Our findings shed additional light at the previous research results in the scope of risk analysis of green bonds. Even though we chose similar method of analysis as other authors (Pahm 2016), the GARCH effect wasn't found in the majority of pairs of indices. It's worth noticing that green bonds indices are positively correlated with conventional bond indices and conditional correlation tends to maintain the average lever of 0,4 in the whole sample. However, they do not transfer violent changes from the conventional bond market. This combination of a positive general correlation with less sensitivity makes green bonds a very attractive instrument. Especially for investment funds that will be able to participate more in financing pro-ecological investments. From our research it stands out that changes in green bond indices rates of return do not impact changes in overall bond market indices. But this effect works in the opposite direction. This seems to be due to the much smaller size of the green bond market compared to traditional bonds. It also increases the attractiveness of these instruments, that apart from financial advantages can also play an important role in sustainable development of economies. We plan to further investigate the relationships due to the fact that GARCH analysis results weren't satisfactory.

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Debt Literacy and Its Importance in the Czech Republic

Bohuslava Doláková

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41 a, 602 00 Brno, The Czech Republic
E-mail: 175975@mail.muni.cz

Abstract: *This paper aims to show the importance of one part of financial literacy that causes most problems in the Czech Republic. According to the latest data, there is quite a lot of Czech overindebted – they borrowed too much money, lost jobs, found a very inconvenient loan, etc. Those people were not able to analyze their financial situation in the broad context of having a loan. As we know from the start of last big financial crisis risky loans (e.g., Mortgages) can cause a worldwide problem. In general people with lower levels of debt, literacy tends to transact in high-cost manners, incurring higher fees and using high-cost borrowing. Due to the New Consumer Credit Act from 2016, there was expected a change in the loan amounts and risk. It is too early to judge the impact of that act, but we can see a basic tendency that shows us people are still willing to go in debts. This makes debt literacy still very important as there are many overindebted people in the Czech Republic.*

Keywords: financial literacy, debt literacy, indebtedness, mortgages

JEL codes: D11, D12, D14, D18, D91, G21

1 Introduction

As there is a lot of attention to financial literacy in media during the last few years, people started to be more aware of the importance of this term. It has also been included into compulsory education in elementary schools and high schools too. We have to wait for the real results of this change in education, but we can see what is happening now in the financial market in the Czech Republic. We can use the data from the Ministry of Finance judging these abilities of the Czech Republic inhabitants. In 2010 and 2015, the Ministry of Finance measured the level of financial literacy of the adult population of the Czech Republic. This survey has become part of the global measurement together with the other dozens of countries of the Organization for Economic Co-operation and Development (OECD). The result was that Czech has in general "good awareness of financial products." That seems to be very optimistic. But on the other hand, Almost a tenth of Czechs over the age of 15 have some property seizures. In total, there are 863,000 people and about 31,000 in the last year. What is a key problem in this area is called "debt literacy," an important component of overall financial literacy? Debt literacy refers to the ability to make simple decisions regarding debt contracts, applying basic knowledge about interest compounding to everyday financial choices (Lusardi and Tufano, 2009). People can have quite good knowledge of financial products, where is the best basic private bank account, etc. But people can be completely unaware of what can happen when they finance their money deficiency by a loan. People with lower levels of debt literacy tend to transact in high-cost manners, incurring higher fees and using high-cost borrowingLatest data about Czech indebtedness shows that some of the people are suffering to overindebtedness.

2 Methodology and Data

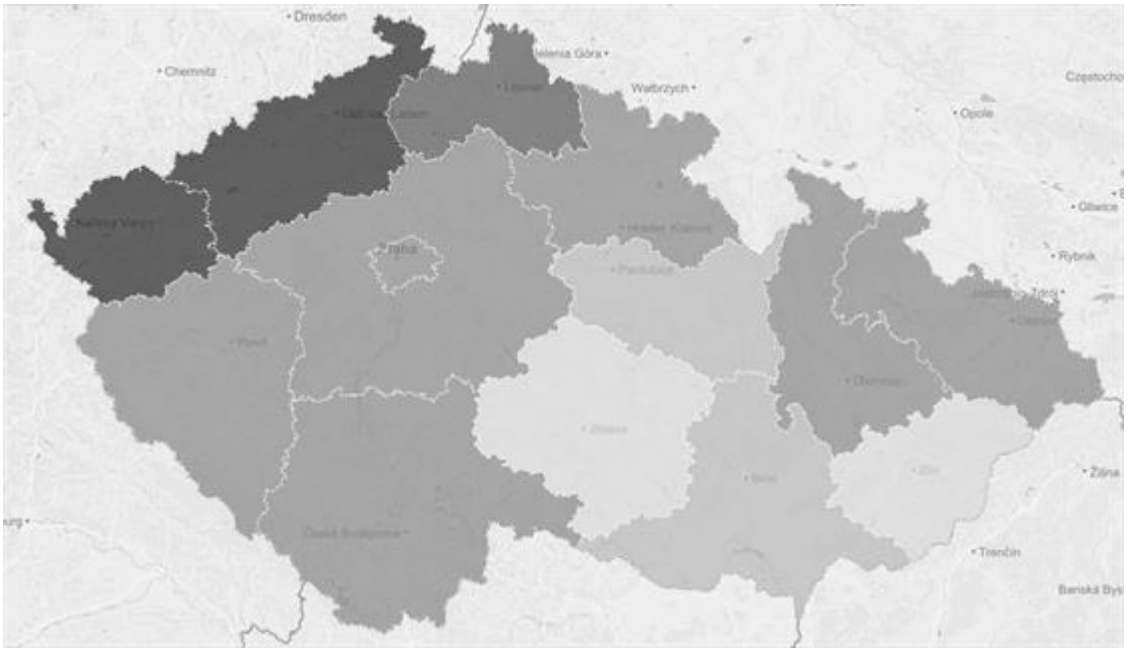
In this paper, there is used latest biggest financial literacy survey from the Ministry of Finance judging these abilities of the Czech Republic inhabitants. In this survey, there were a few questions regarding also debt literacy. Most important one was taken in this research.

The data about the debts, indebtedness, and overindebtedness were taken from quite new and very useful Map of Property Seizures which clearly show the distribution and seriousness of indebtedness in the Czech Republic.

Almost a tenth of Czechs and Czechs over 15 have some property seizures. In total, there are 863,000 people and about 31,000 in the last year. The number of people in property seizures grew 3.4 percent a year, despite record low unemployment and rising wages in the Czech Republic. Even higher salaries and the fact that people have jobs do not help them get out of the debt trap. Only interest and penalties are paid, not the principal of the loan. Half of the people owe less than 10,000 crowns. Most of the claimed sums are mainly costs. The average principal amounts to CZK 65,000. Three or more property seizures have almost half a million people. A total of 151,000 people over 15 have over ten property seizures. It's about 10,000 people between 18 and 29 years old and about 6,000 seniors over 65 years old. 90 percent of property seizures are unenforceable.

The amount of property seizures changes across the Czech Republic as we can see in Figure 1. There is an obvious connection to others social problems like unemployment but especially in such interconnected issues is the debt literacy crucial.

Figure 1 The Map of Property Seizure in the Czech Republic (2017)



Source: Map of Property Seizures http://mapaexekuci.cz/index.php/mapa-2/

Some property seizures encompassed by so-called unsuccessful property seizures for the entire duration of court bailiffs. This includes, for example, property seizures for which insolvency proceedings are conducted, so that the property seizure of the proceedings cannot be executed for that reason alone.

The number is so high, among other things, because there is no effective tool to stop these unsuccessful property seizures. It is necessary to simplify the termination of such property seizures even without the creditor's consent so that the whole system is cleared of these proceedings. After the start and implementation of this process, the number of both mandatory and some proceedings will be several times smaller.

The demotivating factor is that social benefits are calculated by net wages, without deduction of property seizure. People in property seizure often do not reach different types of support, though they are entitled to it because of the actual amount of income. In the Czech Republic, there is also no court fee for executing the property seizure, which, according to experts, leads to abuse of the system. The creditors, in their view, use the property seizure as a free repository of unpaid receivables.

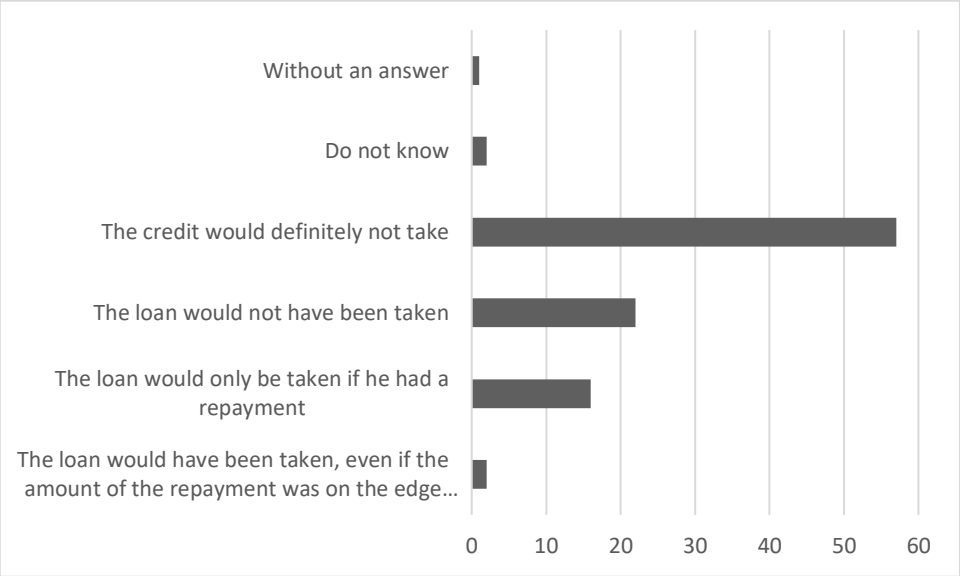
The negative development of the over-indebtedness situation mainly affects the debt cycle. It is proven that people in debt traps do not realize their full economic potential. There is also the negative impacts on their physical and mental health and the enormous burden

on the social system. An estimated two million property seizures of paralyzed Czechs - including family members - are not what the Czech Republic needs.

3 Results and Discussion

When we use the latest data from the Ministry of Finance most of the population (79%) would not take credit to pay for Christmas gifts as we can see in Figure 1.

Figure 2 Willingness to Take Credit Under Certain Conditions (n = 1000, data in%)

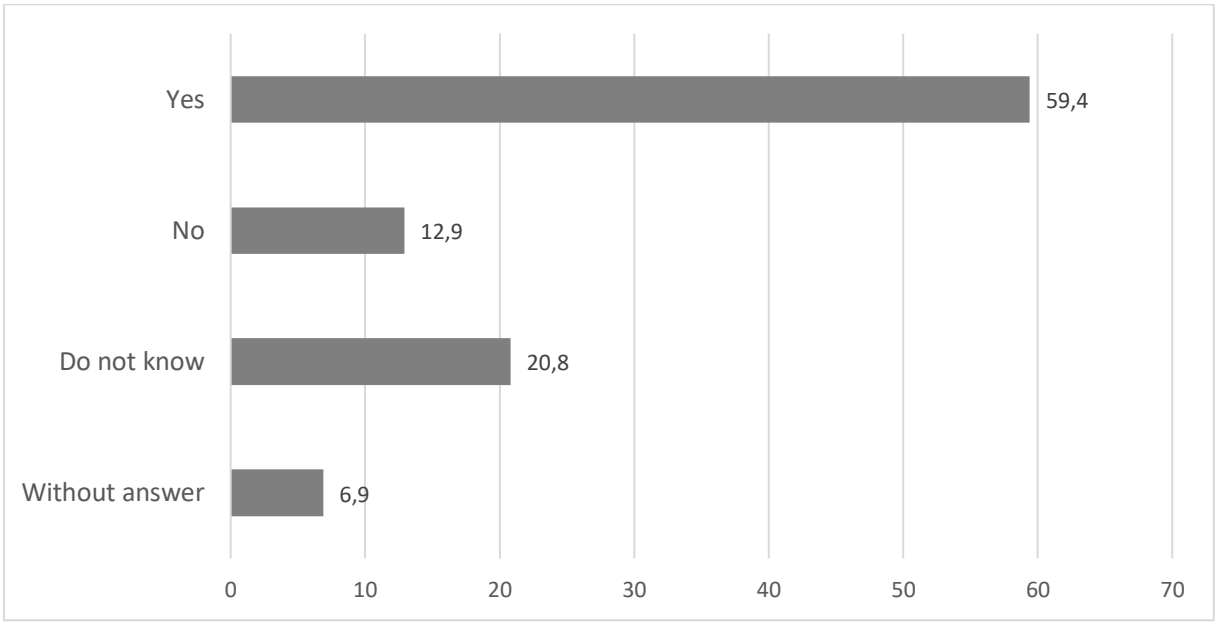


Source: Ministry of Finance (2016)

This seems to be very positive, but according to the latest data a lot of Czechs are indebted and suffer from overindebtedness.

Very important is the approach of people to the troubles with repaying. We can see in Figure 3 that most of the people (59,4%) would inform the creditor about late payment.

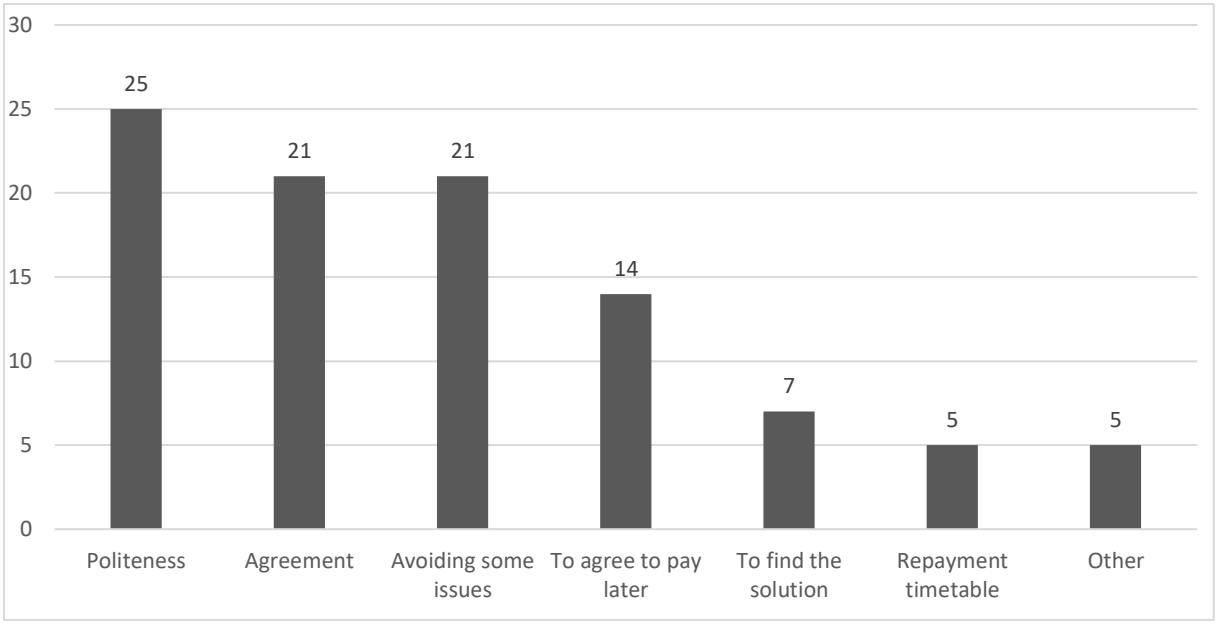
Figure 3 Informing of Creditor when Borrower Cannot Repay on Time (n = 1000, data in%)



Source: Ministry of Finance (2016)

The reasons why people would inform the creditor about late payment are in Figure 4 and it is just politeness, the effort to agree on what to do or just trying to avoid some big issues. People mostly want to protect themselves, and that is responsible.

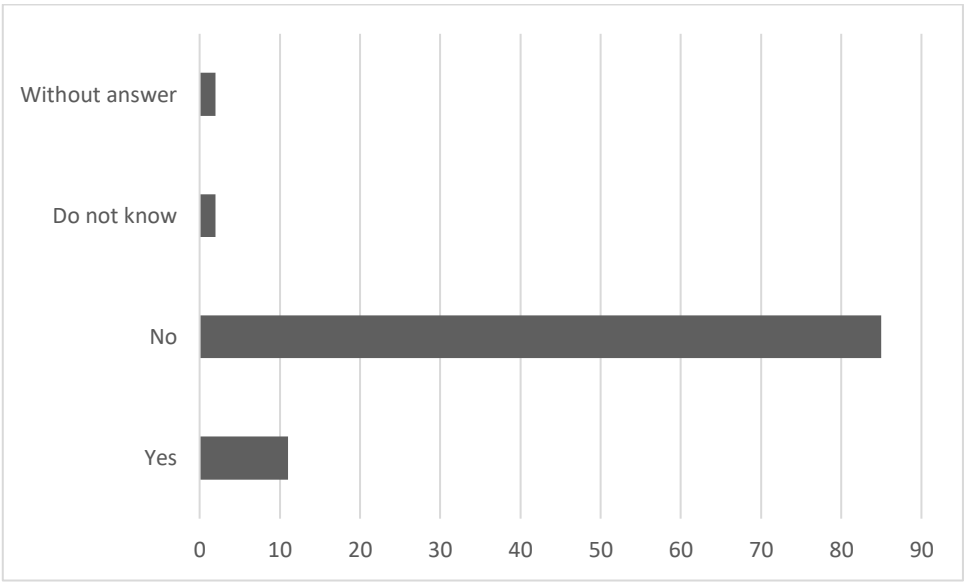
Figure 4 Why Inform the Creditor that Borrower Cannot Repay on Time (n = 1000, data in%)



Source: Ministry of Finance (2016)

The sample was also tested if they have had any repayment issues in the past – most of the people from the sample did not have any repayment issues as shows Figure 5.

Figure 5 Repayment Issues (data in%)



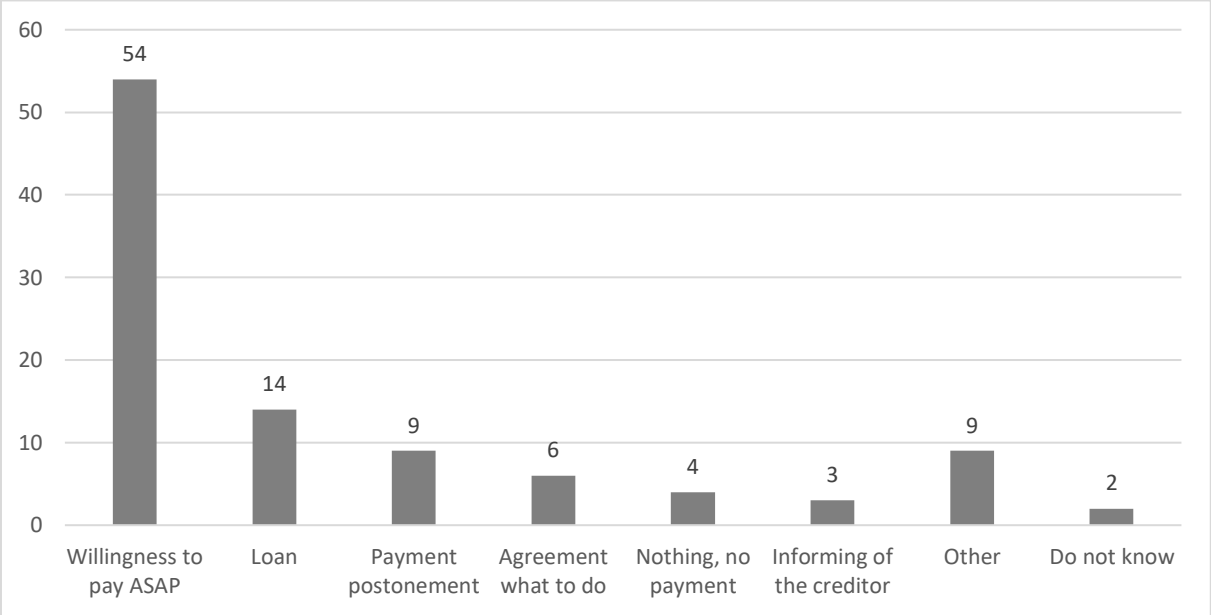
Source: Ministry of Finance (2016)

85% of people have no problems with timely payment of their obligations. In 2010 it was 80%. We can see progress here. People who have had problems with repayment in the past most often report that they have tried to pay the debt as quickly as possible (54%). 14% of people solved the problem with another loan. If these people got into the same situation now, 19% of them would be trying to debt what makes the fastest payment. 13% would have taken another loan. It is a visible change in the behavior – most of the people

tried to repay their debts, but in the future, they would do something else (22% of the people said "Other solution"). We can see people were responsible in the past, trying to be without debts but in the future, they would find some other, unknown solution.

In the past, most of the people (54%) wanted to pay the debt as soon as possible as it is clear in Figure 6. That is very rational and responsible solution.

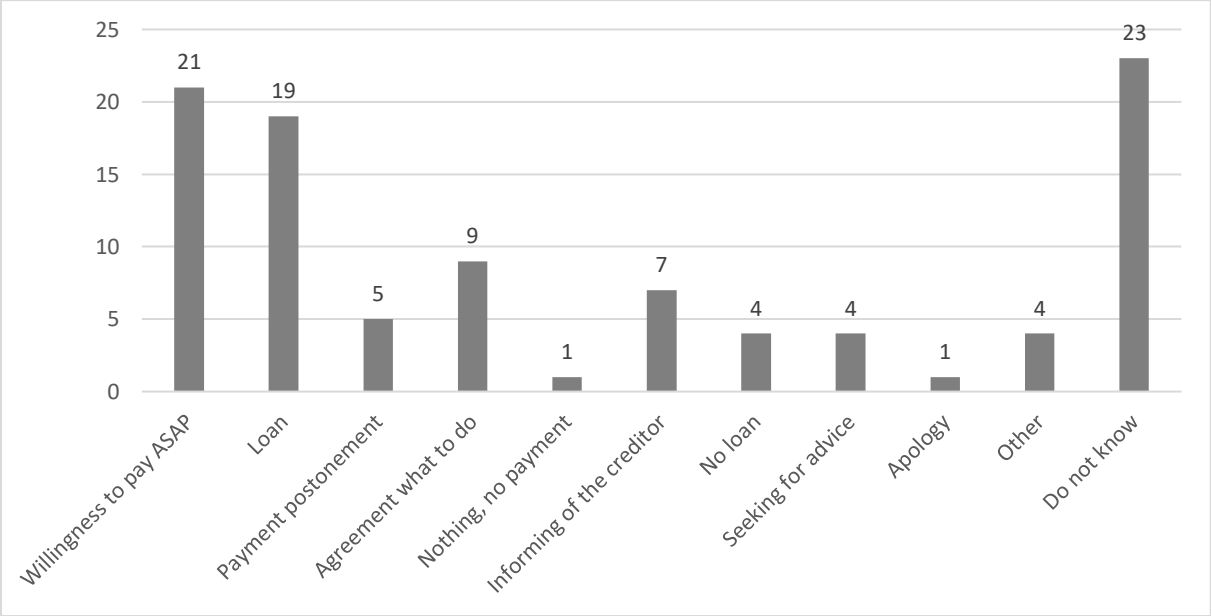
Figure 6 What Have Respondents Done in the Past (data in%)



Source: Ministry of Finance (2016)

What seems quite problematic is the reaction showed in Figure 7 of the people in theoretical repeating of that situation. Just 21% would pay as soon as possible again. Alarming is the fact that 23% of respondents did not know what to do in that situation. That means that they could probably just leave it and would not care about that issue – that is the worst possible solution because they can get very easily to property seizure.

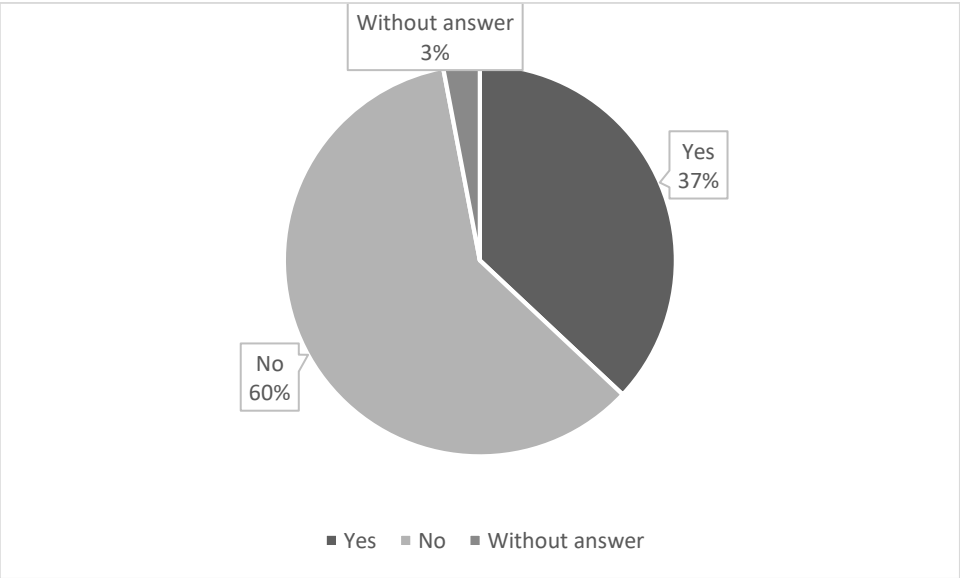
Figure 7 Theoretical Situation: Problems with Repayment (data in%)



Source: Ministry of Finance (2016)

For taking a loan, in general, is important to know some financial terms, especially annual cost percentage rate. From the sample, just 37% of people knew what it means as it is shown in Figure 8.

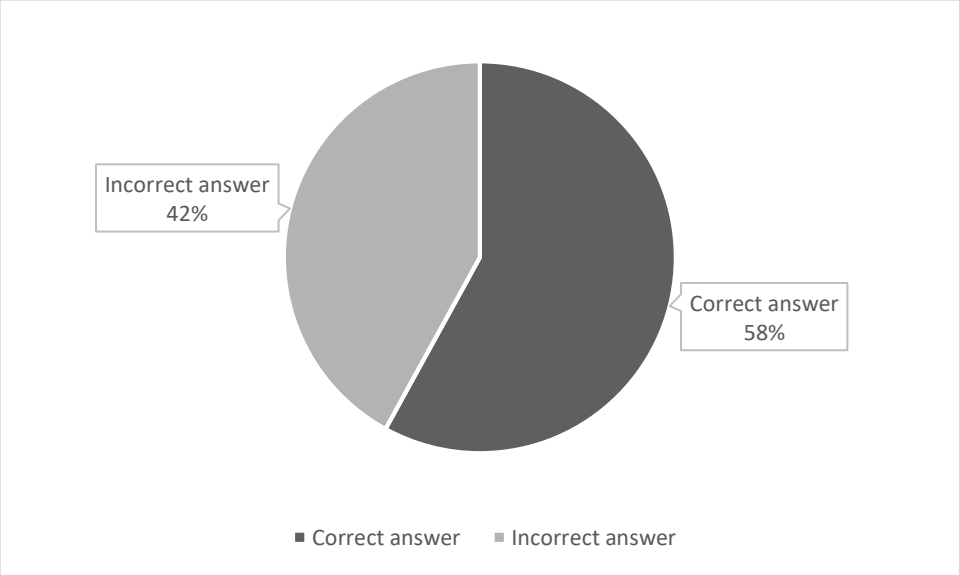
Figure 8 Knowledge of Annual Cost Percentage Rate (data in%)



Source: Ministry of Finance (2016)

Last Figure 9 shows that 58% of people from the sample knew what annual cost percentage rate means, so it is clear that a lot of people just do not know what can be hidden in a loan.

Figure 9 Definition of Annual Cost Percentage Rate (data in%)



Source: Ministry of Finance (2016)

The European Union has approached the regulation of the relationships of financial market participants with the consumer, in particular as regards the provision of loans earlier. These regulatory measures have been reflected in the Czech Republic, among other things, in the adoption in 2010 of Act No. 145/2010 Coll., On consumer credit. However, since December 2016, completely new legislation is in force, which is Act No. 257/2016 Coll., On Consumer Credit. This law covers all types of consumer credit, ranging from classic cash loans, credit cards, mortgage purchases to mortgages and other loans that are not covered by the

Consumer Credit Act (i.e., housing loans and so-called micro-loans). The Consumer Credit Act will thus in the future represent a comprehensive adjustment of the retail credit products distribution. Besides the product area, the law also unifies the institutional elements of regulation, among others, establishes uniform conditions for obtaining a business license in the credit sector, regulates the process of registration of regulated entities and supervising them, or defines uniform rules for the verification of expertise for persons acting with consumers.

There was an expected change in the increasing trend of property seizure because of overindebtedness 2016 due to the change in credit legislation effective from 1 December 2016. New Consumer Credit Act should make it more difficult to trick the consumers with inconvenient loans. We can compare the trend in (usually) the biggest loan that is taken, a mortgage.

Table 1 Number of New Mortgages in the Czech Republic

	2014	**2015**	**2016**	**2017**
Number of Mortgages	40 019	47 489	60 013	47 952

Source: Czech National Bank

The introduction of the Consumer Credit Act was fully reflected in mortgage lending procedures in 2017. The rules and procedures for granting mortgage loans are now much stricter and more transparent for clients. The two-fold increase of the CNB's two-week repo rate, together with the tightening of maximum LTV requirements, contributed to the reversal of the mortgage rate trend. However, the rise in interest rates last year was not dramatic.

Table 2 Total Household Debt (in CZK million), 30.4.2018

	Value	**A year ago**	**Change**
Consumption	287 074.00	272 470.70	5.36%
Accomodation	1 179 255.40	1 085 616.30	8.63%
Other	161 287.50	156 276.90	3.21%

Source: Czech National Bank

From Table 2 we can assume people still want to take on more loans. Now, there is a positive economic situation in the Czech Republic – as we have very low unemployment, minimal wages are rising and also other wages. In this situation is the debt literacy the most important. It should protect people who have taken a loan also against situations that can come in not such a positive economic situation (like an economic crisis).

4 Conclusions

This paper showed the importance of debt literacy as a special part of financial literacy that is crucial for the everyday life of the people. Financial literacy is important as a sum of knowledge, but it is different knowing how to safe few Czech crowns by choosing a cheaper bank account then knowing how to protect yourself against the inability to pay your debts and what to do in that situation. People should have the skill of reason to debt. The debt should not be stigmatized but rationally drawn. Financial literacy is focused on the *price* of the loan (knowledge of financial mathematics), debt literacy is focused more on the *risk* of the loan (knowledge of the law consequences). Debt literate person should know the strategies of individual lenders, the different mechanisms that generate profit. The debt literate person should also be able to make sense of this knowledge in a responsible and responsible manner, and he/she should be able to recognize unfair practices. To be able to defend himself. Be able to find help in such a situation According to available and latest data; financial literacy is improving (when we compare big surveys from 2010 and 2015 made by Ministry of Finance). Debt literacy questions were answered very often in an

uncertain way – it is clear that people are struggling with this field of financial literacy. Data about rising property seizure levels suggest the same conclusions.

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Patterns of Currency Co-movement: Changes in the Impact of Global Currencies

Małgorzata Doman[1], Ryszard Doman[2]

[1] Poznań University of Economics and Business
Faculty of Informatics and Electronic Economy, Department of Applied Mathematics
Al. Niepodległości 10, 61-875 Poznań, Poland
E-mail: malgorzata.doman@ue.poznan.pl

[2] Adam Mickiewicz University in Poznań
Faculty of Mathematics and Computer Science, Laboratory of Financial Econometrics
Umultowska 87, 61-614 Poznań, Poland
E-mail: rydoman@amu.edu.pl

Abstract: *In the paper, we analyze the pattern of currency co-movement and document the impact of global currencies (USD, EUR, GBP, JPY) on selected minor ones. The investigation of linkages in the currency market is more complicated than it is in the case of capital markets. The reason for this is that the analysis of co-movement between two currencies requires the consideration of exchange rates which are always calculated against a third currency. The choice of this third currency certainly influences the results of comparison. There prevails an opinion that the pattern of the co-movement in the currency market is significantly driven by the relative influence of the global currencies, mostly the US dollar and the euro, but to some degree also by the British pound and the Japanese yen. In the paper, we examine the dynamics of strength and areas of this influence in the global currency market during the period 2011-2018. We pay special attention to the changes in the pattern caused by the European debt crisis and the UK decision about Brexit. The dynamics of the linkages is modeled by means of Markov regime switching copula models, and the strength of the linkages is described using dynamic Spearman's rho coefficients and the dynamic coefficients of tail dependence.*

Keywords: exchange rates, global currencies, minor currencies, linkages, copula, Markov regime switching, tail dependence

JEL codes: G15, F31, C58, C32

1 Introduction

In the paper, we show to what degree the selected minor currencies : AUD, CAD, CZK, CNY, INR, KRW, PLN, TRY, ZAR, representing different parts of the world, co-move with some major currencies (USD, EUR, GBP, JPY). To describe the dynamics of linkages in currency market, we model the dependence between exchange rate returns using dynamic copula models. This allows us to apply dependence measures which are better suited to quantify dependence in the case of nonelliptical joint conditional distributions and take into account dependence between extremes.

Currencies are an important class of assets. The mechanism of currency comovement is essential for diversifiability of currency exchange risk, which occurs during cross-border investments and trade. However, the analysis of co-movement in the case of currency markets is more complicated than it is, for example, in the case of capital market. The specificity of this problem is connected with the fact that examining the linkages between currencies, one has to use exchange rates which are always against some third currency (usually the American dollar or the euro). Naturally, the results of the analysis essentially depend on the choice of this third currency. Despite this difficulty and the fact that the exchange rate fluctuations are subject to different shocks, it seems to be possible for some currencies to find patterns of dependence indicating that they can co-move in a predictable way.

In the paper, we analyze the phenomenon of the co-movement of a minor currency with a major one, against other major. Our choice of the considered major currencies is done on

the basis of opinions by practitioners and researchers. It is clear that the USD and the euro are the most important, global currencies but the British pound and the Japanese yen play a significant role in the currency market as well (Angeloni *et al.*, 2011).

The concept of modeling currency co-movement we use in this paper goes back to Eun and Lai (2004) and Eun *at al*. (2013). The core of it is the following observation: if a minor currency XYZ is driven by a major one, say USD, then for an alternative major currency, say EUR, the exchange rates XYZ/EUR and USD/EUR, co-move very closely. To support this, the above mentioned authors use some linear models. Doman and Doman (2010, 2014, 2017) pointed out that the linear approach may be insufficient to describe the complex dynamics of dependence in the contemporary financial market, and used copulas to get a deeper insight into the structure of linkages.

In the first part of our analysis we determine the impact of the euro and the USD on each of the 11 considered currencies. In the second part, we show to what degree each of the minor currencies co-moves against the US dollar with the euro, British pound, and Japanese yen. The aim of the investigation is to describe the dynamics of dependence and possible changes in the pattern of linkages in the currency market taking into account the European debt crisis and the UK decision about Brexit.

2 Methodology and Data

The linear correlation still plays a role in financial theory. This tool for measuring dependence between financial returns is, however, appropriate only in the case of multivariate normal or, more general, elliptical distributions (e.g. multivariate Student's *t* distribution). Yet, observed asymmetries in one-dimensional marginal conditional distributions as well as in the conditional dependence structure imply that join conditional distributions of financial returns mostly are not elliptical (see e.g. McNeil *et al*., 2005). Because of that, modeling the returns using standard multivariate GARCH models (Bauwens *et al*., 2006) may be unfounded. Instead, employing dynamic copula-based dependence models, which allow to model dependence structure separately from univariate marginal distributions, can be a better solution.

A bivariate copula is a function $C:[0,1]\times[01]\to[0,1]$ from the unit square to the unit interval that is a distribution function whose marginals are standard uniform (McNeil *et al*., 2005). If X_1 and X_2 are random variables with joint distribution function F and marginal distributions F_1 and F_2 then, by a theorem by Sklar (1959), the following decomposition holds:

$$F(x,y)=C(F_1(x),F_2(y)). \tag{1}$$

Formula (1) shows that the joint distribution function splits into the marginals and a copula. Thus a copula can be seen as the dependence structure between X_1 and X_2.

If F_1 and F_2 are continuous, the function C is given by the formula

$$C(u_1,u_2)=F(F_1^{\leftarrow}(u_1),F_2^{\leftarrow}(u_2)), \tag{2}$$

for $u,v\in[0,1]$, where $G^{\leftarrow}(u)=\inf\{x:\ G(x)\geq u\}$. In that case, C is called the copula of X_1 and X_2 or of F.

The simplest copula, which corresponds to independence, is defined by

$$C^{\Pi}(u,v)=uv. \tag{3}$$

In this paper we also apply the Gaussian (normal), Student, Joe-Clayton, and rotated Joe-Clayton copulas. They are defined by as follows:

$$C_{\rho}^{Gauss}(u_1,u_2)=\Phi_{\rho}(\Phi^{-1}(u_1),\Phi^{-1}(u_2)), \tag{4}$$

$$C_{\rho,\nu}^{Student}(u_1,u_2)=t_{\rho,\nu}(t_\nu^{-1}(u_1),t_\nu^{-1}(u_2)), \tag{5}$$

$$C_{\kappa,\gamma}^{J-C}(u_1,u_2)=1-\left(1-([1-(1-u_1)^\kappa]^{-\gamma}+[1-(1-u_2)^\kappa]^{-\gamma}-1)^{-1/\gamma}\right)^{1/\kappa}, \tag{6}$$

$$C_{\kappa,\gamma}^{J-C-r90}(u_1,u_2)=u_2-C_{\kappa,\gamma}^{J-C}(1-u_1,u_2), \tag{7}$$

where in (4) Φ_ρ denotes the distribution function of a bivariate standardized Gaussian vector with the correlation coefficient ρ, and Φ stands for the distribution function of the standard normal distribution. Similarly, $t_{\rho,\nu}$ in (5) denotes the bivariate Student *t* distribution function with ν degrees of freedom and the correlation coefficient ρ, and t_ν stands for the univariate Student *t* distribution function with ν degrees of freedom. The parameters in the Joe-Clayton copula (6) satisfy the conditions: $\kappa \geq 1$, $\gamma > 0$. This copula, also called the BB7 (Joe, 1997), is capable of modeling asymmetric dependence structures and, in particular, asymmetric dependence between extreme events. The rotated Joe-Clayton copula is a version of the Joe-Clayton copula that models negative dependence.

Spearman's rho for variables X_1 and X_2 with marginal distribution functions F_1 and F_2 can be defined as

$$\rho_S(X_1,X_2)=\rho(F_1(X_1),F_2(X_2)), \tag{8}$$

where ρ denotes the usual Pearson correlation. This is a dependence measure, which depends solely on a copula linking X_1 and X_2. When C is the copula of X_1 and X_2, then

$$\rho_S(X_1,X_2)=\rho_C=12\iint_{[0,1]^2}C(u_1,u_2)du_1du_2 \tag{9}$$

(Nelsen, 2006). From the definition of a copula it follows that if C_1 and C_2 are copulas then for any $0\leq\alpha\leq 1$ the function $C=\alpha C_1+(1-\alpha)C_2$ is also a copula. Thus, formula (9) implies that in such a situation the following holds for the corresponding Spearman's rhos:

$$\rho_C=\alpha\rho_{C_1}+(1-\alpha)\rho_{C_2}. \tag{10}$$

We model the joint conditional distribution of bivariate returns assuming that there can be three regimes in each of which a fixed copula describes the dependence structure, and the regime switching is driven by some Markov chain (cf. Garcia and Tsafack, 2011). Thus, in the applied Markov switching copula (MSC) model the conditional distribution of the vector $\mathbf{r}_t=(r_{1,t},r_{2,t})$, $t=1,\mathrm{K},T$, has the following form

$$\mathbf{r}_t\,|\,\Omega_{t-1}\sim C_{S_t}(F_{1,t}(\cdot),F_{2,t}(\cdot)\,|\,\Omega_{t-1}), \tag{11}$$

where Ω_t denotes the up to time *t* information set, $r_{i,t}\,|\,\Omega_{t-1}\sim F_{i,t}$, $i=1,2$, and S_t is a homogeneous Markov chain with state space $\{1,2,3\}$. The parameters of the MSC model (i.e. those of the univariate ARMA-GARCH models for the marginal distributions, of the copulas C_1, C_2 and C_3, and the transition probabilities $p_{ij}=P(S_t=j\,|\,S_{t-1}=i)$) are estimated by the maximum likelihood method. The main by-products of the estimation, which are used to construct time-varying conditional dependence measures, are the conditional probabilities $P(S_t=j\,|\,\Omega_{t-1})$, $P(S_t=j\,|\,\Omega_t)$ and $P(S_t=j\,|\,\Omega_T)$ (Hamilton, 1994).

We analyze the dynamics and strength of the impact of a major currency on a minor one using the idea proposed by Eun and Lai (2004). This idea consists in an observation that when a minor currency XYZ is driven, for instance, by the US dollar then the exchange XYZ/EUR and USD/EUR co-move very closely. In the opposite case, i.e. when the XYZ is influenced by the euro, the exchange rates XYZ/USD and EUR/USD show strong

interdependence. The aim of our analysis is to determine to what degree each of the considered minor currencies co-moves with a major one against another major. The first part of the analysis concerns the competitive influence of the US dollar and the euro on the currency market. In the second part, we show to what degree each of the considered minor currencies co-moves with the euro, British pound, and Japanese yen, examining the corresponding exchange rates against the US dollar.

The analysis presented in the paper is based on the percentage daily logarithmic returns of exchange rates. The period under scrutiny is from January 3, 2011 to March 30, 2018 (1878 observations). The steps of the analysis were as follows. First, to each of the investigated return series a univariate ARMA-GARCH model was carefully fitted. It is worth mentioning that in the case of the exchange rates of minor currencies against major ones the standardized innovations of fitted models mainly followed skewed Student's *t* distributions (Laurent, 2013) with diverse degrees of freedom. This precluded from using standard multivariate GARCH models, and justified applying dynamic copulas.

The MSC models were fitted to the transformed ARMA-GARCH standardized residuals by the maximum likelihood method. We tried to apply at most 3 regimes, and copulas from various families. Our final choice is the effect of taking into account the obtained values of the information criteria and, where applicable, the results of the performed likelihood ratio tests. All the calculations were done using G@RCH 7.0 package (Laurent 2009) and the MATAB software. Due to space limitations, we do not present here the obtained parameter estimates. Instead, we show estimates for the dynamic smoothed Spearman's rho coefficients. They were calculated by the formula

$$\rho_t = \sum_{i=1}^{3} \rho(i) P(S_t = i \mid \Omega_T), \tag{12}$$

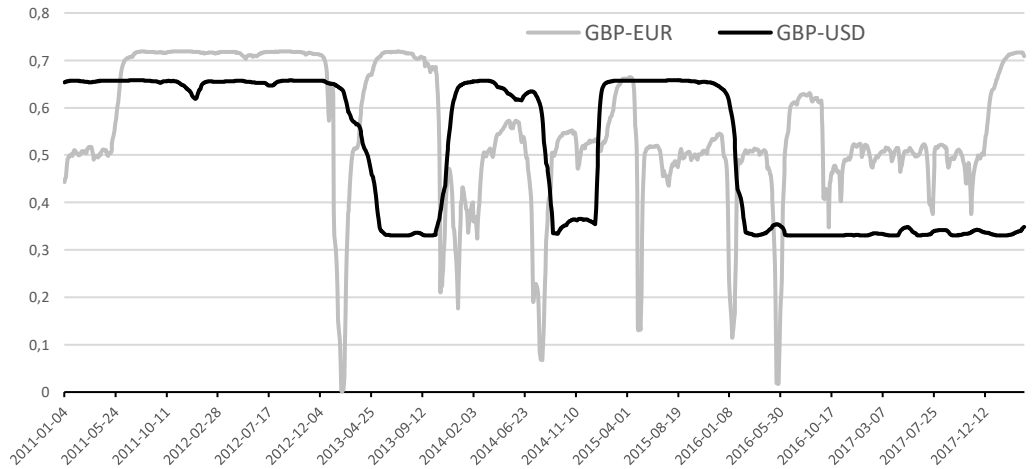
where $\rho(i)$ is Spearman's rho for the copula prevailing in regime *i*.

3 Results and Discussion

Eun and Lai (2004) consider trade pattern, financial integration, colonial heritage and geographical location to be the main factors determining the pattern of currency co-movement. This allowed us to formulate some conjectures concerning the future results. For example, we expected that the PLN, CZK, TRY and GBP were linked with the euro; the CAD, KRW and JPY with the USD; and the INR and ZAR with the GBP.

Although in the second part of our analysis we consider the GBP and JPY as major currencies, the knowledge about their co-movement with the USD and euro is necessary to understand their impact on minor currencies. Figures 1 and 2 show the estimates of dynamics Spearman's rhos for the GBP and JPY, respectively.

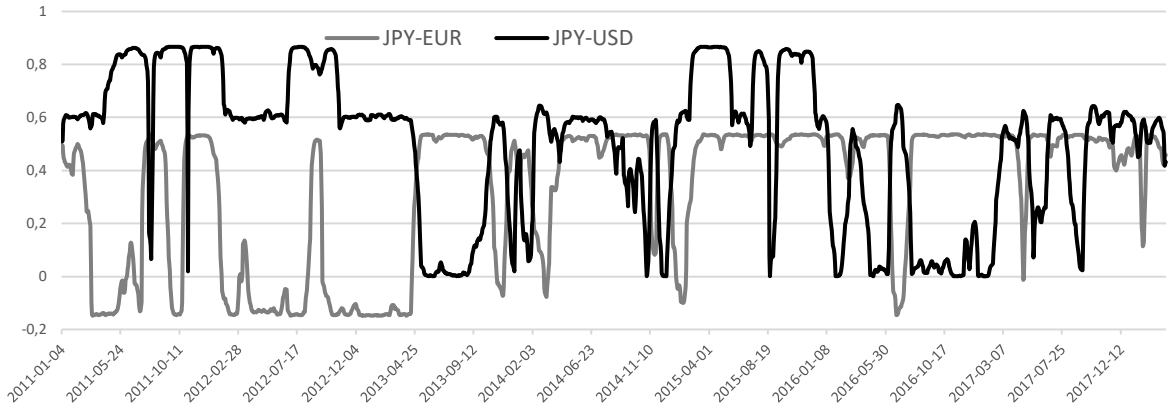
Figure 1 Dynamic Spearman's Rhos for (GBP/USD, EUR/USD) and (GBP/EUR, USD/EUR)



Source: authors

The plots presented in Figure 1 show that the British pound alternately co-moves with the euro and US dollar. This supports a common opinion that the GBP should be considered to be one of major currencies. Another pattern is visible for the Japanese yen (Figure 2) – high values of Spearman's rho indicate strong linkages with the USD.

Figure 2 Dynamic Spearman's Rhos for (GBP/USD, EUR/USD) and (GBP/EUR, USD/EUR)



Source: authors

Table 3 Co-movement of Minor Currencies with the USD against the EUR and with the EUR against the USD (copulas: N = *Gauss*, t = *Student*, PI = Π, JC = *Joe-Clayton*)

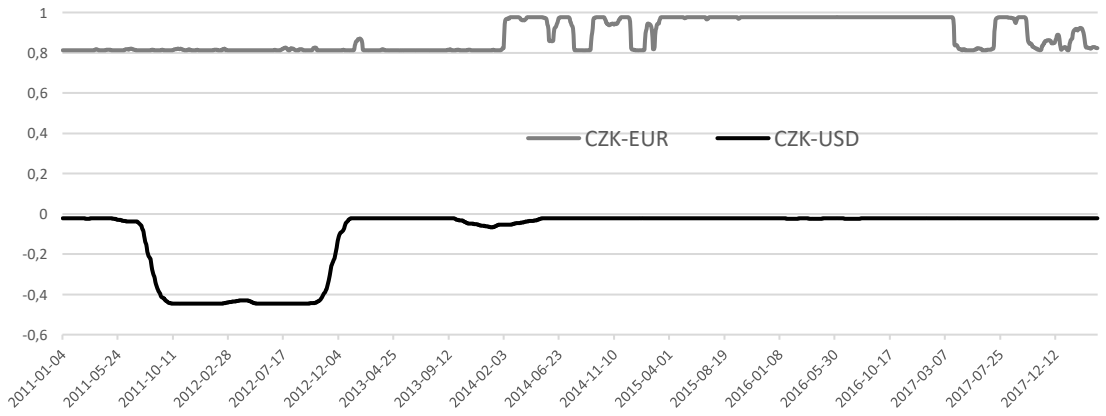
Minor currency	**with the USD against the EUR**	**with the EUR against the USD**
GBP	Spearman's rho from 0.3302 to 0.6576; strong dependence (rhos about 0.65) until the end of 2015 with short periods of weaker (0.33) linkages, from 2016 stable level of Spearman's rho about 0.3. Model: N-t	Spearman's rho from 0.0011 to 0.7187; strong dynamics of dependence driven by market events; occasionally no linkages. Model: N-N-PI
JPY	Spearman's rho from 0 to 0.8666; during almost all of the analysed period strong linkages (rho greater than 0.6), very short periods of independence. Model: N-N-PI	Spearman's rho from 0.1477 to 0.5362; negative dependence during the European debt crisis and about the British referendum concerning Brexit ; from 2014 mostly stable level of Spearman's rho (about 0.5). Model: N-t
AUD	Spearman's rho from 0.1268 to 0.4914; weak linkages at the beginning of the analyzed period (until August 2012) and during the British referendum concerning Brexit. Model: N-t	Spearman's rho from 0.0006 to 0.6734; the highest values at the beginning of the analyzed period (until September 2012) and during the British referendum concerning Brexit. Model: N-N-PI
CAD	Spearman's rho from 0.3427 to 0.6584; an increase in the strength of linkages in April 2012, in 2011 weak linkages (probably the remnants of the subprime mortgage crisis). Model: N-t	Spearman's rho from 0.1642 to 0.6248; generally weak linkages (rhos about 0.2) with short periods of increase, among others, after the British referendum concerning Brexit. Model: N-N
CNY	Spearman's rho from 0.0018 to 0.4077; strong dynamics of linkages with intensive fluctuations.	Spearman's rho from 0 to 0.5191; stable level of Spearman's rho until June 2012, then strong dynamics of linkages with intensive fluctuations.

	Model: PI-JC	Model: N-N-PI
CZK	Spearman's rho from -0.4462 to -0.220, i.e. negative dependence during all the considered period. Model: N-JC_r90	Spearman's rho from 0.8119 to 0.9778, the highest values during the period 2015-2017. Model: N-t
INR	Spearman's rho from 0.0036 to 0.4295; regular oscilations of Spearman's rho during all the considered period (March 2014-March 2016). Model: N-PI	Spearman's rho from -0.2023 to 0.1182; very weak positive depedence or negative dependence (April 2014-April 2015, June 2015, February 2016). Model: N-C
KRW	Spearman's rho from 0.0002 to 0.2285; stronger linkages until May 2012, and then fro May to August 2015. Model: N-PI	Spearman's rho 0.0588; almost independence. Model: N
PLN	Spearman's rho from -0.4764 to 0.1429; regular oscillation. Model: N-N-JC	Spearman's rho from 0.5479 to 0.8523; Stable connection with regular oscilation. Model: N-N
TRY	Spearman's rho from 0.2903 to 0.6908; short periods with stronger linkages (in 2012-2013; 2015, 2016, 2018). Model: N-N	Spearman's rho from 0.1089 to 0.5993; strong fluctuations – sensitivity on markets events. Model: N-N-JC
ZAR	Spearman's rho from 0 to 0.3055; Weak dependence or independence (2011-2012, 2017) Model: C-JC	Spearman's rho from 0.1942 to 0.6961 The strongest linkages from May 2011 to April 2012; regular oscilations of Spearman's rho during the remaining part of the period. Model: N-N-JC

Source: authors

In Figure 3 we present the results for the Czech koruna. There is no surprise, the koruna is linked with the euro and exhibits no depedence with the US dollar. In the case of linkages with the euro, the highest values of Spearman's rho occur during the period of the exchange rate commitment, i.e. 7.11.2013-6.04.2017 (Noerr 2017). An interesting thing is that in the fitted 2-regime MSC model the second regime is driven by the JC90 copula. This means that there appeared negative dependence in extreme events between the USD and Czech koruna against the euro.

Figure 3 Dynamic Spearman's Rhos for (CZK/USD, EUR/USD) and (CZK/EUR, USD/EUR)



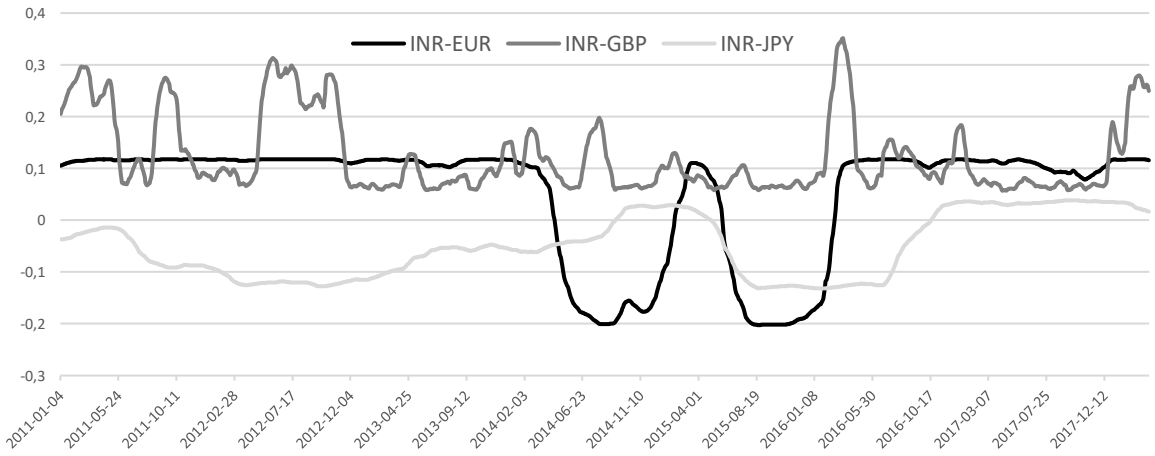
Source: authors

The results of the first part of our analysis indicate that the CZK, PLN, TRY and ZAR belong to the euro area of influence. The impact of the USD on the CAD, CNY, INR, KRW and JPY is clear.

The aim of the second part of the analysis is to determine with which of the three major currencies (EUR, GBP, JPY) each of the considered minor currencies co-moves against the US dollar. In Figure 4 we present the results for the Indian rupee. One can see that the linkages with the GBP are the strongest, though the observed values of Spearman's rho are not very high (0.06-0.35). The plots presented in Figure 5 combined with the results in Table 1 clearly indicate that the Polish zloty strongly co-moves with the euro.

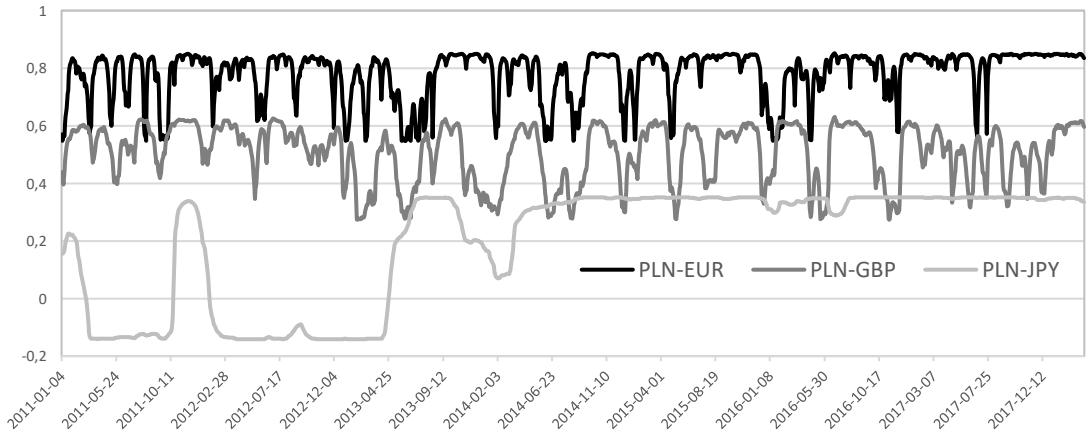
Our results show that, considering co-movement against the USD, we can divide the investigated minor currencies into four groups. The directions of movements of the CZK, PLN, TRY against the USD are concordant with the behavior of the euro. The AUD and CAD co-move with the euro and GBP with similar intensity. The INR and ZAR seem to be connected with the GBP. Surprisingly, we do not observe any significant linkages of the analyzed currencies with the JPY. The KRW and CNY are not linked with any of major currencies.

Figure 4 Dynamic Spearman's Rhos for (INR/USD, EUR/USD), (INR/USD, GBP/USD) and (INR/USD, JPY/USD)



Source: authors

Figure 5 Dynamic Spearman's Rhos for (PLN/USD, EUR/USD), (PLN /USD, GBP/USD) and (PLN /USD, JPY/USD)



Source: authors

4 Conclusions

The investigation of linkages in the currency market is more complicated than it is in the capital market case. The reason is that the analysis of the co-movement of two currencies requires the consideration of exchange rates which are always calculated against a third currency. The choice of this third currency certainly influences the results of comparison. In the paper, we showed to what degree some selected minor currencies representing different parts of the world (AUD, CAD, CZK, CNY, INR, KRW, PLN, TRY, ZAR) co-move with some major currencies (USD, EUR, GBP, JPY). We describe the dynamics of linkages in the currency market by means of Markov switching copula models. In the first part of our analysis we determine the impact of the euro and USD on each of the 11 considered currencies. For the CZK, PLN, TRY and ZAR, the dominating currency is the euro, and the remaining currencies are in the USD area of influence. The second group of our results deals with the co-movement against the US dollar. We find that the CZK, PLN and TRY co-move with the euro against the USD, and the AUD and CAD co-move with the euro and GBP with similar intensity. The INR and ZAR seem to be connected with the GBP. We did not observe any significant linkages of the analyzed currencies with the JPY. The dynamics of linkages is sensitive on market events. The impact of the British decicion concerning Brexit is visible but short-lived.

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Motor Vehicle Insurance in SMEs

Michal Fabuš[1], Viktória Čejková[2]

[1] School of economics and management in public administration in Bratislava
Department of economics and finance
Furdekova 16, SK – 851 04 Bratislava, Slovakia
E-mail: michal.fabus@vsemvs.sk

[2] School of economics and management in public administration in Bratislava
Department of economics and finance
Furdekova 16, SK – 851 04 Bratislava, Slovakia
E-mail: viktoria.cejkova@vsemvs.sk

Abstract: *In the present paper we deal with the insurance of motor vehicles in small and medium-sized enterprises. We deal with legal aspects of insurance of motor vehicles, we characterize this type of insurance in the Slovak Republic. We analyze in more detail the compulsory contractual liability insurance for motor vehicle damage, as well as emergency insurance. We analyze the insurance of motor vehicles in the selected small business. In the last part, we deal with the development of motor vehicle insurance, problems in motor vehicle insurance and trends in motor vehicle insurance in the Slovak Republic.*

Keywords: insurance, motor insurance, motor vehicle operation, compulsory contractual liability insurance, white card, green card

JEL codes: G 22

1 Introduction

Every entrepreneur works with different risks. The risk arising from business activities can be eliminated or reduced to an economically acceptable rate by applying appropriate measures. The negative consequences of risks can be reduced by the entrepreneur by transferring them to another entity operating on the financial market - to a commercial insurance company. One of the most frequently encountered risks that threatens small and medium-sized businesses is the risk of damage to, destruction or theft of a motor vehicle and damage caused by the operation of a motor vehicle. Therefore, this paper deal with the insurance of motor vehicles in small and medium-sized enterprises.

The market economy system (market economy) is a system in which the solution of the basic questions of the organization of the economy is in the hands of individuals. These decisions are made based on a price mechanism and the interaction of demand and supply. The market economy is based on a system of free enterprise and free competition (Lisý, 2016).

At present, we understand insurance as a normal part of modern life. Without insurance, many areas of today's society and economy could not function properly. The insurance industry provides coverage of economic, climatic, technological, political and demographic hazards, making it easier for individuals and businesses to live in business, innovation and development. A dynamically developing insurance market positively affects the economic growth (Grmanová, 2015).

Importance of insurance can be assessed both in terms of insured business and citizens, as well as in terms of the whole society (Grmanová, Hošták, 2016). For businesses, insurance stabilizes their economic level and affects the economic outcome. It allows the distribution of costs for business entities and the reduction of large costs in case of unforeseen events. In the event of adverse events that are the subject of insurance, the losses of business entities will moderate and thus stabilize their economic situation (Čejková, 2013).

2 Methodology and Data

In our papers, we characterize the insurance, its significance and its breakdown, as well as the insurance products of the obligatory contractual liability insurance for the damage caused by the operation of the motor vehicle, and the accident insurance of the vehicle. We will highlight the development of motor insurance in a small enterprise, and their application in this insurance in the selected SME. Also, problems and trends related to insurance of motor vehicles and the anticipated development of insurance of motor vehicles in the Slovak Republic. At the same time, we emphasize the importance of motor vehicle insurance for small and medium-sized businesses, such as mandatory contractual liability insurance and the possibility of reducing economic loss in the event of motor vehicle theft or the impact of a motor vehicle caused by the businessman himself.

The methods of description, analysis, synthesis, deduction and comparison will be applied.

Based on data from selected private company on the development of premiums and claims paid and received in the period of 2008-2017 we analyze economic outcomes of motor vehicle insurance. According the data we can see the difference between paid premiums and received claims, which are positive form economics point of view.

3 Results and Discussion

Commercial insurance companies in the Slovak Republic provide insurance for motor vehicles that cover several risks - the risks associated with the operation of the motor vehicle and with the ownership of the motor vehicle. Damage caused by the operation of a motor vehicle covers compulsory contractual liability insurance for damage caused by the operation of a motor vehicle. Damage that arises on a motor vehicle, his theft is covered by accident insurance, also called KASKO insurance.

A motor vehicle may cause damage while operating, and at the same time damage to the motor vehicle may occur. In the case of insurance against risks related to the motor vehicle, the following insurances were incurred: compulsory contractual liability insurance for damage caused by the operation of a motor vehicle, and accident insurance - KASKO.

In terms of insurance classification, we may be required to make compulsory liability insurance for damage caused by the operation of a motor vehicle, also referred to as "compulsory contractual insurance" or "CCI". Under Section 822 of the Civil Code of Liability Insurance, the insured person has the right to insure the insurer, in the event of a claim, to compensate him under the insurance conditions for damage to which the insured person is liable. The insurer pays the refund to the injured party; however, the injured party has the right to be paid by the insurer, unless otherwise provided in the special regulations.

Obligatory contractual insurance is legislatively regulated in the Act of the National Council of the Slovak Republic no. 381/2001 Coll. on compulsory contractual insurance for liability for damage caused by the operation of a motor vehicle and on the amendment and supplementation of certain laws.

The motor vehicle is a self-propelled vehicle as well as a non-self-propelled vehicle for which a vehicle registration certificate, vehicle technical certificate or a similar license is issued.

The obligation to conclude an insurance policy in a domestic motor vehicle is the one who is the holder of a motor vehicle registered in the vehicle or the person who is registered in the vehicle documents as the person to whom the motor vehicle has been transferred in other cases the owner of the motor vehicle or its operators. If a rental contract is concluded on a motor vehicle with the right to purchase a leased property, the lessee has the obligation to conclude the insurance contract. Liability insurance applies to anyone who is responsible for the damage caused by the operation of the motor vehicle covered by the insurance contract.

The insured has the right to insure liability for the insurer to compensate for the damaged and proven claims, namely: damage to health and the cost of death, damage caused by damage, destruction, theft or loss of the expense incurred by the legal representation in the exercise of claim, lost profits and others.

Compulsory contractual insurance covers the liability of the insured for the territory of the Slovak Republic and the territory of the states with which the Slovak Republic has concluded an agreement on the mutual settlement of claims for damages. These countries are listed in the green card. An insurer for compulsory contractual insurance issues the insured insurance certificate (white card) and a green card. The white card proves the liability insurance in the territory of the Slovak Republic, the green card is an international document on the validity of the insurance abroad. In countries not listed in the green card, insurance is required when entering the country border insurance.

After the occurrence of the damage event, the insured is obliged to notify the insurer in writing of the occurrence of the damage event within 15 days after its occurrence if the damage occurred in the territory of the Slovak Republic and within 30 days after its origin, as it originated outside the territory of the Slovak Republic.

Accident insurance is governed in the Slovak Republic by the Civil Code and insurance conditions. The Civil Code regulates insurance contracts, the process of insurance contract conclusion, termination of insurance, change of insurance, property insurance and limitation.

According to the provisions of Section 806 of the Civil Code of Property Insurance, the insured person has the right to receive a payment in the amount determined according to the insurance conditions if the insured event relates to a matter covered by the insurance.

The conditions of accident insurance of individual insurers are quite different. Most insurers have insurance options that offer different coverage options.

The subject of emergency insurance is the vehicle. The vehicle is most often defined as a self-propelled vehicle as well as other non-self-propelled vehicles for which a vehicle registration document is issued and which is subject to vehicle registration in the Slovak Republic. The trailer is a road vehicle designed to be connected to a motor vehicle. The vehicle at the time of insurance closure must be undamaged, in proper technical condition and fit for operation. Insurance is most often negotiated at a new value, i.e. the amount corresponding to the price of a new vehicle of the same type, quality, equipment without discounts at the time of purchase of a vehicle as new in the territory of the Slovak Republic. The territorial validity of insurance is the most common geographical area of Europe.

Insurance risks in accident insurance may be broken down by individual insurers' products. Insurers cover the most frequent risks of accident insurance: damaging or destroying the vehicle because of an accident, damage or destruction of the vehicle as a result of a natural occurrence, damage or destruction of the vehicle by vandalism, theft of part or all of the vehicle.

Assistance to accident insurance is multiple, collision avoidance with animals, windscreen attachment and others. Motor insurance assurance services are services provided by insurers as part of insurance free of charge. For a fee, the assistance services are usually with a larger range of assistance services, respectively higher coverage limits. Assistance services include a range of services that can be used by insurers within the limits and under certain conditions of the insurer: assistance services are covered by the vehicle during the period of compulsory insurance or accident insurance, the driver and the persons transported by the insured vehicle are entitled to the assistance services.

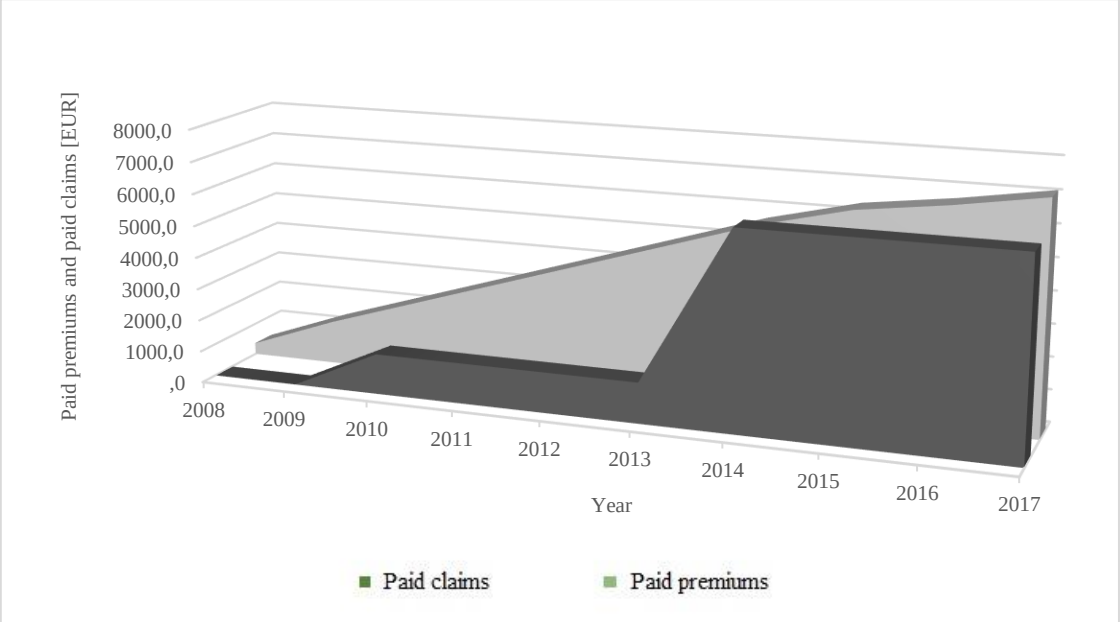
Motor insurance will be monitored between 2008 and 2017 in a real company operating in the Slovak Republic. State what motor vehicles the company used and what insurance it had for motor vehicles. The company, a small business, is listed in the financial and insurance activities sector. For our paper, we will call the company XY.

In 2008, the company acquired seven motor vehicles. All vehicles were Škoda, four Octavia and three Škoda Octavia Combi. One of the vehicles (Škoda Octavia) was stolen in 2009. In 2015, the company sold four motor vehicles (two Škoda Octavia and two Škoda Octavia Combi) and bought one Škoda Octavia. In 2016, the company bought two more Škoda Octavia vehicles. At present, the company owns four vehicles Škoda Octavia and one Škoda Octavia Combi. Compulsory insurance for liability for damage caused by motor vehicle company in 2008, negotiated in the Česká poisťovňa - Slovensko, Inc. such as fleet insurance. The scope of compulsory contracted insurance arises from the law on compulsory contractual insurance. The obligatory contract insurance was provided by Česká poisťovňa - Slovensko, a.s. assistance services. Assistance services were provided in the event of an unforeseen event because of a traffic accident or mechanical disruption in the countries listed in the Green Card.

From the information on the insurance of third party liability insurance company and information on claims paid by insurers show that in the reporting period was paid by insurance in the amount of € 7,134.11 and paid indemnity insurers in that period was € 6,156.78.

Figure 1 shows a graphical representation of the paid insurance by the company and claims paid by insurers for damaged from compulsory contractual insurance.

Figure 1 Comparison of Paid Premiums and Insurance Payments of Compulsory Contracted Insurance

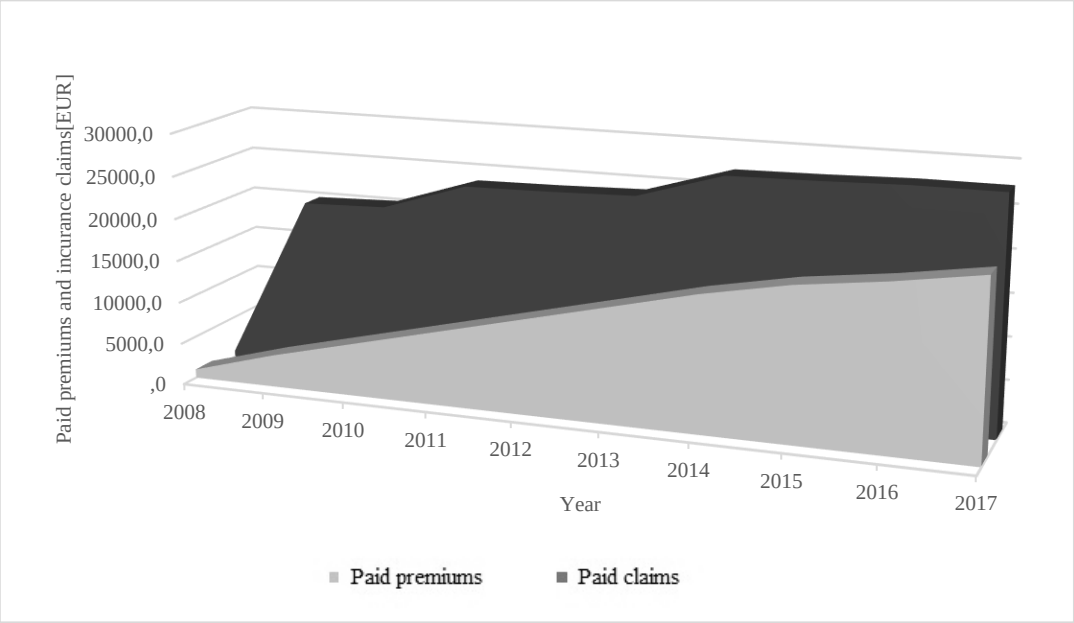


Source: Own processing based on internal company documents

In the monitored years, the company also paid premiums for accident insurance of € 20,869.13. In the case of insurers, 12 insurance events were claimed from the accident insurance, the amount of the indemnity amounting to € 27,600.65

Figure 2 shows a graphical representation of the paid insurance by the company and the insurance benefits paid by the insurers.

Figure 2 Comparison of Paid Premiums and Insurance Payments of Accident Insurance

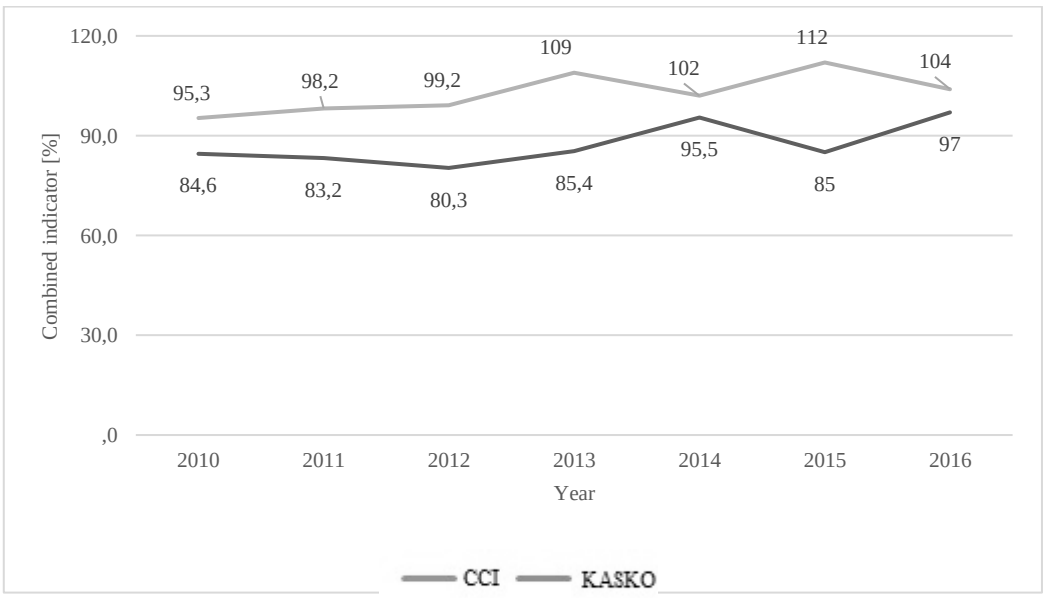


Source: Own processing based on internal company documents

The comparison shows that the company received € 27,600.65 on insurance claims from insurers. In total, the company paid premiums of € 20,869.13. Therefore, the company received 32% more than insurance premiums. The fact that the company had an accident insurance with economic benefits was due to the performance of a specific insurance event - theft of a motor vehicle in 2009.

Every year, the National Bank of Slovakia processes the analysis of the Slovak Financial Sector. In the section on insurance, it provides information on motor vehicle insurance. One of the main indicators of motor vehicle insurance is a combined indicator that expresses the loss and cost of insurance on the earned premium. Figure 3 shows a composite indicator for compulsory contracted insurance and accident insurance for the period 2010 to 2016.

Figure 3 Combined Indicator in CCI and KASKO Insurance



Source: Own processing based on internal company documents

In 2016, the combined indicator of motor vehicles continued to grow for a long time, and by September 2016, this sector was loss-making. The net combined motor insurance indicator was 101% (97% of the PZP, 104% of the accident insurance) as of September 2016. The premiums received did not cover the costs of claims. In the case of an estimate of gross combined indicator, this would be 100% in the case of accident insurance and 98% in the case of compulsory contracted insurance. As a result, motor insurance premiums do not cover insurance claims for long periods. The reasons why motor insurance is long-term loss are long-term problems in motor vehicle insurance.

Motor vehicle insurance in practice faces several problems with which insurers and insurances must deal with. There are some problems, insurers and insurers are bored for years such as insurance claims, total vehicle damage or non-material damage. With some of them, most of the insurers have already dealt with, for example, counting for wear and tear in real damage. Some of the problems are just overdue and insurers will have to deal with them soon, such as applying a more appropriate bonus / malus system.

4 Conclusions

The answer to the question of what development trends can be expected in motor insurance in the coming years is not easy at all, as it is not entirely clear how the insurance will change after legislative adjustments in the coming years. Some future things, such as, for example, tax deduction from motor vehicles, systematic driver education, and changes in age of driver adepts. The center of interest of the insurers, i.e. commercial insurers must be a client and an understanding of his ever-changing needs in these motor vehicle insurances. The introduction of new technologies will then enable personalized offers to be provided by commercial insurance companies that take even more into account the individual needs of clients and motorists.

Based on our data from selected private company, we can positively identify that the company received higher paid claims then the paid premiums in the analyzed period.

Expected trends in motor vehicle insurance will include the development of digitization and innovation, the expansion of insurance in compulsory contractual insurance and the convergence of compulsory contractual insurance and accident insurance. In the longer term, insurers will be faced with solving the issue of insurance vehicles.

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Ratio Bias under Conditions of Uncertainty – Experimental Results

Maria Forlicz[1], Tomasz Rólczyński[2]

[1] Wroclaw University of Economics
Faculty of Engineering and Economics, Department of Economic Sciences.
118-120 Komandorska Street, 53-345 Wrocław, Poland
E-mail: maria.forlicz@ue.wroc.pl

[2] WSB University in Wroclaw
Faculty of Finance and Accounting, Department of Economics
29-31 Fabryczna Street, 53-609 Wrocław, Poland
E-mail: tomasz.rolczynski@wsb.wroclaw.pl

Abstract: *It has been found that when making decisions under risk regarding positive results (gains), people prefer lotteries with probabilities expressed as a ratio of large numbers (eg. the chance of winning is 30 to 1000) to lotteries with equal probabilities expressed as a ratio of small numbers (eg. 3 to 100)- it is a phenomenon called ratio bias (eg. Denes-Raj, Epstein [1994], Reyna, Brainerd [2008]). However, since it is usually impossible to know or to calculate probabilities of occurrence of various events, it seems plausible to claim that most decisions made in everyday life are decisions under uncertainty. That is why the aim of this article is to investigate people's perception of chances to win in a lottery under conditions of uncertainty when for the same price they obtain fewer or more tickets (with equal prices and number of tickets obtained for all participants). It is important to know if buying 1 ticket for 1 euro is as attractive as buying 10 tickets for the same price while the (unknown) probability of winning stays the same. The aim will be achieved by conducting an experiment with real but non-monetary pay-offs. Students will be given an opportunity to participate in a lottery in which one can win additional points to their final score in a subject. In Scenario I a student will be able to buy one lottery ticket for a small price, while in Scenario II 10 lottery tickets. In both scenarios the number of winning tickets will be the same. Along with ratio bias theory it is hypothesized that (with unchanged probability of winning) an increased number of tickets sold for a specified price will effect an increased demand for the tickets.*

Keywords: decision under uncertainty, lottery, expected value

JEL codes: D120, D800

1 Introduction

Every person makes hundreds of decisions every day. What to eat, when to get up from bed, what to wear, whether or not to buy a new car, to lend money to a friend. Scientists have shown that many of those decisions depend on the way the decision problem is described, which is a violation of the assumption of human rationality. Framing effect, well known in economic psychology, has been shown to influence people's decisions made under risk. For example Tversky and Kahnemann (1981) described a research in which the same decision-making situation was framed positively and negatively (concentrating on possible gains or losses), with the participants' decisions being significantly different. One of the manifestations of framing effect might be ratio bias effect which occurs when people judge the possibility of occurrence of some event as more probable when its probability is expressed in the form of an equivalent ratio of larger numbers than when it is expressed in smaller numbers. The aim of the paper is to check whether ratio bias appears also in decisions made under uncertainty. Definitions and difference between the notions of risk and uncertainty are a point of interest of many researchers and were described, for example, by Knight (1964), von Thünen (1910), Keynes (1921). Most commonly, it is assumed that the difference lies in knowing (in the former case) or not knowing (in the latter) probabilities of occurrence of some events or probability distribution. These differences can be shown by using the example of a lottery. Deciding whether to play in a

lottery in which the number of tickets and the number of winning tickets is known is to make decision under risk. If the number of tickets is not known or it is not known how many tickets are winning, we say we are in a situation of uncertainty. The hypothesis to be verified in the paper is that (with unchanged probability of winning) an increased number of tickets sold for a specified price will effect in increased demand for the tickets because the subjects of the experiment believe that obtaining more tickets will give them more chances to win. The hypothesis is to be verified on the basis of an experimental result.

2 Literature review

Along with Framing Theory, Support Theory proposed by Tversky and Koehler (1994) says that different descriptions of the same situation can lead to different values of subjective probability. People offered home insurance against all hazards are less likely to buy this policy than those who are offered insurance against fire, flooding, theft and other events. If an event is unpacked into smaller parts, it seems more probable. This situation may be caused by neglecting denominator and concentrating on the numerator, as in the case of a jointly packed description, the nominator is 1, and with an unpacked description the nominator increases to a number bigger than 1. In turn, denominator neglect might be a reason for ratio bias effect. One of the first studies that revealed the existence of this phenomenon was conducted by Miller et al. (1989). The authors asked participants what was more suspicious a) that a child would draw a chocolate cookie from a jar in which there were 19 oat cookies and one chocolate cookie, with the chocolate cookie being the child's favorite or b) that the child would draw a chocolate cookie from a jar in which there were 190 oat cookies and ten chocolate cookies. Participants on average judged a) as more improbable. Kirkpatrick and Epstein (1992) showed (based on experimental results with real but small payoffs) that people preferred drawing a ticket from a large pool when the probability of winning was small and from a smaller pool when the probability of winning was high, and reversely, they preferred drawing a ticket from a large pool when the probability of losing was high and from a smaller pool when the probability of losing was low. Denes-Raj and Epstein (1994) even showed that 82% of subjects made at least one non-optimal choice deciding to draw a ticket (actually a jelly bean) from a greater pool with a smaller percentage of winning tickets (actually red jelly beans) instead of drawing from a smaller pool but with a greater percentage of winning tickets. Slovic et al. (2000) demonstrated that 40% of clinical psychologists refused to discharge a mental patient from an acute civil mental health facility when risk of violence was stated as follows: "20 out of every 100 patients similar to Mr. Jones are estimated to commit an act of violence" and only 20% refused to discharge the patient when risk was given as "2 out of every 10 patients similar to Mr. Jones are estimated to commit an act of violence." Alonso and Fernandez-Berrocal asked participants a hypothetical question which job position they would choose to apply for themselves, and which job position they thought other people would choose to apply for if applying for one job gave 3 to 10 probability of obtaining the job, and in the latter case the probability was expressed as a 10 to 100 ratio. 68.6% would choose to apply for the first position but only 48.6% of participants believed that the others would make the same decision. 25.7% believed that from a logical perspective it was better to choose applying for the second job. Rudski and Volksdorf (2002) surprisingly found that the ratio bias was more prevalent for choices presented graphically than for those described textually. Amsel et al. asked participants which choice was rational: choosing a jar with 1 to 10 or 10 to 100 probability of winning, or being indifferent between drawing from the two jars. Only around 31% of subjects was moderately or strongly convinced that the only rational answer was being indifferent. However, Passerini et al. (2012) argue that ratio bias is only an experimental artefact and it decreases sharply when participants are given the option that allows them to express the correct answer (i.e. being indifferent between two equally probable options). In the present paper the authors describe an experiment in which subjects made a choice under condition of uncertainty and they were not given a choice between lotteries, with each participant choosing only how many lottery tickets to buy. Next, the demand for the tickets in two groups (which differed in the number of tickets obtained for a specific price) was compared. Separately, it was checked in a survey (with

different subjects) which lottery seemed more attractive and why. However, in the survey it was possible to say that the two lotteries were equally attractive.

2 Methodology and Data

In order to test the hypothesis stating that an increased number of lottery tickets sold for a specific price will increase the demand for lottery tickets, and to achieve the objective outlined in the introduction, an experiment was carried out. Further on in the paper, this study will be referred to as an experimental study. Subjects of the experiment were students of two universities, whose total number was 139 persons. The experiment involved offering students to participate in a lottery in which they could win additional points needed to obtain credit in a subject. The experiment was conducted according to two different scenarios:

Scenario I:

As part of a scientific experiment, I'd like to offer you participation in a lottery where the winning ticket is 21 points. Everyone of you can buy a chance of drawing **10 lottery tickets** in that you write down your first name and surname by hand on a sheet of paper a 100 times; if anyone feels like buying lottery tickets for a multiple of 100 complete signatures, in other words, for example, a chance to draw 20 lottery tickets from the box for 200 complete signatures, he or she is very welcome do so. In the box from which you will be drawing lottery tickets there will be 3 tickets which give you 21 points. The total number of tickets in the box depends on how many tickets the entire group will buy. Now please approach and tell me how many tickets you would like to buy. Please, make sure your declaration is well thought-out, because your withdrawing will have negative consequences in terms of points.

Scenario II:

As part of a scientific experiment, I'd like to offer you participation in a lottery where the winning ticket is 21 points. Everyone of you can buy a chance of drawing **1 lottery ticket** in that you write down your first name and surname by hand on a sheet of paper a 100 times; if anyone feels like buying lottery tickets for a multiple of a 100 complete signatures, in other words, for example, a chance to draw 2 lottery tickets from the box for 200 complete signatures, he or she is very welcome to do so. In the box from which you will be drawing lottery tickets there will be 3 tickets which give you 21 points. The total number of tickets in the box depends on how many tickets the entire group will buy. Now please approach and tell me how many tickets you would like to buy. Please, make sure your declaration is well thought-out, because your withdrawing will have negative consequences in terms of points.

Students were informed that in order to participate in the lottery one was required to refrain from any communication with other participants before making the decision about the number of lottery tickets one wanted to buy. The reason for this requirement was to make the conditions for decision-making uncertain, that is, when deciding to buy lottery tickets, participants would not know how many tickets had already been bought by other participants, and thus would not be able to calculate the probability of winning. Including in the scenario the clause about negative consequences, if one should fail to commit to "payment" for the ordered tickets, was meant to prompt students to make well-thought out decisions. Moreover, one should note that unlike other studies concerned with ratio bias, one did not manipulate here with the proportions of winning tickets in relation to a larger or smaller denominator (thus, the first group was not told that there were 3 winning lottery tickets to 100, and in the second group 30 to 1000); what was changed was the number of chances a given person could win, while the probability of winning was the same.

Furthermore, with a view to verifying the assessment as to which lottery seemed more favorable, an quasi-experiment was conducted in that participants were offered a hypothetical possibility of purchasing lottery tickets in one of the above mentioned lotteries (Scenario I or Scenario II), that is, purchasing 10 lottery tickets for a 100 signatures, or

purchasing 1 lottery ticket for 100 signatures (or multiples of 100). Students were supposed to indicate which lottery they would like to participate in and in addition, they were to provide a rationale for their choice. The objective was to collect information on the evaluation of attractiveness of those lotteries, and, first and foremost, the information on the motives which guided people in their evaluation of attractiveness. This study was conducted on 142 people, who were not the same as those who were subject to the experiment described earlier. This afforded the possibility to define which lottery participants would choose and which they would find more favorable.

3 Results and Discussion

139 people participated in the experiment. Table 1 presents the results of descriptive statistics for the experimental study conducted. With a view of consolidating and comparing the results as to the number of lottery tickets purchased, the number of the lottery tickets bought in the experiment, which was carried out according to Scenario I, was divided by 10. The results showed that the mean number of lottery tickets bought in the Scenario II experiment (1 ticket for 100 signatures) was bigger than the mean number of lottery tickets bought in the Scenario I experiment (10 tickets for 100 signatures). Those means were statistically significantly different at a significance level $\alpha=0.05$. Also, the median for Scenario II (3 lottery tickets) was bigger than for the Scenario I experiment (2 lottery tickets). The distributions were characterized by the same modes (1 lottery ticket) and right-hand side asymmetries.

Table 1 Descriptive Statistics on the Number of Lottery Tickets Bought in the Case of Choice under Uncertainty

Variable	**Descriptive statistics**			
	Mean	Median	Mode	Sd
purchased tickets in the case of 10 tickets for 100 signatures (number of tickets divided by 10) – Scenario I	2.5429	2.0	1.0	2.7698
purchased tickets in the case of 1 ticket for 100 signatures – Scenario II	3.6522	3.0	1.0	3.4803

Source: Authors' own study

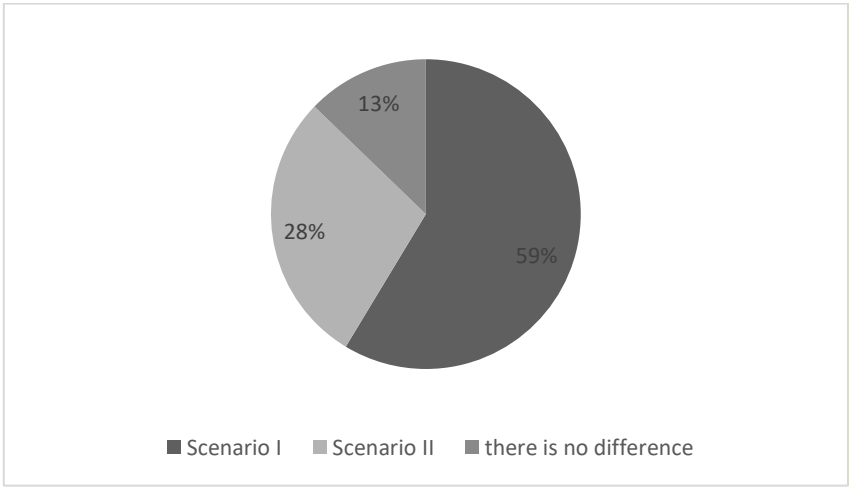
The distribution of the number of lottery tickets bought is presented in Figure 1. Extreme observations were disregarded in the distribution. Subjects were characterized by a smaller variation in terms of the number of tickets bought in the lottery conducted according to Scenario II, as compared to the Scenario I lottery. Surprisingly, there were fewer people who were not willing to buy any tickets at all in Scenario II (4% vs. 10% in Scenario I); and in Scenario II there was a substantial number of people who were willing to buy 10 tickets. Moreover, in Scenario I, buying two tickets was as nearly popular as buying one ticket.

Figure 1 Distribution of the Number of Purchased Tickets in the Case of 1 for 100 Signatures and 10 for 100 Signatures

Source: Authors' own study

The second study intended to show which lottery respondents would choose if they had such choice. 52% of respondents would play the lottery according to Scenario I, while 41% would play the lottery following Scenario II. Moreover, considering the rationale for those choices it was determined which lottery respondents found more attractive on the whole. Attractiveness evaluation sometimes differs from the decision as to which lottery a particular respondent would participate in. The comment that was frequently stated was that "my friends will surely choose lottery X, so I choose…". This implies that in making their decision on lottery choice some respondents were prompted by predictions as to how other participants would behave and what would be their preferences, trying to increase in this way their own chances of winning. The results collected in the form of commentaries and rationale for respondents' choices allowed for assessing which lottery was perceived as more attractive. Even if the participant chose lottery designed according to Scenario II justifying his choice by saying that others would choose the Scenario I lottery, "because it is more attractive," that would indicate that in his view the lottery according to Scenario I was more attractive. The results of attractiveness evaluation are presented in Figure 2.

Figure 2 Percentage of respondents stating specified lottery was more favourable



Source: Authors' own study

Respondents decided that the more attractive lottery was the one designed according to Scenario I. 59% found the Scenario I lottery more attractive, while 28% found the lottery conducted according to Scenario II more attractive. 13% of respondents indicated that

they saw no difference in terms of the lottery attractiveness, stressing, in the justification of their choice, that the chances of winning were the same for both lotteries, since it did not matter whether one would buy one lottery ticket (or a multiple) for 100 signatures or 10 tickets (or a multiple) for 100 signatures. Still, out of the 13% there were some who chose to participate in either lottery, hence when it came to choosing the game, only 7% was reported to be indifferent as to the choice of the lottery. The analysis of the arguments justifying respondents' decisions allowed for explaining their behaviour. As a rationale for choosing a particular lottery, the majority of respondents wrote that they discerned a greater chance of winning when buying 10 lottery tickets for 100 signatures. Moreover, in the second form of arguments for a particular choice it was claimed that one needed to buy more lottery tickets in the lottery according to Scenario II so as to even up the winning chances, as compared to Scenario I. This kind of rationale explained why in the experiment there was a higher average demand for lottery tickets in the lottery conducted according to Scenario II. Respondents believed that buying tickets for lottery designed according to Scenario I provided a bigger chance of winning than in the Scenario II lottery. In order to increase their chance, they bought more lottery tickets in the experimental study in order to have a greater chance of winning. One can view this situation from the reverse perspective. If participants bought 10 lottery tickets for 100 signatures in the study according to Scenario I, then they saw their chance of winning as high enough so as not to feel induced to buy a bigger number of lottery tickets. Persons who found the Scenario II lottery more favourable argued that in this case the lottery pot would be smaller and thereby their chances of winning would increase. Persons who decided to participate in the Scenario II lottery noted that many people would not be willing to write 100 signatures just for one lottery ticket, and consequently they would buy fewer tickets, which in turn would increase the winning chances of persons filling up the questionnaire because they were less lazy than others.

4 Conclusions

Two studies were conducted in order to test the hypothesis stating that an increased number of tickets sold for a specific price would increase the demand for lottery tickets. The first study was experimental, while the second was quasi-experimental, since subjects were placed in the situation of a hypothetical choice. Additionally, in the quasi-experimental study, information was gathered on the motives behind the subjects' choices. On the basis of the collected information, one can assert that the lottery which people found more attractive was the one in which they could receive more lottery tickets for a specific price. In particular, in comparing the two lotteries, respondents explained their choices saying that they saw more chances of winning in the lottery designed according to Scenario I, compared to the Scenario II lottery. The hypothesis advanced was not confirmed. A greater number of lottery tickets to be bought for a specific price did not increase the demand for lottery tickets. On the contrary, it was the smaller number of lottery tickets for the same price that motivated participants to greater effort and to the purchase of more lottery tickets. The rationale for this situation came with the analysis of the answers provided by the participants of the quasi-experimental study who argued that given that the lottery conducted according to Scenario I gave a bigger chance of winning, there was no need to buy a multiple of 10 lottery tickets, which resulted in a decreased demand for lottery tickets in this lottery.

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Actuarial Model for Pricing Disability Insurance Policy

Ján Gogola, Lucie Kopecká

University of Pardubice
Faculty of Economics and Administration,
Institute of Mathematics and Quantitative Methods
Address: University of Pardubice
Faculty of Economics and Administration
Studentská 84, 532 10 Pardubice
E-mail: jan.gogola@upce.cz, lucie.kopecka@upce.cz

Abstract: *The main objective of our contribution is to apply stochastic processes for disability policy that gives annuity benefit in case of temporary or permanent disability. We apply durational effect to the disable state, by splitting it into several states. Using the data supplied by the Continuous Mortality Investigation (CMI) we calculate the single and annual premiums for that policy.*

Key words: disability insurance, Markov process, semi-Markov process, splitting of states,

JEL Classifications: C51, C52, G22, J11

1 Introduction

The main goal of this paper is to apply Markov process for disability income insurance benefits. The data we used in our contribution were supplied by the Continuous Mortality Investigation (CMI). The CMI is a research organisation established by UK actuarial profession.

Disability insurance, long-term care insurance and critical illness cover are becoming increasingly important in developed countries as it is mentioned in Pacáková, V., Jindrová, P. (2014). The private sector insurance industry is providing solutions to problems resulting from these pressures and other demands of better educated and more prosperous populations.

Most of the disability policies in UK are accelerated policies (88%) and they are attached to life insurance, term insurance or endowments. Typically, regular premiums are payable throughout the term while the policy is in force.

We describe the actuarial structure of disability insurance. Actuarial problems such as pricing and reserving are considered within the context of multiple state modelling, providing a strong and sound framework for analysing personal insurances.

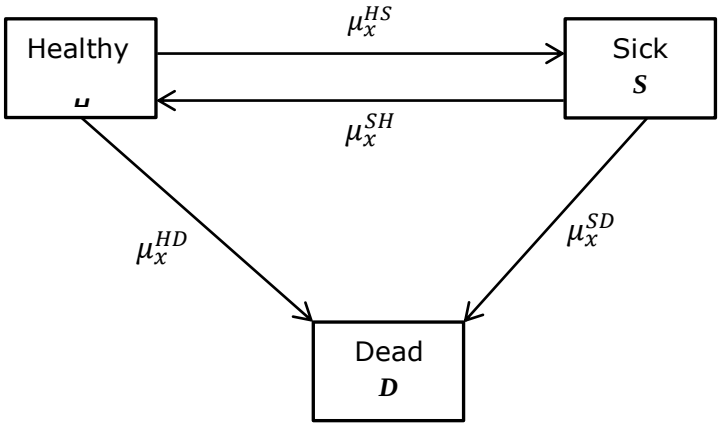
Our contribution is based on Markov process that can be used to develop a general, unified and rigorous approach for describing and analysing disability and related insurance benefits. The use of Markov process or Markov chain in life contingencies and their extensions has been proposed by several authors; for example Dickson, D. C., Hardy, M. R., & Waters, H. R. (2013), Haberman, S., & Pitacco, E. (1998).

2 Methodology and Data

Multiple state models are one of the most exciting developments in actuarial science nowadays. They are a natural tool for many important areas of practical interest to actuaries. They provide solid foundation for pricing and valuing complex insurance contracts. Many actuarial applications are modelled as time inhomogeneous Markov processes. Markov process assumes that probabilities of transitions at any time t depend only on the current state and not on the past. A Markov model for disability insurance has state space $\mathscr{S} = \{H, S, D\}$, where '$H$' means healthy, '$S$' sick (or ill) and '$D$' dead. Transitions rates at each age x are illustrated in the Figure 1. An individual is, at any time t, in one of three states, "Healthy", "Sick" or "Dead". We can use this simple three state

model to define a random variable $Y(t)$ which takes one of the three values '*H*', '*S*' and '*D*'. Suppose we have an individual aged *x* years at time *t*=0. The event $Y(t) = H$ means that an individual is healthy at age *x*+*t*, and $Y(t) = D$ means that an individual died before age *x*+*t*. The set of random variables $\{Y(t)\}_{t\geq 0}$ is an example of a continuous time stochastic process. We will assume that $\{Y(t)\}_{t\geq 0}$ is a Markov process. A policyholder is supposed to be healthy at the time of the commencement of the policy and he/she stays in this state until at some time he/she transits to one of the 2 possible states, that means a death or an illness occurred.

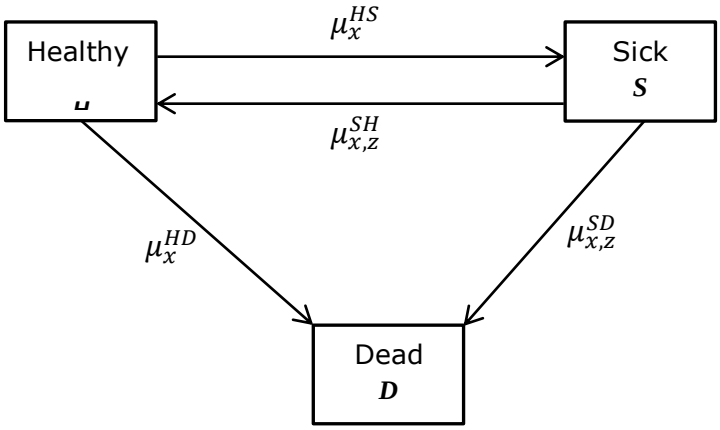
Figure 1 The Disability Income Model – Markov Model



Source: Own processing

It is perhaps more realistic to modify the previous model so as rates from "Sick" to "Healthy" and from "Sick" to "Dead" depend on the length of time *z* already spent in the "Sick" state, as well as on the age *x* of the individual. But then the Markovian property of the process is lost. This approach gives more complicated insurance policies which require more sophisticated model – semi-Markov model.

Figure 2 The Disability Income Model – Semi-Markov Model

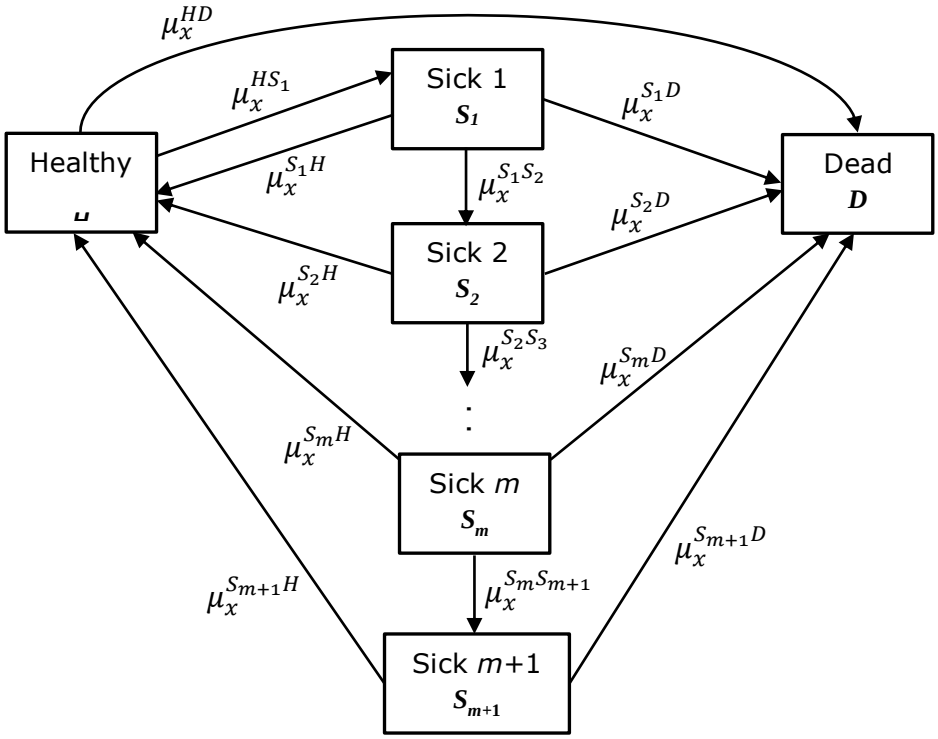


Source: Own processing

The disability income insurance pays a benefit during periods of sickness, the benefit ceases on recovery. Figure 2 shows a model suitable for policy which provides an annuity benefit while person is sick, with premiums payable while the person is healthy. The model represented by Figure 2 differs from that in Figure 1 in one important aspect: the

dependence of transition rates (and probabilities) on the time spent in the state "Sick" since the latest transition to that state.

Figure 3 Splitting of "Sick" State



Source: Own processing

We restrict the influence of the durational effect to some specified states. Let us replace state "Sick" by m+1 states S_1, S_2,…, S_m, S_{m+1}, where state

S_1 means that an insured is disabled with duration of disability between 0 and τ_1 units of time,

S_2 means that an insured is disabled with duration of disability between τ_1 and τ_2 units of time, …

S_m means that an insured is disabled with duration of disability between τ_{m-1} and τ_m units of time,

S_{m+1} means that an insured is disabled with duration of disability longer than τ_m units of time.

Thus, we have made a splitting of state "Sick" of the state space $\mathscr{S} = \{H, S, D\}$. New state space is as follows: $\mathscr{S}^* = \{H, S_1, S_2,\ldots, S_m, S_{m+1}, D\}$. Hence, we formally revert to the Markov process $\{X(t); t \geq 0\}$ based on the state space $\mathscr{S}^*$.

Thus, the introduction of more states representing the durational effect is a notational tool for treating semi-Markov model within the simpler Markov framework.

The splitting allows us to consider select intensities (and probabilities) without formally introducing a semi-Markov model (leading to major difficulties).

In general case, with states H, S_1, S_2,…, S_m, S_{m+1}, D we refer to μ_x^{ij} as the force of transition or transition intensity between states i and j at age x. The transition intensities are fundamental quantities which determine everything we need to know about a multiple state model.

The model requires the following transition intensities:

$$\mu_x^{HD}, \mu_x^{HS_1}, \mu_x^{S_1H}, \mu_x^{S_1S_2}, \mu_x^{S_1D}, \mu_x^{S_2H}, \mu_x^{S_2S_3}, \mu_x^{S_2D}, \dots, \mu_x^{S_mH}, \mu_x^{S_mS_{m+1}}, \mu_x^{S_mD}, \mu_x^{S_{m+1}H}, \mu_x^{S_{m+1}D}.$$

As far as recovery is concerned, morbidity experience suggests:

$$\mu_x^{S_1H} > \mu_x^{S_2H} > \cdots > \mu_x^{S_mH} > \mu_x^{S_{m+1}H}.$$

In particular it is possible put $\mu_x^{S_{m+1}H} = 0$, in the case of no recovery is possible after τ_m units of time.

Let us assume that a time-continuous Markov model has been assigned. Thus, the transition intensities have been specified and the transition probabilities have been derived. It is self-evident that the implied time discrete probabilistic structure can be immediately derived. To do this, we simply have to restrict our attention to transition probabilities ${}_tp_x^{ij}$ only, where x, t now denote integer values, so we get time-discrete Markov model.

Our splitting states model requires the following transition probabilities

$$p_x^{HD}, p_x^{HS_1}, p_x^{S_1H}, p_x^{S_1S_2}, p_x^{S_1D}, p_x^{S_2H}, p_x^{S_2S_3}, p_x^{S_2D}, \dots, p_x^{S_mH}, p_x^{S_mS_{m+1}}, p_x^{S_mD}, p_x^{S_{m+1}H}, p_x^{S_{m+1}D}.$$

3 Results

Consider the model (Figure 3) for a disability income insurance. The disability state is split into six states (due to available data). For states S_1, S_2,…, S_5 recovery is possible, whilst S_6 is assumed to represent permanent disability. These assumptions lead to the one-year transition matrix (or the transition matrix of one-year probabilities) of Table 1.

Table 1 One-year Transition Probabilities M_x

	H	***S*₁**	***S*₂**	***S*₃**	***S*₄**	***S*₅**	***S*₆**	***D***
H	p_x^{HH}	$p_x^{HS_1}$	0	0	0	0	0	p_x^{HD}
***S*₁**	$p_x^{S_1H}$	0	$p_x^{S_1S_2}$	0	0	0	0	$p_x^{S_1D}$
***S*₂**	$p_x^{S_2H}$	0	0	$p_x^{S_2S_3}$	0	0	0	$p_x^{S_2D}$
***S*₃**	$p_x^{S_3H}$	0	0	0	$p_x^{S_3S_4}$	0	0	$p_x^{S_3D}$
***S*₄**	$p_x^{S_4H}$	0	0	0	0	$p_x^{S_4S_5}$	0	$p_x^{S_4D}$
***S*₅**	$p_x^{S_5H}$	0	0	0	0	0	$p_x^{S_5S_6}$	$p_x^{S_5D}$
***S*₆**	0	0	0	0	0	0	$p_x^{S_6S_6}$	$p_x^{S_6D}$
D	0	0	0	0	0	0	0	1

Source: Own processing

For calculation we use transition intensities from the CMI Working paper 12. From these data we apply our model for the probabilities of disablement, i.e. $p_x^{HS_1}$,

$$p_x^{HS_1} = e^{-6{,}11+0{,}0458\cdot x}, \tag{1}$$

and for the probabilities of recovery as a function of attained age x. For each state S_1, S_2,…, S_6, the following functions are used

$$p_x^{S_jH} = \alpha_j - \beta_j \cdot x, \tag{2}$$

for j =1, 2,…, 6.

The parameters α_j, β_j are given in Table 2.

Table 2 Parameters for Probabilities of Recovery

j	α_j	β_j
1	1,4161	0,0222
2	0,7400	0,0115
3	0,3739	0,0058
4	0,2855	0,0046
5	0,1918	0,0031

Source: CMI Report 12

We assume that the health mortality equals to general population mortality

$$p_x^{HD} = q_x = 1 - \exp\{-\int_0^1 \mu_{x+t}\,\mathrm{d}t\} \quad , \tag{3}$$

where μ_{x+t} is given by Gompertz-Makeham law of mortality $\mu_{x+t} = \mu_{x+t}^{HD} = a + b \cdot c^{x+t}$, with $a = 0.0005$, $b = 7{,}5858 \cdot 10^{-5}$ and $c = 1.09144$.

Probabilities of death for disabled insured, $p_x^{S_jD}$ (for j =1, 2,…, 6), are assumed to be equal to $(1+\eta) \cdot p_x^{HD}$, where η is the extra level of mortality of disabled. The technical rate of interest i = 0.015 p.a. (or 1.5 % p.a.) has been assumed.

Let $\ddot{a}_{x:n}$ denote the actuarial value of an annuity

$$\ddot{a}_{x:n} = \sum_{k=0}^{n-1} {}_kp_x^{HH} \cdot v^k \quad , \tag{4}$$

where v is the discount factor ($v = \frac{1}{1+i}$).

The disability benefit (one monetary unit) is paid whatever disability state S_1, S_2,…, S_6 is occupied by insured.
Hence, the actuarial value of the disability benefit is defined, for a healthy individual, as follows

$$a_{x:n}^{HS} = \sum_{k=1}^{n} \sum_{j=1}^{6} {}_kp_x^{HS_j} \cdot v^k \quad . \tag{5}$$

The disability annuity is assumed to be payable up to the end of the policy term n.

The actuarial value of the disability benefit is defined, for a disabled individual aged x+t who occupies the state S_j (j = 1, 2, …, 6) as follows

$$a_{x+t:n-t+1}^{S_jS} = \sum_{k=0}^{n-t} \sum_{h=1}^{6} {}_kp_{x+t}^{S_jS_h} \cdot v^k \;;\; (t = 1, 2, \ldots, n), \tag{6}$$

where ${}_0p_{x+t}^{S_jS_h} = 1$ if $h = j$ and 0 otherwise.

The annual premium, $P_{x:n}$, payable for n years while the insured is healthy, is given by:

$$P_{x:n} = \frac{a_{x:n}^{HS}}{\ddot{a}_{x:n}}. \tag{7}$$

The calculation of the actuarial values defined by equations (4), (5) and (6) and then the calculation of premium according to formulae (7) imply the use of the underlying probabilities, which can be derived from one-year transition matrix M_x (Table 1). The product of one-year transition matrices at successive ages is a two-year transition matrix $M_x \cdot M_{x+1} = {}_2M_x$. Continuing the matrix multiplication through subsequent ages, we can determine the k-year transition matrix ${}_kM_x$ for any integer k.

Table 3 presents numerical results for policy terms n = 10, 15, 20 years and η =0.20 and illustrate single and annual premiums calculation in a time-discrete Markov context.

Table 3 Single and Annual Premium, $\eta = 0.20$.

Term\Age	x =30	x=40	x=50
n = 10	0.18053	0.39654	0.81965
n = 10	0.01977	0.04469	0.09831
n = 15	0.36988	0.84171	1.72679
n = 15	0.02840	0.06785	0.15502
n = 20	0.66287	1.49959	2.88050
n = 20	0.04030	0.09819	0.22109

Source: Own processing

4 Conclusions

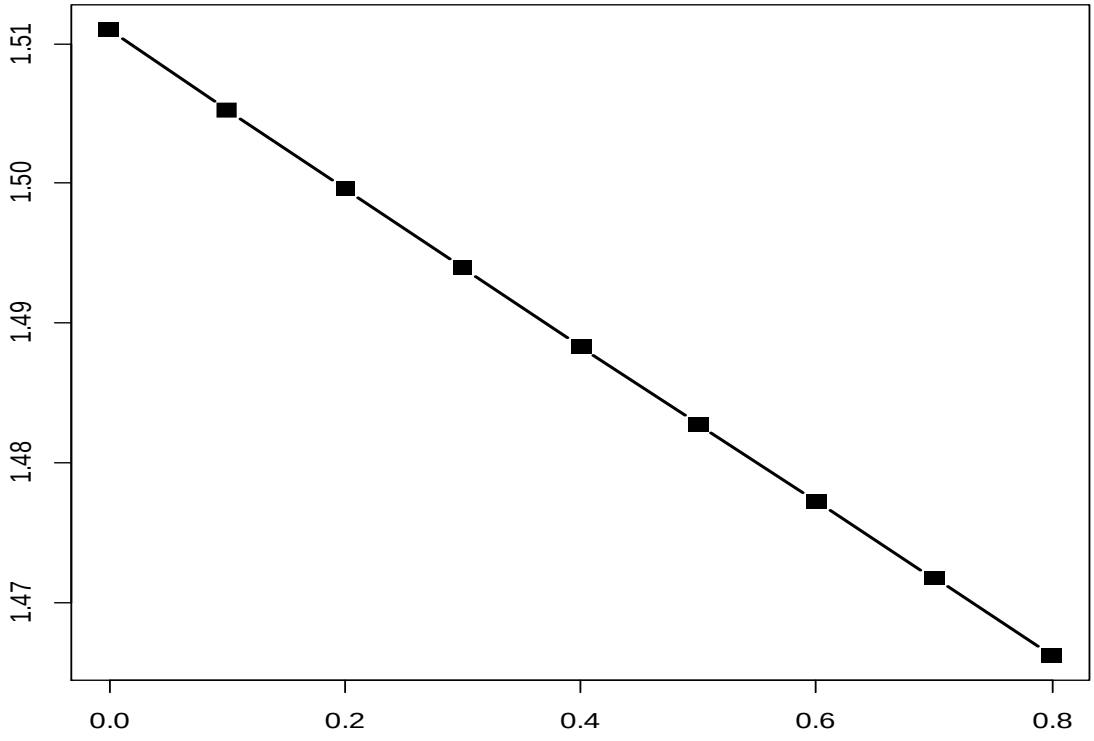
We have presented an application of multiple state models to problems in actuarial science. There are various extensions of multiple state models. One way is to allow the transition intensities out of a state to depend not only on individual's current age but also on how long they have been in current state. This breaks the Markov property assumption and leads to the new process known as a semi-Markov process. This could be appropriate for the disability income insurance process where the intensities of recovery and death from the sick state could be assumed to depend on how long the individual had been sick, as well as on current age.

We have to emphasize that no attempt has been made to discover a precise relationship between p_x^{HD} and $p_x^{S_jD}$ (for j = 1, 2, …, 6), i.e. probabilities of death for healthy and disabled insured. It does however suggest that an office which calculate disabled lives' reserves for claims in force, by assuming mortality according to a standard life table, may have an implicit margin of strength in its reserving basis. The Figure 4 illustrates the behaviour of single premium as a function of the extra level of mortality η.

The transition intensities are fundamental quantities which determine everything we need to know about a multiple state models. Therefore it would be useful to have data from domestic insurance industry. Our further research will focus on estimation of transition intensities for the Czech Republic (or other central European countries) in similar manner as in Pacáková, V., Jindrová, P., Seinerová, K. (2013).

There is a need for awareness of model risk when assessing a disability income insurance benefits and/or critical illness benefits, especially with long term. The fact that transition intensities can be estimated does not imply that they can sensibly describe future medical development.

Figure 4 Single Premium as a Function of the Extra Level of Mortality η; x=40, n=20.



Source: Own processing

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Effectivences of Commercial Banks in Poland versus Bank Tax

Ewa Gubernat

Wroclaw University of Economics
Finance Department,
ul. Komandorska 118-120, 53-345 Wrocław,
email: ewa.gubernat@ue.wroc.pl

Abstract: *Effectiveness in the era of a market economy is one of the most important financial categories regarding the degree of achievement of the assumed priority. The same applies to banking operations, where efficiency management has already become a separate area of unit management. As part of the efficiency quantification process, there are used four groups of indicators: profitability, margins, workloads and employment efficiency. They are an important analytical instrument allowing to assess whether the bank's activity is conducted economically. The aim of the article is to assess the impact of a bank tax on the operational efficiency of commercial banks in Poland and the effects of its introduction on banking services for costumer. The author draws attention to insufficient research on the consequences of tax and the stability of the banking system, in particular in the context of low interest rates and increased burdens borne by banks. The author accepted the hypothesis that the introduction of a new tax burden resulted in lowering basic ratios of banks' profitability and an increase in costs incurred by clients in connection with the use of banking products. The analysis of aggregated financial data was used to verify hypotheses.*

Keywords: bank tax, commercial banks, ROA, ROE

JEL codes: G21, H24, H71

1 Introduction

Efficiency in the era of a market economy is one of the most important financial categories. It mainly concerns the degree of achievement of the assumed goal. The same applies to banking operations, where efficiency management has already become a separate area of unit management. The banks' activities are additionally subject to taxes. The introduction of a bank tax prevents the instability of financial markets and limits the risk taken by banks.

In 2009-2012, the bank tax was introduced in 14 EU countries. This action was a reaction to the moral hazard of banks. The most important argument for the additional burden was the fact that private banks on the one hand led to the financial crisis and often benefited from the help of public funds. Therefore, they should bear financial responsibility responsibility (financial crisis liability fee). It was recognized then that it would limit the unstable sources of bank financing and would allow the governments of the EU countries to recover funds previously spent on rescuing the banking sector.

The Polish banking sector, which is the main source of financing the economy, is developing steadily. However, the adoption of a bank tax in Poland requires deeper reflection. Lack of evaluation of the potential effects of establishing this tribute can cause long-term negative consequences for the development of both the banking sector and the entire economy. It is extremely important that this type of tax does not generate a risk for financial stability and the dynamics of bank lending, which may ultimately harm the growth of the real economy. As a result, the conditions of loans or other services provided by banks could deteriorate and uncertainty could be created for these institutions.

The aim of the article is to assess the impact of a bank tax on the operational efficiency of commercial banks in Poland and the effects of its introduction on banking services for consumers. The author accepted the hypothesis that the introduction of a new tax burden resulted in lowering basic ratios of banks' profitability and an increase in costs incurred by clients in connection with the use of banking products. The analysis of aggregated financial data was used to verify hypotheses.

The introduction of a bank tax in Poland is unjustified due to the fact that these banks did not use state financial assistance, nor were they the cause of the financial crisis. Meanwhile, his goal was to increase the state budget revenues. In Poland, it was decided to accept additional banking tax in the form of tax. It was adopted by the law on tax from some financial institutions in early 2016. In contrast to regulations adopted in most EU countries, the Polish banking tax is purely fiscal. Bank tax in Poland differs significantly from regulations adopted in most EU countries. In EU countries, the basis for taxation of banks is usually their liabilities, these taxes are not strictly related to the scale of operations of banks, do not have a fiscal objective, and their amount is mainly due to the risk of operations. The project promoters justify its introduction with the necessity to increase the share of the financial sector in incurring tax burdens and its high profitability (Cichy and Puszer, 2016). The act stipulates that the bank tax is income of the state budget, whereas the subject of tax is the assets of entities that are its taxpayers. The Polish banking tax is not related to specific risks related to the financial system. Nor does it apply to public aid previously granted to the financial sector. Therefore, it may happen that its taxpayers will undertake actions (transactions) that do not affect the amount of their balance sheet total due to their desire to avoid paying this tribute. The least justified reason for the introduction of a bank tax is the fiscal objective, because the inevitable transfer of its costs to bank customers will mean an increase in the cost of loans, possibly a drop in interest rates on deposits or an increase in the prices of banking operations. The fiscal goal of a redistributive nature, although justified from the point of view of the state budget, is not justified in the case of caring for the safety and stability of the banking sector. The introduction of asset tax encourages financial institutions to optimize their balance sheets. Asset taxation may reduce lending in the long term, including a move away from long-term low-margin loans to more lucrative and short-term consumer loans and credits. Banks can theoretically increase the share of risky off-balance sheet transactions. The method of reducing the value of the tax base is, for example, the sale of portfolios of working and non-working loans. In addition, banks may provide them with guarantees or sureties to secure their bonds issued by these companies instead of financing their subsidiaries with loans.

Banks can theoretically increase the share of risky off-balance sheet transactions. The method of reducing the value of the tax base is, for example, the sale of portfolios of working and non-working loans. In addition, banks, in order to reduce the tax instead of financing their subsidiaries with loans, may give them guarantees or sureties constituting collateral for bonds. A bank contract is a construction classified in the so-called property taxes. Many indications have been formulated for the introduction of a bank tax and its introduction (Kil and Ślusarczyk, 2014):

The most important arguments are:.

- Greater financial stability
- Less financial speculation
- Lower costs of bank billing in the future due to limited use of public funds
- Possibility of allocating the collected funds from the tax for the restructuring of banks in a difficult financial situation
- In turn, the following arguments include, among others:
- Increase in prices of products and banking services
- Lack of equal treatment of all financial institutions
- Lower ability of banks to accumulate capital
- Reducing the efficiency of banks and, consequently, weakening their competitive position in the global financial market
- Difficult separation of speculative and hedging transactions

The banking sector shows profits similar to other sectors of the economy, which is why the legitimacy of charging banks due to their allegedly extraordinary profit in relation to the non-financial sector is questioned.

2 Methodology and Data

The theoretical part of the work was based on a study of the subject literature, while the empirical part based on data obtained from the financial supervision committee. In order to determine the economic and financial standing of the banking sector, profitability ratios of total assets and return on equity ROE were used. As part of the efficiency quantification process, 4 groups of profitability ratios are applied (Capiga, 2003): margins, workloads and employment effectiveness. They are an important analytical instrument allowing to assess whether the bank's activity is economically effective.

Empirical studies covered the years 2015 - 2017 and they concerned the entire banking sector in Poland. The test results are presented in tabular and descriptive form. For the purpose of the article, three selected measures of profitability will be assessed: ROA, ROE and interest margin (NIM).

3 Results and Discussion

The decision to introduce a banking tax raised serious doubts. Among other things, they were concerned about unfavorable effects on lending, a reduction in the profitability level of assets and equity as well as a direct transfer of tax-related costs to banking services customers. The main source of financing for losses was to be increased fees and commissions from banking operations. In order to verify the veracity of the thesis, a comparison was made between the results from the basic banking activity before and after the introduction of the tax on some financial institutions. It can be noticed that in the analyzed period the margin increased. The total net interest income increased by PLN 4.6 billion, ie 12.0%. Reasons for this state of affairs should be sought on the side of stable lending and changes in the deposit and credit policy. Impulses stimulating lending development were low interest rates, improvement in the labor market and price stabilization in the real estate market. Recovery can also be observed for the portfolio of consumer loans and corporate loans. Lowering the interest rate on deposits, while increasing the price of some loans, allowed to raise the generated margins (Capiga 2003).

The persistent environment of record-low interest rates along with the improvement of investment and consumption moods allowed in the period from January 2016 to the end of 2017 to increase the balance sheet total by PLN 140 billion (5.8% year-on-year). On the assets side, the portfolio of debt assets and loans had the decisive share in the change, while on the liabilities side deposits of households and the public sector. At the same time, further strengthening of the capital base was noted. Own funds from the level of PLN 159.1 billion at the end of 2015 increased by PLN 39 billion at the end of 2017 (24.5% in the perspective of 2 years). The average total capital ratio at the end of the year reached 18.2%, which also meant an improvement compared to previous years - by 5.3 pp. in relation to 2015. A visible phenomenon on the Polish banking market was the improvement of operational efficiency through optimization of employment and sales network (2013-15,3 thousand of people to 2017-13.4 thousand people) (KNF, 2016).

Even before the introduction of the bank tax, mortgage margins increased. In 2015, several banks, despite strong competition in the market, decided to raise fees and commissions and reduce interest rates on deposits for retail clients and enterprises. Financial institutions also introduced fees for services that were not previously paid. However, the concerns about decreasing lending growth have not been confirmed. The increase in the sales of credit products was mainly driven by high internal demand and low interest rates.

In the short term (see table 1 and table 2), a drop in the interest rate on new deposits could be observed with an increasing interest rate on new loans. The increase in loan margins was temporary, which may indicate that the attempts made by banks to compensate for the tax burden on some financial institutions were limited by competitive pressure on the market. Thus, the assumption of the project was not confirmed that due to strong market competition, the tax will not affect the prices of banking services. Most of the costs of the bank tax were transferred to depositors, causing a quasi-reduction in interest rates on deposits.

Table 1 Selected Elements of the Banking Sector Income Statement

	Value (PLN mio)		Change	
	2016	2017	Mln PLN	%
Result of banking operations	59 315	61 763	2 448	4,1%
a) result of banking rest	38 024	42 629	4 604	12,%
b) result on fees and commissions	12 592	13 743	1 151	9,1%
c) other fees	8 699	5 391	-3 307	-38%

Source: Own study

Table 2 Selected Measures of Operational Efficiency

	Sector			Commercial banks			Cooperative banks		
	2015	**2016**	**2017**	**2015**	**2016**	**2017**	**2015**	**2016**	**2017**
NIM	2,24	2,29	2,44	2,22	2,28	2,45	2,96	2,84	2,89
ROA	0,71	0,84	0,78	0,84	0,86	0,79	1,09	0,51	0,59
ROE	6,60	7,76	7,07	7,57	7,73	6,98	11,21	5,33	6,04

Source: Own study

For banks in Poland, the ROA calculated as the arithmetic mean increased from 0.71% to 0.78%. However, taking into account the results achieved in recent years, it should be noted that the value of the ratio is still low. Negative factors include the increase in operating expenses resulting mainly from new tax liabilities and an increase in the negative balance of impairment losses and provisions. However, it can be added that the average rate of return on assets of the Polish banking sector is still higher than the average rate in other EU countries.

The second analyzed profitability ratio is the ROE (rate of return). For the banking sector in Poland, ROE increased from 6.60% to 7.07%. Similarly, however, it is necessary to refer to previous years. Observation of data suggests that, in retrospect, current values are at a low level. High return on equity in previous years was the result of relatively low equity. At present, the rapid increase in the balance sheet total and the increase in equity as a result of the introduced prudential regulations do not allow maintaining the ROA at a higher level.

4 Conclusions

- The concept of introducing a bank tax prevents the instability of financial markets and limits the risk taken by banks.
- In the analyzed period 2016-2017, was observed an increase in lending dynamics. The increase in the sales of credit products was mainly driven by high internal demand and low interest rates. The increase was recorded for net interest income, which indicates an increase in the average interest margin. Using the environment of low interest rates, banks have reduced interest rates on deposits while at the same time increasing the interest rate on low loans.
- The Polish banking sector, which is the main source of financing the economy, has been developing steadily. The persistent environment of record-low interest rates, together with the improvement of investment and consumption moods, allowed, from 2016, an increase in the balance sheet total by approx. PLN 140 billion (5.8%).

- At the same time, further strengthening of the capital base was also registered. Own funds from the level of PLN 159.1 billion at the end of 2015 increased by PLN 198,1 billion at the end of 2017- 24,5%. The average total capital ratio at the end of the year reached 18.2%, which also meant an improvement compared to the previous year.
- Due to the short period of the banking tax in Poland, the risk associated with it has not yet been fully materialized. Therefore, it can not be ruled out that in the longer term the situation in the assessed areas will change, and banks will try to compensate for the costs of the bank tax through aggressive policy on margins and fees and commissions.

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Bitcoin Compared on Price, Liquidity and Volatility: Crypto "Currencies" or an Asset Class of Their Own?

Peter Haiss, Jakob Schmid-Schmidsfelden

WU University of Economics and Business
Department of Global Business and Trade, Institute of Export Management
Welthandelsplatz 1, Building D1, A-1020 Vienna, Austria
E-mail: peter.haiss@wu.ac.at; jakob.schmidsfelden@gmx.at

Abstract: *In comparing Bitcoin to other cryptocurrencies, we analyze whether these can become a viable alternative to fiat currencies. In the theoretical part we assess if these embody the main functions of a currency (Krugman, 1984). The empirical part analyzes the price development, liquidity and velocity of Bitcoin in comparison to the major other cryptocurrencies in 2017. We conclude that Bitcoin Cash, a cryptocurrency that evolved during a hard fork of Bitcoin, may develop into sharing features of a global currency. Currently cryptocurrencies are rather tokens and a highly volatile asset class of their own.*

Keywords: blockchain; Bitcoin Cash; cryptocurrencies; liquidity; monetary velocity

JEL Codes: E390, E420, E510, G15, E51

1 Introduction

In 2017, the cryptocurrency market experienced a development the economy had not yet seen before. Bitcoin and its competitors gained much attention in the financial sector of both positive and negative nature. The system of this cryptocurrency is based on a peer-to-peer network that allows transactions which are verified de-centralized by all the Bitcoin-users and then stored in the blockchain (Nakamoto, 2008; Haiss and Moser, 2017). It represents the idea of de-centralizing a currency. Therefore, it is formally independent from governmental authorities and financial institutions, though influenced by its activities (e.g. reacted to announcements by the Chinese government to forbid mining and trading in early 2018) (Allerstorfer, 2016). Cryptocurrencies not only could turn out to be a highly lucrative (though risky) investment opportunity, but also could represent a potential alternative (and thus a threat) to fiat currencies. Or is it just a token? A currency or rather an asset class of its own?

This paper is a comparative study based on descriptive data. The first part provides a theoretical background, discussing whether Bitcoin shares the functions of a currency as defined by Krugman (1984). The second part compares the development of the major cryptocurrencies Bitcoin, Bitcoin Cash, Ethereum, Litecoin and Ripple in 2017. We analyze their price development, liquidity and velocity. We conclude by discussing if these may represent a viable alternative to fiat currencies as a kind of a new asset class.

2 Cryptocurrencies and the Functions of a Currency

Features of Cryptocurrencies

Virtual currencies are digital on the one hand, and based on cryptography to secure the system on the other hand (Lee, 2016). Cryptocurrencies are tokens that use "cryptographic hashing and digital signatures to verify transactions and avoid double spending" (Halaburda & Sarvary, 2016). Cryptography is used to prevent unauthorized access of particular content (confidentiality) and unauthorized changes (integrity). It enables involved parties to identify each other as well as the information sent (Allerstorfer, 2016).

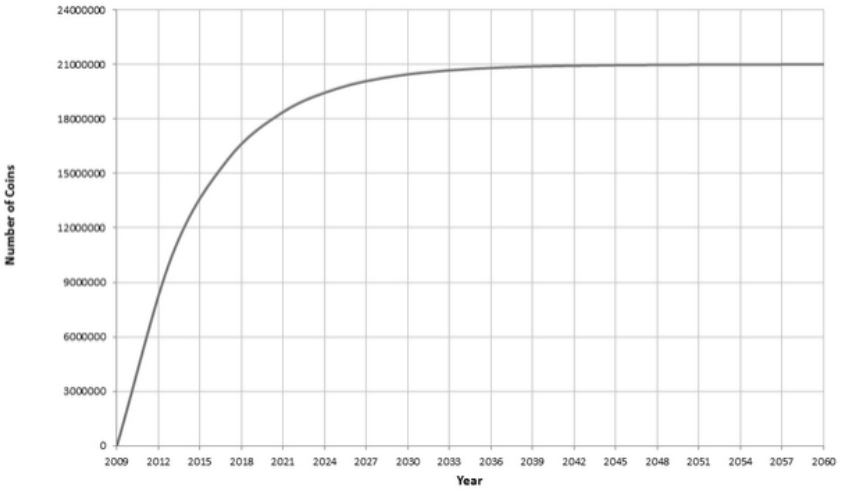
When Bitcoin was introduced in 2008, it was the first of all cryptocurrencies. At the time of writing (Q2/2018), there are about 1.500 different cryptocurrencies existing, which have all emerged after the introduction of Bitcoin (see Coinmarketkap.com for the current status). In essence, Bitcoin features as a decentralized peer-to-peer digital "currency" based on cryptography, with a more or less finite monetary supply (Nakamoto, 2008). Every direct transaction made is verified de-centrally by a network of Bitcoin users. This

means that it is possible to carry out transactions "without the assistance and verification of a trusted third party" (Lee L. , 2016). As most other cryptocurrencies are based on some type of blockchain all of their functions including storing, transferring, buying and selling are executed completely online (Osterrieder, Chan, Chu, & Nadarjah, 2017).

As cryptocurrencies are a relatively new phenomenon, a precise legal definition of virtual currencies does not yet exist, though several countries enacted special cryptocurrency laws, e.g. the 4th Anti-Money Laundering Directive by the EU, which only includes exchanges between cryptocurrencies and fiat currencies, or the US virtual currency law (EDCAB, n.d.; Waters, 2017). According to Tymoigne & Wray (2005), it is crucial for any monetary system to be based on a structure that is capable of recording transactions. In the case of cryptocurrencies this necessity is fulfilled through the blockchain.

The blockchain, which is often seen as the key innovation of Bitcoin, is a distributed ledger system that stores and keeps record of all Bitcoin transactions (Haiss & Moser, 2017). This ledger is increased as miners add new blocks to the chain in a chronological order, whereas hundreds of transactions are stored and verified in every individual block. The blockchain is called a public ledger, because every transaction can be associated with a particular Bitcoin address (information publicly available by using a block explorer, e.g.: https://blockchain.info/). In order for a block to be added to the ledger, a miner first has to discover it, before all miners can verify it. This is achieved by solving a cryptographic mathematical problem through computational effort. That process is called proof-of-work (Dwyer, 2014). The first miner that verifies the blockchain receives a reward in the form of newly created Bitcoins and a transaction fee. Besides mining, another option to acquire Bitcoins is to exchange it for fiat money, by buying it either from people through Bitcoin wallets or from an exchange platform (Swan, 2015). A major disadvantage of the proof-of-work system is that this process makes mining and payment transactions extremely energy extensive and thus very costly (Harm, Obregon, & Stubbendick, 2016).

Figure 1 Bitcoin (BTC) Supply over Time



Source: Antonopoulos, 2017

The supply of Bitcoin, which is governed by an algorithm, is limited to 21 million Bitcoins. The algorithm of the issuance schedule adjusts itself by halving the amount of the possible creation of new Bitcoins every four years (Antonopoulos, 2015). This adaptation is achieved by increasing the difficulty of the algorithm that needs to be solved by the miners (Dwyer, 2014). It is important to note, that the number of blocks discovered per year does not change (52.500), and only the amount of Bitcoins per block is halved every four years (every 210.000 blocks). The idea behind this decreasing-supply algorithm is to best imitate a rare commodity like gold. Cermak (2017) estimates that "99% of all Bitcoins will be "mined" by 2040 and the remaining 1% will be mined over the next 80-100 years". The decreasing issuance model also contributes to an increased amount of energy (i.e. rising cost), leading to a decreasing rate at which Bitcoins are mined (Antonopoulos, 2017; see

figure 1). As the rate of newly created Bitcoins is decreasing, the value of each Bitcoin is likely to rise. This is also one of the main reasons why investors are likely to hold Bitcoin as a speculative investment. Furthermore, the decreasing issuance schedule suggests an increase of the transaction fees, since the reward the miners receive, denominated in newly created Bitcoins, will get smaller.

According to Krugman (1984), in the classical economist definition, money serves three functions: it is a medium of exchange, a unit of account, and a store of value for both the private and official sector. As virtual currencies so far mainly operate in the private sector (Bech & Garratt, 2017), we will focus on that.

2.2 Features of Traditional (fiat) Currencies

According to Cermak (2017), "For a currency to function as a medium of exchange, it must represent a standard of value accepted by all parties. The most essential function of a medium of exchange is to measure value. A medium of exchange should have a constant intrinsic value and a stable purchasing power on average."

Table 1 Functions of a Currency

	Private	**Official**
Medium of exchange	Vehicle	intervention
Unit of account	Invoice	peg
Store of value	Banking	reserve

Source: Krugman, 1984

The second dimension of money mentioned by Krugman (1984) is the function as a *unit of account*. The main aspect of a unit of account is its ability to serve as a standard numerical unit and measure the value and costs of goods, services, assets and liabilities (European Central Bank, 2012). No monetary system could perform accordingly without an asset that functions as a unit of account, as this function is also needed to ensure an accurate method of recording transactions. Traditionally, the unit of account function was always associated to some kind of a central authority that set standards (Tymoigne & Wray, 2005). Yet, this perception will most probably have to change in future times, because of the introduction and emergence of the blockchain.

The third major feature of a currency is its function as *store of value,* ie to preserve value over time (Lehdonvirta, 2014). Clearly, this implies the need for a stable respectively somewhat predictable price development. Enough liquidity is another basic function for the store of value dimension, as the value of something that cannot be exchanged for other goods and services at any point in time is useless to function as money (Cermak, 2017). A further key characteristic concerning the store of value is the predictability of supply. Knowing by what degree the supply will increase or decrease can give a suggestion of how much inflation or deflation should be expected in the future. By being aware of the future supply, one can be confident not to experience a sudden drop in purchasing power of used the currency (Ammous, 2016). One very important aspect why gold is one of the most reliable mediums of exchange, is its ability to store value over time. This is due to its property for being extremely durable and hard to counterfeit. Furthermore, its supply is limited and difficult to harvest, which makes it a rare resource (Ammous, 2016).

Throughout the modern history of money, there has always been some kind of central authority in charge of the monetary system (Cermak, 2017). Accepting a third party to be in charge of the monetary base has many advantages, but also demands some degree of trust by the general public in central banks. On the positive side, institutions in charge of the monetary system will not only aim to act as a guardian of price stability, but also stand ready to lend money to financial institutions in times of financial crisis or deflationary collapse and engage in various open market operations (Ammous, 2016). On the contrary, a third authority has the power to influence and manipulate the workings and ground rules of currencies. Within the boundaries of their bylaws, central banks can basically create as

much money as they want (Malliaris, 2005). In some cases, this led to extreme cases of inflation. Illustrative examples in this context would be the hyperinflation in Venezuela or also Russia at the demise of the Soviet Union.

Krugman's typology (1984) connects "trust" with the currency itself instead of connecting it with the authorities in charge. As part of the store of value function of a currency, Krugman simply argues that trust comes with stability. Thus, if a currency is not stable enough due to high inflation or political uncertainties it will probably also be used less, because the general public would not trust the currency. The ECB (2012) specifies the importance of trust in the current monetary system:

"Fiat money is any legal tender designated and issued by a central authority. People are willing to accept it in exchange for goods and services simply because they trust this central authority. Trust is therefore a crucial element of any fiat money system."

With the emergence of the blockchain and cryptocurrencies, a new way of regulating monetary systems evolved. The blockchain system allows parties to transfer funds directly to one another, using a peer-to-peer system (Lee, 2016). This weakens respectively removes the need for a trusted third party. In such a decentralized monetary system, it is possible to fully rely on a system to record transactions without the need of an intermediary in control (Nakamoto, 2008). This game-changing fact redefines the definition of trust in a currency. In contrast to fiat currencies, trust in the world of cryptocurrencies is based on cryptographic proof and technology instead of intrinsic value or a third authority (Fink & Johann, 2014). By introducing the blockchain, Nakamoto not only removed the need for a trusted third party, but also figured out a way to avoid double spending. This is possible because the blockchain records every transaction on a "public time-stamped ledger" (Cermak, 2017). Cryptocurrencies are also not obliged to a certain location or jurisdiction.

3 Price development, Liquidity and Velocity of Major Crypto-"Currencies"

Cryptocurrencies Chosen

In the following, we compare the five strongest cryptocurrencies, namely Bitcoin, Bitcoin Cash, Ethereum, Litecoin and Ripple. The reason for choosing these cryptocurrencies was mainly their market capitalization, but also because they show distinct approaches in offering digital currencies. Table 2 provides an overview of their major features.

These are, however, not without alterations. For example, the community could not agree about increasing the blocksize of Bitcoin (from initialy 1 MB), although trying for years. To raise blocksize to 8 MB, *Bitcoin Cash* was launched in a "hard fork" from Bitcoin as a new cryptocurrency in August 2017. Every Bitcoin holder as of block number 478.558 received equally as many Bitcoin Cash as they had Bitcoin at this exact time. Thus there are two separate Bitcoin blockchains that coexist without interfering with one another. Bitcoin Cash is exactly the same as Bitcoin, just with the advantage of lower transaction costs and faster verification times (due to its scalability; BitcoinCash.org, 2017), making it a better substitute for fiat currencies.

Ethereum is a platform that allows different kinds of distributed applications in the form of peer-to peer "smart" contracts to function without fraud or trusted authority interference (Ethereum.org, 2017). The fundamental technical differences to Bitcoin lie in the programming language and the required time to verify transactions (Bajpai, 2017). Ethereum could process an infinite amount of transactions, since it is not limited in its blocksize as is the case for Bitcoin. There is no maximum amount of Ether, but the amount issued per year is capped to 18 million Ether (Harm, Obregon, & Stubbendick, 2016).

Litecoin was designed by modifying the Bitcoin software. Just like Bitcoin, Litecoin is based on a peer-to-peer system and uses open-source software (Jakes, 2016). The reason for launching this virtual currency was to decrease the block generation time to 2.5 minutes to make it better suited for smaller transactions and to provide better cybersecurity.

Ripple has a very different approach compared to the other virtual currencies, as it is designed to only facilitate trade relationships to send money on a global basis. Therefore,

it does not embody a substitute to the current financial system per se. The idea behind Ripple is that every currency should only be exchangeable by going through Ripple itself, instead of being able to exchange every currency with any other currency. However, similarly to Bitcoin, Ripple also has a limited supply. It is a peer-to-peer system and intends to allow financial transactions without the need of a third-party authority (Jakes, 2016).

Table 2 Comparison of Cryptocurrencies

Name (Founder)	Re-lease	Sym-bol	Market Capitali-zation USD bn	Price (USD)	Hash algo-rithm	PoW/ PoS	Comment
Bitcoin BTC (Satoshi Nakamoto)	2009	BTC, XBT	145,7	8.650,51	SHA-256d	PoW	1st based on block-chain
Bitcoin Cash	2017	BCH	19,7	1.160,96	SHA-256d	PoW	Hard fork from BTC (increased blocksize)
Ethereum (Vitalik Beterin)	2015	ETH	87,8	901,28	Ethash	PoW/ PoS	Platform for smart contracts
Litecoin (C. Lee)	2011	LTC	7,1	128,19	Scrypt	PoW	similar to BTC
Ripple (Larsen & McCaleb)	2013	XRP	33,2	0,85078	ECDSA	Con-sensus	For peer-to-peer trans-actions

Source: Adapted by the authors from Wikipedia (2018) and Coinmarket.com (2018)

Measures Chosen

The first selected measure is price development. A stable price is the strongest indicator for the stability of a currency, high volatility shows incompatibility for the medium of exchange function. A currency that is very volatile in its price is very unlikely to be used as store of value as it embodies great uncertainty about its future value. An unstable currency is unsuited to function as a unit of account. For our analysis, we checked price development in USD, as this is the most used currency to trade cryptocurrencies.

The second selected measure is the liquidity of each currency. Liquidity is a precondition for any currency to function as medium of exchange. If there is no counterparty willing to accept an asset, it cannot be exchanged immediately at a certain market (Damodaran, 2013), which would make it unsuitable to function as a medium of exchange, as it cannot guarantee trade at any time at a fair price anymore. In order to measure illiquidity, either the transaction costs or the time that is needed to execute a transaction can be taken as a measure (Damodaran, 2013). Additionally, liquidity is also essential to fulfil the function as a store of value. If an asset has a very low trade volume (which is a typical measure for liquidity), it cannot be sold easily on the market (Chordia, Roll, & Subrahmanyam, 1999). This makes it less favourable to be used as a store of value. Furthermore, the trade volume is a convenient measure for the breadth of a market, which gives insights in both the amount and size of transactions as well as the influence of transaction costs (Lybek & Sarr, 2002). For our analysis, we use the daily 24h trade volume as a measure, compiled from Coinmarketcap.com. We also looked at transaction costs.

The third measure we apply is the velocity (of circulation). According to Amadeo (2017), "The velocity of money is the rate at which people spend cash. It is how often each unit of currency, such as the U.S. dollar or euro, is used to buy goods or services during a period." This definition implies that the lower the velocity the higher the tendency that the currency is used as an investment, rather than as a medium of exchange. People will not want to

pay with a "currency" which could exponentially rise in a very short period and rather hold on to it. High velocity, on the other hand, implies that individual units of a currency change hands on a very frequent basis (Amadeo, 2017). Therefore, the function as a medium of exchange is the one function most affected by this measure. For our analysis of the velocity of circulation, only data for Bitcoin was available, compiled from blockchain.info.

Descriptive Comparison

As observation period, we chose November 2015 to November 2017. This covers the period in which the breadth and depth of cryptocurrencies developed strongly, but excludes the "fat tails" in its beginning and the outliers from the extreme hype around the change of the year 2017/2018. We also tie in findings from related research.

Concerning the price development of the selected cryptocurrencies, each of them shows both a significant increase in value, but also a very high degree of volatility, especially in 2017. If you had invested $5 on November 12, 2015, in Bitcoin, you would have got roughly $100 in late 2017, which is more than twenty times as high. After a slow but constant increase in price in 2016, in April 2017 Bitcoin sharply surged, due to the fact that Japan announced Bitcoin as legal tender. This indicates that Bitcoin is not entirely independent from governmental actions, which is not in line with the claims made by its supporters. Bitcoin continued its race to almost $3.000, until the price started to fall again in June 2017, when it decreased about 40% in only one month. This freefall was mostly triggered by uncertainties among Bitcoin holders about the upcoming programme code upgrade, which was set for 1st of August 2017 (Rizzo, 2017). Nevertheless, from mid-July 2017 onwards, Bitcoin set for another extreme rise in price, hitting a record high of $4.800 in early September. This development was strongly supported by the hard fork on 1st of August and the activation of Segregated Witness in late August, which drew a lot of media attention towards Bitcoin (BitcoinCash.org, 2017). In early September, China announced that it will ban ICO's (Initial Coin Offerings), which might have been the cause for the next downswing (Merkel, 2017). When J.P. Morgan publicly called Bitcoin a "fraud that will ultimately blow up", Bitcoin continued its downward race (Monaghan, 2017). After hitting a price slightly below $3.000 in mid-September, Bitcoin set off for another very fast price hike. Once the CME Group, one of the biggest options and futures exchanges worldwide, announced that it would offer Bitcoin Futures, the price of Bitcoin soared to a new record high of over $6.500 in late October (Baker & Leising, 2017). Bitcoin maintained its upswing as the 16th of November approached, which was set to be the day for the introduction of Segwit2x (Russo, 2017). However, shortly before this day arrived, the split was cancelled, which caused the Bitcoin price to plunge from its all-time high of $7.400 down to $6.625 on 12th of November 2017.

Similar to Bitcoin, the time between 2015 and 2017 was by far the strongest period for Ethereum. In only two years its price increased by more than 3.000%, from less than $1 to over $300. On November 12, 2017 Ethereum had a price of roughly $308. Until March 2017, the price of Ethereum almost increased twentyfold to reach a price of almost $20. From there on, it started a strong upward phase, before reaching its all-time high of $390 in mid-June 2017. This remarkable increase in price most probably occurred, because of a rise in adoption of the whole cryptocurrency industry and an overall ICO hype in 2017 (Aru, 2017). Nevertheless, Ethereum saw itself on a downward race for a whole month until mid-July when it hit a price of $150, which represented a price reduction of 60%. This extreme fall represented a market correction and was also triggered by wrongly distributed news about the death of Vitalik Buterin, the founder of Ethereum (Reiff, 2017). From there on, Ethereum benefited from the increased media coverage of Bitcoin, which resulted in a rise of Ethereum's price. Ethereum regained almost all of its value of mid-June to reach around $380 on 1st of September 2017. Ethereum was then heavily affected by the announcement of China to ban ICO's, as ICO's most often run through Bitcoin and Ether (Merkel, 2017). From there on Ethereum continued a very volatile development in October and early November 2017, before it hit $308 on November 12th.

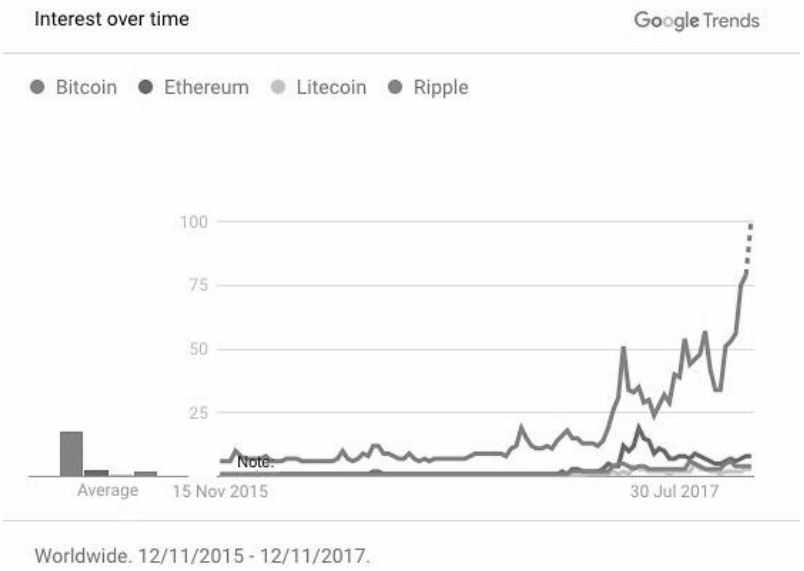
Compared to Ethereum and Bitcoin, Litecoin only increased marginally between November 12, 2015 and April 2017, trading at a stable price between $3 and $4. It was in mid-April

2017, when Litecoin also profited from the general rise in acceptance of cryptocurrencies by the general public. This upward trend was further supported by the successful activation of Segregated Witness in early May (Hertig, 2017). From there on, Litecoin continued its surge until it reached an all-time high of over $82 on 1st of September at the time. Litecoin was also heavily affected by Chinas announcement to ban ICO's in early to September, which led to a drop to $42 within just one week (Merkel, 2017). I recovered to trade around a price of $60 as of November 12, 2017.

As of November 12, 2017, Ripple's is $0.196. It experienced its all-time high in mid-May with a price of $0.41. This price peak could only be maintained for a very short period of time. In general, Ripple followed the overall trend of the cryptocurrency market by significantly increasing its value from May 2017 onwards. Up to the time of writing, there is very limited literature on reasons for price changes of Ripple. However, in general it can be assumed that the price of Ripple is strongly influenced by news about the acceptance of cryptocurrency by retail banks and central banks. This originates from the fact that Ripple is also designed to function within the interbank SWIFT-network (Tsihitas, 2017).

The high volatility of the selected cryptocurrencies could have its origin in the still significantly high level of uncertainty amongst investors, concerning the whole cryptocurrency market. Even minor negative news and information gathered through media often strongly affect the decisions of investors and can quickly lead to mass selling or mass buying. This often causes a sharp decrease or increase in price, respectively. The fact that Bitcoin is still often only used as a speculative investment, rather than as a medium of exchange, invites a great number of uninformed investors to enter and to leave the Bitcoin market, causing high volatility (Fink & Johann, 2014).

Figure 2: Google Trends of the Selected Cryptocurrencies



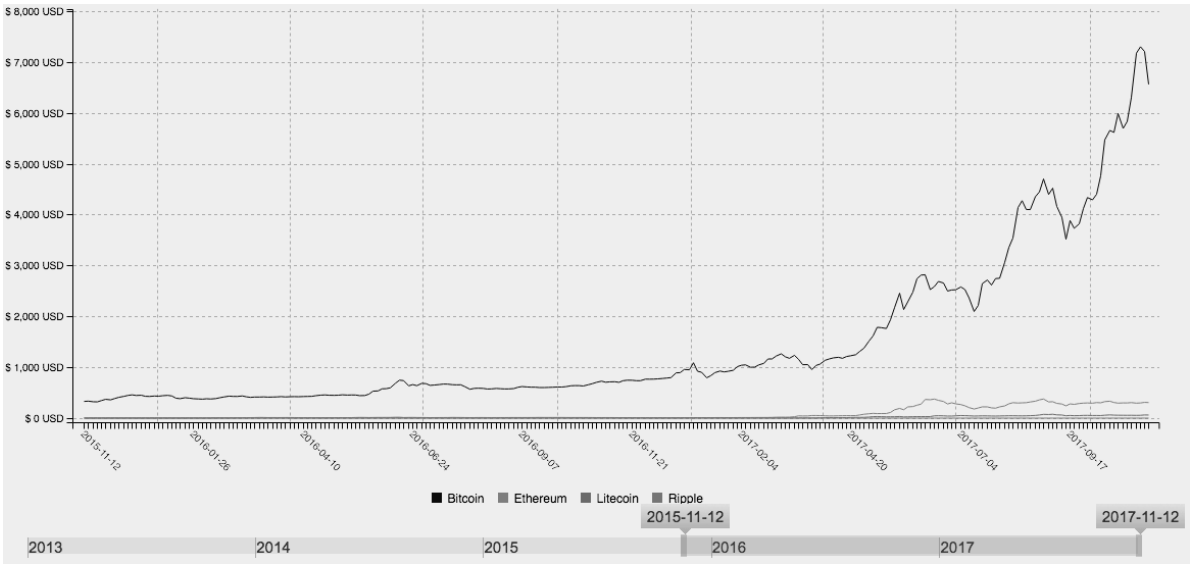
Source: Google Trends, 2017

Enhanced media presence could have had a significant effect on investment activities as well, regarding to Bovaird (2017). The heavy influence of an increased media profile, which could even lead to temporary price bubbles, is also supported by Wang & Vergne (2017). Stenquvist & Lonno (2017), who analyzed if there is a correlation between Bitcoin related Twitter-posts and its price, observed „a partial correlation between binary sentiment and price change for small subsets of data". Conducting a word count analysis provides another avenue of research. By looking at the Google search interest a high correlation between the price development of each cryptocurrency and the search interest of each cryptocurrency, can be observed. As representative search key words, the names of the different cryptocurrencies were selected. Figure 2 represents the "search interest relative

to the highest point on the chart for the given time" (Google Trends, 2017). Again, the selected time span is November 12, 2015 to November 12, 2017.

By comparing the Google trends to an overlapping chart of the price development of all four selected cryptocurrencies within the same period of time, similar developments can be examined. This shows a high correlation of the growing price and the growing interest (measured by Google searches):

Figure 3: Overlapping Price Developments



Source: CryptoCurrencyChart.com

With regards to *liquidity*, we find that all cryptocurrencies are still very volatile in their 24h trade volume up to now. This is strongly influenced by the fact that cryptocurrencies are not yet used for the same purpose as the USD or Euro. Most cryptocurrency investors only use them as a speculative investment (Allerstorfer, 2016). Once one cryptocurrency will be accepted broadly and commonly be used as a medium of exchange, this situation may change. When examining the corresponding movements between liquidity and velocity, at least in case of Bitcoin, a tendency of correlating liquidity and *velocity* can be observed. In 2017, almost every time when liquidity was high, velocity was high too, whereas when liquidity was low, velocity only fell partly. This leads to the conclusion that Bitcoin is on its way to turn from a speculative market towards a mass market.

4 Conclusion

This paper aims to provide an answer to the research question if one of the selected cryptocurrencies fulfils Krugman's three functions of a currency (medium of exchange, unit of account and store of value) and thus could substitute fiat currencies (Krugman, 1984). Therefore, three measures were taken into consideration, namely price development, liquidity and velocity. After analyzing the four cryptocurrencies Bitcoin, Ethereum, Litecoin and Ripple, as well as the newly emerged Bitcoin Cash, we draw the following conclusion. The only cryptocurrency that could in theory fulfil the functions of a currency is Bitcoin Cash, because of two main reasons. First, Bitcoin Cash is truly decentral, meaning that there is no single group or third authority, nor anything that is comparable to a third authority that controls the Bitcoin network. Second, the supply of Bitcoin Cash is fixed with a determined issuance schedule. Both the total supply and the issuance schedule are very unlikely to be altered (Ammous, 2016).

Though Bitcoin (BTC) has these same attributes, there is one big disadvantage of Bitcoin, namely its scalability. Bitcoin has already reached a point where it cannot handle the amount of transactions anymore. This results in high transaction costs and long confirmation times. Fortunately, there is already a solution for this problem. The solution

is called Bitcoin Cash. The blocksize of Bitcoin Cash is adjustable, which means that it is not facing the problem of scalability. Both transaction costs and the duration to verify a transaction will be kept to a minimum (BitcoinCash.org, 2017). This is also in the sense of the original invention of Bitcoin, since it was designed to be a decentral cryptocurrency, that is scalable, if the demand rises (Nakamoto, 2008). As all the other technical specifications of Bitcoin Cash stayed the same as the ones of Bitcoin, Bitcoin Cash could, from a technical point of view, be preferred over Bitcoin.

Ethereum is not in the position to function as a viable substitute to fiat currencies, because there is a small group of miners that could, together with the Ethereum Foundation, control the network of Ethereum and thus function like a third authority in charge. It thus would be less favourable compared to Bitcoin and Bitcoin Cash. Furthermore, Ethereum's purpose is not to be a substitute to fiat currencies, but to provide a platform to ease peer-to-peer activities like smart contracts. Its currency, Ether, was only established to facilitate these activities and not to function as a medium of exchange (Bajpai, 2017).

Although Litecoin is most similar to Bitcoin, it still has a major disadvantage with regard to security. A cryptocurrency that in theory is 100 times easier to be influenced by malicious activity, which could for instance have an impact on the issuance schedule, should never be chosen. Litecoin is also less accepted than Bitcoin globally (Ammous, 2016).

Finally, Ripple is also not in the position to substitute fiat currencies, as it is simply not designed to function as such. The purpose of Ripple is rather to function as an exchange medium between existing currencies. By doing so, it aims to facilitate the current financial system. Ripple also has a company behind it which controls the Ripple network, which is comparable to a central bank (Ripple.com, 2017).

All in all, currently cryptocurrencies are rather tokens and a highly volatile asset class of their own.

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Specifics of the Reporting under International Accounting Standard IAS 41 Agriculture and its Usage on the Central European Stock Exchanges

Filip Hampl

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno-Pisárky, Czech Republic
E-mail: filip.hampl@mail.muni.cz

Abstract: *Companies listed on stock exchanges in the European Union prepare and present their financial reports mostly in accordance with International Financial Reporting Standards (IAS/IFRS). International Accounting Standard IAS 41 Agriculture, prescribing the accounting treatment and disclosures related to biological assets used for agricultural activity, is an integral part of these standards. The need of the particular standard for agriculture stands from the specific character of agricultural activity based on the biological transformation of living organisms – plants and animal beings. This paper deals with the specific areas of the accounting treatment incorporated in the International Accounting Standard IAS 41. Furthermore, it examines whether there are agriculture companies reporting in accordance with IAS 41 among corporations publicly listed on the stock exchanges in the Czech Republic, in Slovakia, Poland, Hungary and Austria. Results show that only small number of agriculture companies is listed on the Central European stock exchanges. Therefore, there is the low usage of IAS 41. Although IAS 41 might seem redundant, it has its importance consisting in the specific accounting treatment that cannot by substitute by other standards.*

Keywords: agriculture company, biological assets, financial reporting, IAS/IFRS, stock exchange

JEL codes: M41, Q14

1 Introduction

Agriculture represents a specific sector of the national economy. Agriculture companies differ within the meaning of nature of their activities from other business entities. Bohušová et al. (2012) mention that agricultural activity is in comparison with other activities of business subjects dependent on the natural and environmental conditions (geographic condition, weather, etc.). According to Dvořáková (2014), agricultural activity takes place independently of human activities due to the biological characteristic of assets, such as vegetation period, pollination by specific species, multi-annual length of the production cycle. People can only facilitate or influence biological transformation by enhancing or stabilizing conditions necessary for the process to take place (e.g. moisture, temperature, fertility and light). Sedláček (2010) claims that in comparison with other economic branches, the agricultural activity is characterized by specific activities that require the appropriate accounting attitudes. This is also confirmed by Bohušová et al. (2012) who mention that the specifics of the biological character of transformation should be reflected by the methodology for reporting for activities of agriculture companies. According to Dvořáková (2012), nature of agricultural activity based on biological transformation (comprising growth, degeneration, production, etc.) that changes the substance of biological asset, is difficult to capture in traditionally used accounting models established on historical costs and realization principle.

On the international level of accounting and financial reporting particularities of agricultural activity are treated in the International Accounting Standard 41 Agriculture (IAS 41). The objective of IAS 41 Agriculture is to prescribe the accounting treatment and disclosures related to agricultural activity. IAS 41 should be considered "lex specialis" to other "lex generalis" International Financial Reporting Standards (IAS/IFRS). Although it is dedicated to agriculture, it does not treat accounting of agricultural sector as a whole. It only deals

with the accounting treatment of specific assets related to agriculture, mainly with their particular measurement. Other accounting matters of agriculture companies are prescribed by other IAS/IFRS.

2 Methodology and Data

This paper aims to present specific accounting treatment of agricultural activity incorporated in the International Accounting Standard 41 Agriculture and find out whether there are agriculture companies reporting in accordance with IAS 41 among publicly listed corporations on the stock exchanges in the Czech Republic, in Slovakia, Poland, Hungary and Austria.

This paper is based on an analysis of the International Accounting Standard 41 Agriculture, other relevant International Financial Reporting Standards and appropriate literature sources, articles and monographs. To discover publicly listed companies applying IAS 41, the data from the stock exchanges and corporations' annual or quarterly reports from the year 2017 is used. All stock market segments of the following stock exchanges are selected for the research:

- Prague Stock Exchange (Burza cenných papírů Praha),
- Bratislava Stock Exchange (Burza cenných papierov v Bratislavě),
- Warsaw Stock Exchange (Giełda Papierów Wartościowych w Warszawie),
- Budapest Stock Exchange (Budapesti Értéktőzsde) and
- Vienna Stock Exchange (Wiener Börse).

The methods of description, analysis, synthesis and deduction will be applied in this paper. The conclusion will assess the necessity of IAS 41 regarding specific assets related to agricultural activity.

3 Results and Discussion

IAS 41 is applied to account for biological assets, agricultural produce at the point of harvest and government grants related to agricultural activity. IAS 41 does not deal with agricultural produce after harvest and its processing, for example, the processing of sugarcane into sugar, harvested cotton into thread or picked tea leaves into tea, although such processing may be a logical and natural extension of agriculture activity or there should be a certain perceptible similarity to biological transformation. IAS 2 or another suitable standard applies to harvested produce in dependence on the course of its use.

On the other hand, IAS 41 cannot be applied to assets which are in the scope of other standards, such as land related to agricultural activity (IAS 16 Property, Plant and Equipment), intangible assets related to agricultural activity (IAS 38 Intangible Assets), right-of-use assets arising from a lease of land related to agricultural activity (IFRS 16 Leases).

Standard defines used terms; for purposes of this paper, only the most important definitions will be mentioned. Under the *agricultural activity,* IAS 41 understands management by an entity of the biological transformation and harvest of biological assets for sale or conversion into agricultural produce or additional biological assets with *biological asset* defined as a living animal or plant. Based on this definition, agricultural activity covers a diverse range of activities, e.g. forestry, annual or perennial cropping, cultivating orchards and plantation, fish farming or cattle farming. *Agricultural produce* is the harvested product of the entity's biological assets. Three common features can be identified within this diversity – biological asset capability of biological transformation (growth, degeneration, production and procreation), conditions management of biological transformation and measurement of qualitative and quantitative changes brought about by biological transformation or harvest.

Recognition and measurement

Recognition and measurement are the pivotal part of IAS 41, such as other standards. In compliance with the common definition of assets included in the Conceptual Framework, an entity shall recognize biological assets or agricultural produce only when:

a) an entity controls the asset as a result of past events,
b) it is probable that future economic benefits associated with the asset will flow to the entity, and
c) the fair value or cost of the asset can be measured reliably.

IAS 41 requires all biological assets related to agricultural activity to be measured on initial recognition and at the end of each reporting period at *fair value less costs to sell* where costs to sell are defined as incremental costs directly attributable to the disposal of an asset, excluding finance costs and income taxes. Agricultural produce harvested from an entity's biological asset is measured at its fair value less costs to sell at the point of harvest. Such measurement is the cost at that date when applying IAS 2 Inventories or another applicable standard.

There is a presumption that fair value can be measured reliably for a biological asset. That presumption can be rebutted only on initial recognition for a biological asset for which quoted market prices are not available and for which alternative fair value measurements are determined based on professional judgement to be clearly unreliable. Only in such case, entity measures the biological assets at its acquisition cost less any accumulated depreciation and any accumulated impairment. Once the fair value of biological asset becomes reliable, an entity measures it at its fair view less costs to sell. IAS 41 allows that acquisition/production costs may approximate fair value, particularly when only little biological transformation has taken place since initial cost incurrence, or the impact of the biological transformation is immaterial. An entity that has previously measured a biological asset at its fair value less costs to sell is obligated to continue in this type of its measurement.

Measurement prescribed by IAS 41 is based on the principle that the biological transformation that these assets undergo during their lifespan is best reflected by fair value measurement (IFRS Foundation, 2014). Evaluating the agricultural activity at the point of the harvest results from the fact that the transformation process is immediately represented in the financial statements and due to the fact that the stakeholders are able to estimate the future economic benefits (Lefter, Roman, 2007). The fair value of biological assets has the direct relation to changes in anticipating the future benefits. For example, anticipated benefits are directly proportional to the growth of trees in the forest (Dvořáková, 2012). On the other hand, the evaluation at the acquisition/production cost does not reflect sufficiently the increase in value during development phase over the time of growth of biological asset due to the small relation between expended costs and growth of biological assets, e.g. trees in the forest (Lefter, Roman, 2007). Entities using the evaluation at historical cost cannot recognize the revenue until the harvest or sale (it could take decades in case of trees). By using fair value evaluation model, gains can be recognized continuously during each accounting period until the harvest.

Fair value determination

At the time of its creation, IAS 41 contained a definition of fair value and the options of its determination. Since a new International Financial Reporting Standard 13 Fair Value Measurement was approved (effective from 1st January 2013), its definition of fair value is currently prescribed for all standards. IFRS 13 defines *fair value* as a price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date. That definition of fair value emphasizes that fair value is a market-based measurement (i.e. market approach), not an entity-specific measurement (Stárová et al., 2016). According to Dvořáková (2012), active market with biological assets, especially with long-term production cycle, may not function. For that reason, other approaches to fair value (i.e. cost or income approach) offered by IFRS 13

have to be employed. In that case, Svoboda, Bohušová (2017) and Cavalheiro et al. (2017) suggest using discounted cash flow (income approach) to measure biological asset's fair value. But it should be noted that any cash flow for financing the assets, taxation, or re-establishing biological assets after harvest, e.g. the cost of replanting trees in a plantation forest after harvest, cannot be included in the calculation (IAS 41).

An entity should use maximally relevant and observable information in order to measure fair value. IFRS 13 specifies the hierarchy of inputs in the determination of fair value using valuation approaches mentioned above. Level 1 inputs are considered the most reliable evidence of fair value and have to be used without adjustment to measure fair value whenever available; it has the highest priority. Level 1 inputs are quoted prices in active market for identical assets on the principal or the most advantageous market for the asset. Related to biological assets Dvořáková (2014) points out that market prices often have unstable seasonal character – they can differ significantly at the end of reporting period from future sale prices, which could cause recognition of unrealized gains or losses. These unrealized gains could be a subject of taxation (Bartůňková, Semerád, 2013). Level 2 inputs are directly or indirectly observable quoted prices in active markets for similar assets or, in case of missing active markets, quoted prices for identical or similar assets in markets that are not active. Level 3 inputs are unobservable on the markets. They reflect management's own assumptions about the assumptions market participants would use in pricing the asset (including risk assumptions). At level 3 the asset valuation requires a certain degree of judgment by the appraiser, and this could influence reliability and relevance of the generated information (Yang et al., 2005).

Reporting

Biological assets are reported as non-current or current assets in the balance sheet. A gain or a loss arising on initial recognition of a biological asset or agricultural produce at fair value less costs to sell and from a change in fair value less costs to sell is included in the profit or loss for the period in which it arises (IAS 41). A loss might arise on initial recognition of a biological asset because costs to sell are deducted, and they can exceed the fair value of the asset. Gains and losses are compensated and reported separately from other costs/losses and revenues/gains in the statement of comprehensive income.

Governments Grants

Accounting approach related to government grants incorporated in IAS 41 differs from an approach in IAS 20 Accounting for Government Grants and Disclosure of Government Assistance. The common approach to grants based on deducting a grant from the carrying amount of the related asset would be inconsistent with fair value model. (Dvořáková, 2014). For that reason, IAS 41 incorporates its own treatment

Unconditional grants related to biological assets measured at fair value less costs to sell are recognized in income when the government grant becomes available. Conditional grants are recognized in income when the conditions related to the government grant are met. If the terms of the grant allow part of it to be retained according to time that has elapsed, the entity recognized that part in profit or loss as time passes (IAS 41).

Bearer Plants

Beside biological assets mentioned above, IAS 41 distinguishes a specific group of biological assets called bearer plants that differ from other biological assets. Bearer plants are used solely to grow produce over several periods and at the end of their productive lives accounting unit usually gets rid of them. Once bearer plant attains maturity its biological transformation is no longer significant in generating future economic benefits. The only significant future economic benefits of bearer plant come from the agricultural produce that it generates (IFRS Foundation, 2014). In other words, once they are mature and productive, they are similar to "machinery used for manufacturing of goods". IAS 41 defines the bearer plant as a living plant that:

a) is used in the production or supply of agricultural produce;

b) is expected to bear produce for more than one period; and
c) has a remote likelihood of being sold as agricultural produce.

Originally the rules of IAS 41 were applied on bearer plants as well. But based on feedback from stakeholders who argued that fair value measurement was not appropriate for these bearer biological assets (Deloitte, 2014), the International Accounting Standards Board (IASB) has decided to change their accounting treatment. On 30th June 2014, IASB issued Agriculture: Bearer Plants (Amendments to IAS 16 and IAS 41) effective for entities since annual periods beginning on or after 1st January 2016. IASB decided that bearer plants will be within the scope of IAS 16 Property, Plant and Equipment and be a subject to all requirements therein. This includes the option to choose between the cost model and revaluation model for subsequent measurement (EY, 2014).

Plants like tea bushes, grape vines, oil palms and rubber trees usually meet the definition of a bearer plant and are within the scope of IAS 16. However, it is necessary to mention that the produce growing on bearer plants – for example, tea leaves, grapes, oil palm fruit or latex – remains within the scope of IAS 41. Annual crops and other plants that held solely to be harvested as agricultural produce, such as soya, wheat and soya or trees grown for lumber, are not expected to meet the definition of bearer plants. In addition, biological assets with dual use, both bearer (e.g. fruit) and consumable (e.g. lumber) attributes do not hold the definition and remain under the rules of IAS 41 (EY, 2014). Bearer animals are explicitly excluded from the definition and are accounted for under IAS 41.

Bearer plants that are subject to IAS 36 have to meet all measurement requirements in IAS 16. Before maturity, bearer plants will be measured at their accumulated cost, in the same way as self-constructed items of property, plant and equipment before they are in the location and condition necessary to be capable of operating in the manner intended by management. After they become mature, entities choose to measure either the cost model or the revaluation model. Following either model, entities have to determine the useful life of the bearer plant in order to depreciate it. The useful life needs to be re-evaluated each year. Unlike biological assets under IAS 41, property, plant and equipment under IAS 16 are not scoped out of IAS 36 Impairment of Assets – this means the need for assessing whether there are some indicators that bearer plants are impaired at the end of the accounting period.

Usage of IAS 41 on the Central European Stock Exchanges

Regulation (EC) No. 1606/2002 requires that all publicly listed companies on a regulated market in the European Union have to prepare their consolidated financial statements in accordance with IFRS. Member states can still decide on the obligation to apply IFRS for the preparation of individual financial statements of publicly listed companies on a regulated market. In case of corporations traded on a non-regulated market (i.e. multilateral trading facility) responsible market organizer (stock exchange) decides on using IFRS. For example, in the Czech Republic, all publicly listed companies on the regulated market have to prepare their financial statements (individual or consolidated) in accordance with IFRS (Act No. 563/1991 Coll.). On the contrary, in Slovakia only some publicly listed companies on the regulated market have to applied IFRS for their individual financial statements (e.g. banks, insurance companies or reinsurance companies), the others may (but do not have to) use IFRS (Act No. 431/2002 Coll.). Both countries do not regulate using IFRS on non-regulated markets.

Application of IAS 41 supposes that entity is involved in the agricultural activity and prepares its financial statements in accordance with IFRS. The examination of using IAS 41 was conducted among corporations on regulated and non-regulated stock market segments of the Central European Stock Exchanges. The results presented in Table 1 show that only the low number of publicly listed companies uses IAS 41. In total, 1 653 listed companies were examined, and only 19 of them use IAS 41.

Table 1 Usage of IAS 41 on the Central European Stock Exchanges

Stock Exchange	Total number of publicly listed companies	Number of companies using IAS 41	Companies using IAS 41 (%)
Prague Stock Exchange	53	1	1.887
Bratislava Stock Exchange	60	1	1.667
Warsaw Stock Exchange	880	13	1.477
Budapest Stock Exchange	40	0	0.000
Vienna Stock Exchange	620	4	0.645
Total	1 653	19	1.149

Source: Own arrangement based on the data retrieved from the Central European stock exchanges and financial statements of listed corporations

The low usage of IAS 41 can be explained by the small number of publicly listed agriculture companies on the stock exchanges. Most agriculture companies are small, independent, cash and tax-focused, family-operated business units, without the need to obtain capital on stock exchanges (Dvořáková, 2012). According to Eurostat (2013), there were 10.8 million farms across the EU-28. There is a large number (4.9 million) of very small, family farm (less than 2 hectares in size), and a small number (0.3 million) of very large farms (over 100 hectares). Apart from the size, Messah (2011) found out that agriculture companies in relation to listing on stock exchanges face major challenges such as high listing fees, price instability and fluctuations for agricultural produce based on inconsistent weather conditions or fluctuations in profitability in the agricultural sector, hence considered a risky sector to invest in. These reasons can explain the low listing of these companies as well.

Another reason for the results can be found in the state law and stock exchange rules which do not require IFRS application for all listed companies. Agriculture companies are traded particularly on non-regulated market segments where the stock exchanges often do not prescribe mandatory using IFRS. Given the additional costs related to IFRS adoption (e.g. Navarro-García and Bastida, 2010, or Morris et al., 2014) companies are not motivated to apply them. Therefore, not every entity from the small amount of listed agriculture companies uses IAS 41. On the other hand, with continuing globalization and increasing pressure on international comparability of financial statements by owners, potential investors, financial institutions or regulators it can be assumed that the importance of IFRS will rise and agriculture companies will be more motivated to start preparing their financial statements in accordance with IFRS.

Although at first sight, it might seem that IAS 41 is redundant due to its low usage, it is not the case. It provides accountants with coherent, logically structured and understandable set of specific rules that cannot be substituted by other existing IAS/IFRS. Thanks to these rules agriculture companies are able to prepare reliable, transparent and internationally comparable financial statements with respect to their activity based on biological transformation.

4 Conclusion

Agricultural companies differ regarding their activities from the other business corporations. Their activity is based on the biological transformation that is dependent on the natural and environmental conditions and takes independently of human activities – people can only facilitate or influence it. The nature of the agricultural activity is difficult to capture in traditionally used accounting models based on historical cost and realization principle (Dvořáková, 2012).

International Accounting Standard 41 offers the special accounting treatment of biological assets (except bearer plants), agricultural produce at the point of harvest and government grants related to agricultural activity. IAS 41 is based on the fair value principle which represents the best way how to capture the biological transformation in the accounting

books and financial statements because the fair value has the direct relation to changes in anticipating the future benefits. For that reason, IAS 41 requires all biological asset and agricultural produce to be measured at fair value less costs to sell if fair value is reliably measurable. Determination of fair value is incorporated in IFRS 13 which prescribes three fair value determination approaches (market, cost and income) and three levels of applicable input information.

Based on the conducted research among 1 653 publicly listed corporations on the stock exchanges in the Czech Republic, in Slovakia, Poland, Hungary and Austria, there is the only small number of agriculture companies using IAS 41. Although its low usage might suggest its uselessness, it provides a specific set of accounting rules that cannot be found in any other standard, and that is important for agriculture companies (non-listed as well). IAS 41 allows them to prepare financial statements with respect to particularities of the biological transformation based on comparable, internationally known, uniform and reliable accounting rules and principles. It can be expected that continuance of globalization increases the importance of International Financial Reporting Standard even more for owners, potential investors, banks or government agencies and more (not only) agriculture companies will begin to apply IFRS.

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Volatility Model Based GARCH Minimum Variance Hedging

Haochen Guo

VŠB-Technical University of Ostrava
Faculty of Economics, Department of Finance
Sokolská třída 33, 702 00 Ostrava, Czech Republic
E-mail: haochen.guo@vsb.cz

Abstract: *In the risk management, volatility as the important parameter for estimation in the issue of hedging. Volatility model is the regression based forecasting model. GARCH (Generalized Autoregressive Conditional Heteroscedasticity) model is one of volatility model, it presents the variance rate at the current time step is a weighted average of a constant long run average variance rate, the variance rate at the previous time steps and the most recent information about the variance rate. Hence, there are many literatures supposed to use the GARCH minimum variance hedging the financial derivatives. Thus, the bivariate GARCH model provides a superior performance to other dynamic or constant hedge for financial derivatives. In the paper, it estimates the minimum variance hedge based on an advanced econometric model (GARCH model) with time varying minimum variance hedge.*

Keywords: Volatility Model, GARCH Model, minimum variance, hedge ratio

JEL codes: C01, G17, G32

1 Introduction

The forecasting of volatility can be regarded as a significant problem of financial modelling. Because the volatility is an important parameter for financial risk management and it is applied in many issues such as option pricing, portfolio optimization, Value at Risk, hedging and so on. There are many literatures supposed to use the GARCH minimum variance hedging the financial derivatives. Hence, in this paper analyzes the volatility model applies to hedging – GARCH minimum variance hedging.

2 Methodology Volatility Model based GARCH Minimum Variance Hedge

This section describes the minimum variance hedge (section 2.1), the volatility forecasting - GARCH model (section 2.2) and GARCH minimum variance hedge ratio (section 2.3).

Minimum Variance Hedge

Suppose there is a maturity mismatch, so that the hedge position is closed at some time $t < T$, where T is the expiry date of the futures. The value of the hedged portfolio at time t is

$$P(t) = n \times N_F \times F(t,T) - N_S \times S(t). \quad (1)$$

The variance of this portfolio value is

$$Variance\left(P(t)\right) = n^2 N_F^2 Variance\big(F(t,T)\big) + N_S^2 Variance\big(S(t)\big) - 2nN_F N_S Cov(F(t,T)S(t)). \quad (2)$$

Note that if $nN_F = N_S$ as in the one-for-one hedge then

$$Standard\ Deviation\left(P(t)\right) = N_S \times \sqrt{Variance\big(F(t,T)\big) + Variance\big(S(t)\big) - 2Cov(F(t,T),S(t))}. \quad (3)$$

The hedging criterion is to choose n at time 0 to minimize equation (2). Differentiating with respect to n and checking the second order condition gives the optimal number of contracts in the hedge as

$$n^* = \left(\frac{N_S}{N_F}\right) \times \beta^*, \quad (4)$$

where

$$\beta^* = \frac{Cov(F(t,T),S(t))}{Variance(F(t,T))}. \quad (5)$$

The ratio equation is called the minimum variance hedge ratio.

Verification of the financial risk estimation approaches following the minimum variance hedging under partial risk, which expressed variable parameter $r \in (0;1]$. The parameter r means, what part of the risk should be hedged. If the r equal 1, it means the whole risk is hedged, if it is less than 1, it is only a partial hedged. Hence, the minimum variance partial hedge ratio expressed by following equation

$$\beta_r^* = \frac{r*Cov(F(t,T),S(t))}{Variance(F(t,T))}. \quad (6)$$

Estimating Volatility - The GARCH Model

Define σ_t as the volatility of a market variable on day *t*, as estimated at the end of day *t-1*. The square of the volatility on day t σ_t^2 is the variance rate.

To estimate the volatility of a stock price empirically, the stock price is usually observed at fixed intervals of time.

$$R_{i,t} = \ln(\frac{P_{i,t}}{P_{i,t}-1}) \text{ for i=1,2,…,t.} \quad (7)$$

Where, t+1: Number of observations,

$P_{i,t}$: Stock price at end of ith interval (i=0,1,…,t).

Because $P_i = P_{i-1}e^{R_i}$, R_i is the continuously compounded return in the ith interval. The usual estimate, P, of the standard deviation of the σ_i 's is given by

$$\sigma_i = \sqrt{\frac{1}{N-1}\sum_{t=1}^{n}[R_{i,t} - E(R_i)]^2} = \sqrt{\sigma_i^2} \text{ ,} \quad (8)$$

Where $E(R_i)$ is the mean of the $R_{i,t}$'s.

$$\ln\frac{P_T}{P_0} \sim \phi[(R_{i,t} - \frac{\sigma^2}{2})T, \sigma\sqrt{T}] \text{ ,} \quad (9)$$

Following that σ itself can be estimated as σ^* .

$$\sigma^* = \frac{P}{\sqrt{\tau}} \text{ ,} \quad (10)$$

The standard error of this estimate can be shown to be approximately $\sigma^* / \sqrt{2t}$.

Suppose that the value of the market variable at the end of day i is P_i . The variable R_i is defined as the continuously compounded return during day i .

$$R_i = \ln\frac{P_i}{P_i - 1} \quad \text{,} \quad (11)$$

An unbiased estimate of the variance rate per day, σ_t^2 using the most recent *n* observations on the R_i is

$$\sigma_t^2 = \frac{1}{N-1}\sum_{i=1}^{N}[R_{t-1} - E(R_i)^2], \quad (12)$$

Where $E(R_i)$ is the mean of the R_i's:

$$E(R_i) = \frac{1}{N}\sum_{i=1}^{N} R_{t,i}\ , \quad (13)$$

For the purposes of calculating Value at Risk, the formula in equation (13) is usually changed in a number of ways R_i, $E(R_i)$, *N-1*.

Where R_i is defined as the proportional change in the market variable between the end of day i-1 and the end of day i so that

$$R_i = \frac{P_i - P_{i-1}}{P_{i-1}}, \quad (14)$$

$E(R_i)$ is assumed to be zero and N-1 is replaced by t.

The formula for variance rate becomes

$$\sigma_t^2 = \frac{1}{N}\sum_{i=1}^{N} R_{t-i}^2\ , \quad (15)$$

The Generalized Autoregressive Heteroskedastic (GARCH) model is developed by Engle (1982) and Bollerslev (1986).

In GARCH model, σ_t^2 is calculated from a long-run average variance rate, as well as from σ_{t-1} and R_{n-1}. The equation for GARCH is

$$\sigma_t^2 = \gamma\sigma_t^2 + \alpha R_{t-1}^2 + \beta\sigma_{t-1}^2, \quad (16)$$

Where, α is the weight assigned to R_{t-1}^2, and β is the weight assigned to σ_{t-1}^2. Because the weights must sum to one:

$$\gamma + \alpha + \beta = 1, \quad (17)$$

Setting $\omega = \gamma V$, the GARCH model in following equation,

$$\sigma_t^2 = \omega + \alpha R_{t-1}^2 + \beta\sigma_{t-1}^2, \quad (18)$$

This is the form of the model that is usually used for the purposes of estimating the parameters. Once ω, α, β have been estimated, it can calculate γ as $1-\alpha-\beta$. The long-term variance can then be calculated as ω/γ. For a stable GARCH process it requires $\alpha+\beta<1$. Otherwise the weight applied to the long-term variance is negative.

The GARCH Minimum Variance Hedge

This is the number of futures contracts in the hedge when minimize the variance of the hedge portfolio. Note that when beliefs are expressed in terms of returns normally express the minimum variance hedge ratio as

$$\tilde{\beta} = \rho\frac{\sigma_S}{\sigma_F}. \quad (19)$$

It estimated by performing a simply linear regression by OLS. The regression model is

$$r_{St} = \alpha + \tilde{\beta} r_{Ft} + \varepsilon_t, \quad (20)$$

where the dependent variance is the return on the portfolio to be hedged and the independent variable is the return on the hedging instrument.

Time varying minimum variance hedge ratios may also be estimated using a bivariate GARCH model. These models extension to time varying minimum variance hedge ratios is not entirely straightforward, since it is typical that the portfolio will be cointegrated with its hedging instrument.

The disequilibrium term in the error correction mechanism will be closely approximated by the fair value of the basis. To see why, note that

$$lnF^*(t,F) - lnS(t) = (r-y)(T-t) = C(t,T). \tag{21}$$

Although $C(t,F)$ will be stationary when the spot and futures are cointegrated, which they are when the basis is mean-reverting, it need not be the most stationary linear combination of the log of the market price of the futures and the log of the spot time. nevertheless since the mispricing of the futures contract relative to its fair value is so small it is reasonable to assume the error correction term in the error correction model is equal to $C(t,T)$ when log returns rather than returns are used in the GARCH model.

Introducing the notation

$$y_t = \begin{pmatrix} r_{St} \\ r_{Ft} \end{pmatrix},\ \mu = \begin{pmatrix} \mu_1 \\ \mu_2 \end{pmatrix},\ \pi = \begin{pmatrix} \pi_1 \\ \pi_2 \end{pmatrix},\ \Gamma = \begin{pmatrix} \Gamma_{11} & \Gamma_{12} \\ \Gamma_{21} & \Gamma_{22} \end{pmatrix} \text{ and } \varepsilon_t = \begin{pmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,t} \end{pmatrix}, \tag{22}$$

where the vector y contains log returns, it can write the conditional mean equations as

$$y_t = \mu + \Gamma y_{t-1} + \pi C_{t-1} + \varepsilon_t. \tag{23}$$

In the conditional bivariate GARCH framework, it assumes $\varepsilon_t | I_{t-1} \sim N(0, H_t)$ where I_{t-1} denotes the information set as time $t-1$ and $H_t = \begin{pmatrix} \sigma_{St}^2 & \sigma_{SFt} \\ \sigma_{Sft} & \sigma_{Ft}^2 \end{pmatrix}$,

where σ_{St} and σ_{Ft} are the conditional standard deviations of the portfolio and the hedging instrument and σ_{Sft} is their conditional covariance at time t. This matrix is called the conditional covariance matrix. The GARCH minimum variance hedge ratio at time t is then given by

$$\widetilde{\beta}_t = \frac{\sigma_{SFt}}{\sigma_{Ft}^2}. \tag{24}$$

Note that the GARCH model hedge ratio is time varying as well as its estimate.

Verification of the financial risk estimation approaches following the GARCH minimum variance partial hedging under partial risk, which expressed variable parameter $r \in (0;1]$. The parameter r means, what part of the risk should be hedged. If the r equal 1, it means the whole risk is hedged, if it is less than 1, it is only a partial hedged. Hence, the GARCH minimum variance partial hedge ratio expressed by following equation

$$\widetilde{\beta}_t = \frac{r\sigma_{SFt}}{\sigma_{Ft}^2}. \tag{25}$$

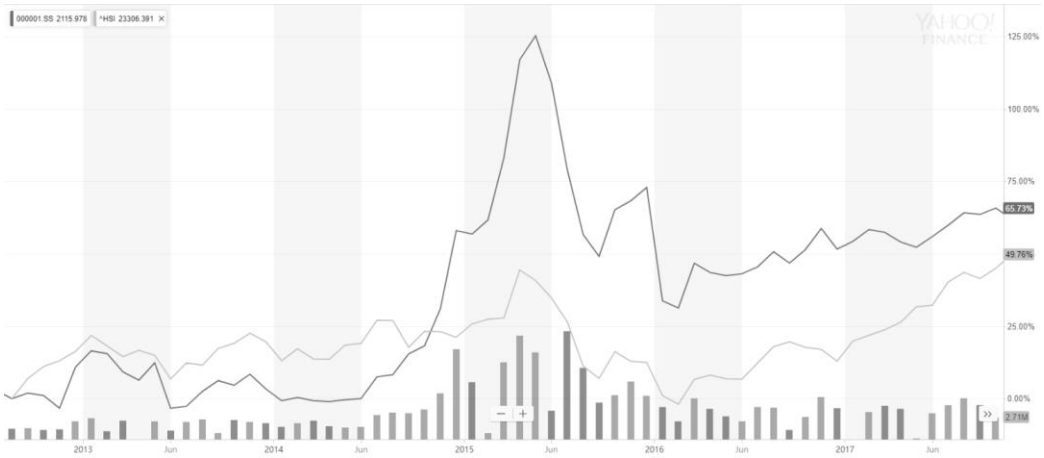
3 Empirical Study of Volatility Model based GARCH minimum Variance Hedge

This section illustrates the minimum variance hedge ratio (section 3.1) and GARCH minimum variance hedge as the empirical research with two Chinese indices (section 3.2).

Minimum Variance Hedge Ratios

Illustrate that based on the equation (5), (6) and (20) to calculate the OLS minimum variance futures hedge ratios for the two Chinese indices (Figure 1) of SSE composite index (000001.SS), HANG SENG index (^HSI) that according to the hedging period of 1 day (daily data). The following Table 1 presents the results of minimum variance hedge ratios from 23th July 2012 – 13th October 2017.

Figure 1 Index Data from 2012-2017



Source: Yahoo Finance

Table 1 Minimum Variance Hedge Ratio

Returns	**SSE**	**HANG SENG**
Spot volatility	23.51%	16.48%
Futures Volatility	26.49%	17.77%
Correlation	0.082	0.020
Minimum Variance Hedge Ratio	0.073	0.018

Source: Own calculation

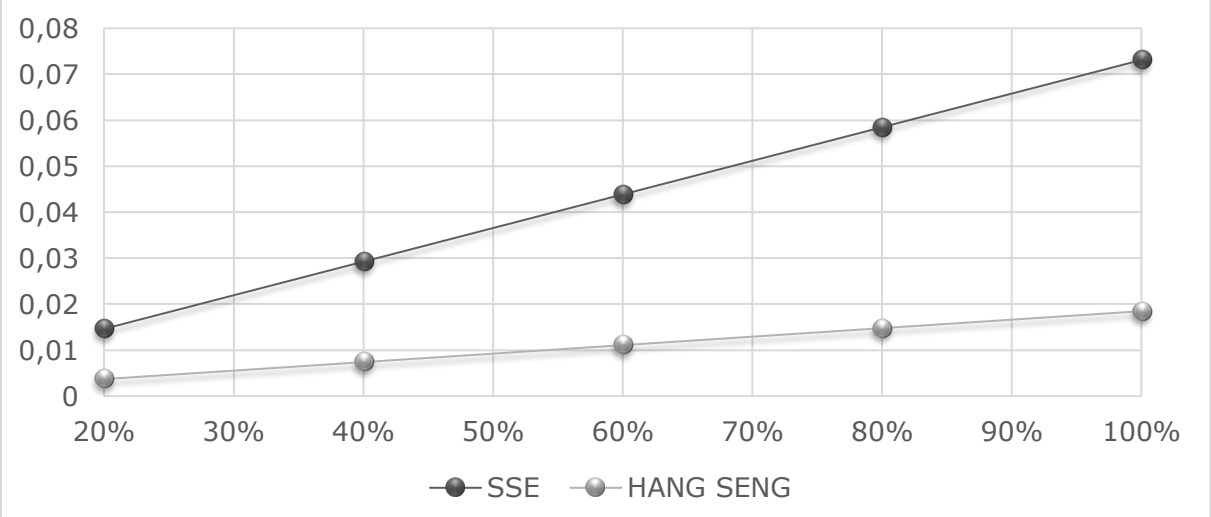
The minimum variance hedge ratio is the product of the correlation coefficient between the changes in the spot and futures prices and the ratio of the standard deviation of the changes in the spot price to the standard deviation of the futures prices. The size of the minimum variance hedge ratio increases with the spot-futures correlation. When the spot and futures are very highly correlated the minimum variance hedge ratios are very close to 1. Otherwise might opposite.

Table 2 Minimum Variance Partial Hedge Ratio

	100% (full hedge)	**80%**	**60%**	**40%**	**20%**
SSE	0.073	0.058	0.044	0.029	0.015
HANG SENG	0.018	0.015	0.011	0.007	0.004

Source: own calculation

Figure 2 Minimum Variance Partial Hedge Ratio



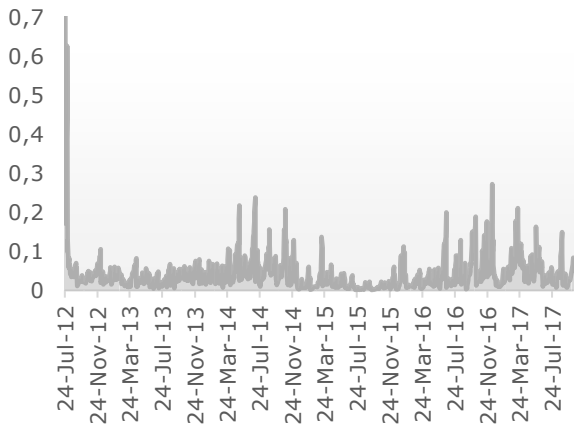
Source: own calculation

The result under the risk of 20%, the partial hedging with SSE is 0.015 and HSI is 0.004; under the risk of 40%, the partial hedging with SSE is 0.029 and HSI is 0.07; under the risk of 60%, the partial hedging with SSE is 0.044 and HSI is 0.011; under the risk of 80%, the partial hedging with SSE is 0.058 and HSI is 0.015; under the risk of 100% (full hedge), the hedging with SSE is 0.073 and HSI is 0.018. Though the increase of risk the partial hedging optimization is going up that is proof in the Figure 2.

The GARCH Minimum Variance Hedge

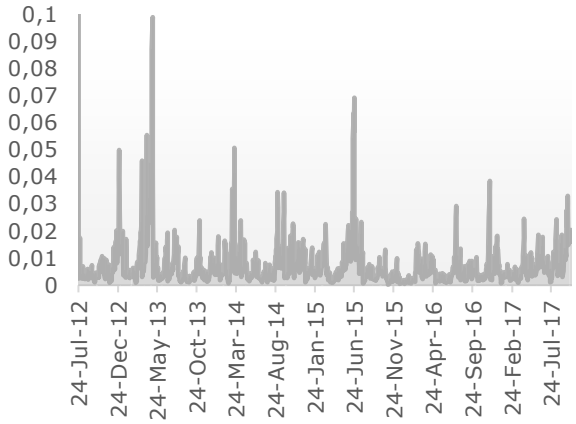
Illustrate that the case of SSE composite index and HANG SENG index apply GARCH minimum variance hedge which based on the equation (24) and (25). The time varying GARCH hedge are extremely variable. Following Figure 3 and Figure 4 present the GARCH minimum variance hedge ratio with full hedge risk and partial risk in SSE composite index (000001.SS) and HANG SENG index (^HSI).

Figure 3 (a) The GARCH Minimum Variance Hedge (SSE)



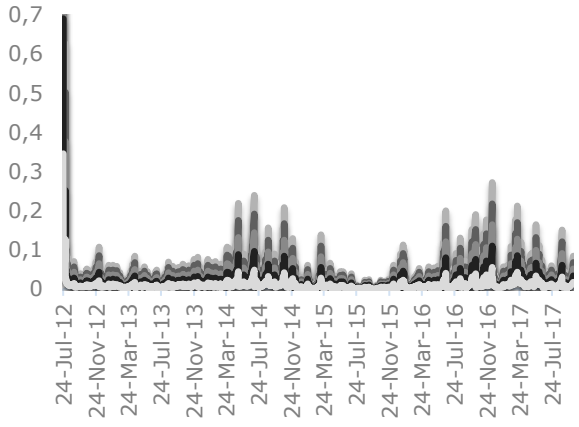
Source: own calculation

Figure 4 (a) The GARCH Minimum Variance Hedge (HSI)



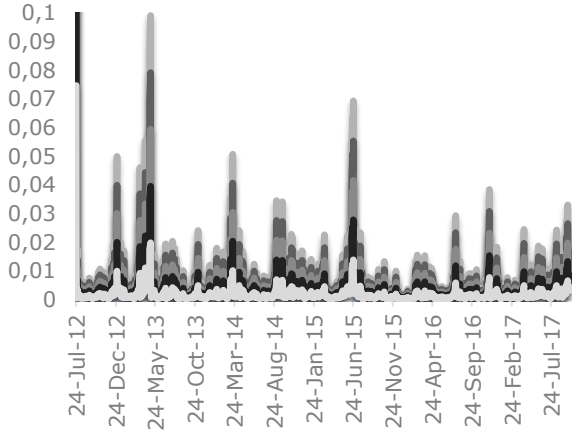
Source: own calculation

Figure 3 (b) The GARCH Minimum Variance Partial Hedge (SSE)



Source: own calculation

Figure 4 (b) The GARCH Minimum Variance Partial Hedge (HSI)



Source: own calculation

Time varying minimum variance hedge ratios estimated GARCH incorporate too much noise to be effective for hedging purposes and one is actually better off using OLS to estimate the minimum variance hedge ratio. The benefits of an active hedging strategy should be economically justifiable yet these models do not account for transactions costs, such as margins and commissions. When the costs of hedging are considered the case against time varying hedge ratios based on conditional covariances is strengthened even further. Result presents the GARCH hedge ratios sensitivity does not influence performance.

4 Conclusions

This paper analyzes the volatility model (GARCH model) to estimate minimum variance hedge ratio when the hedge is placed over a very short horizon (daily data) with SSE composite index (000001.SS) and HANG SENG index (^HSI). The forecast based on longer time series should be better. The characteristic property of the GARCH model is the slower reversion to the observed variance after greater shocks. In principle, the GARCH model is better compared with the EWMA model for short term forecasting. Hence, the following step of empirical study will the volatility model based EWMA minimum variance hedging.

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Efficiency Hospitals in the Czech Republic: the Difference Between the Methods Used

Taťána Hajdíková[1], Kateřina Trubačová[2]

[1]University of Economics, Prague
Faculty of Management, Department of Management
Jarosovska 1117/II, 37701, Jindrichuv Hradec, Czech Republic
E-mail: hajdikova@fm.vse.cz

[2]University of Economics, Prague
Faculty of Management, Department of Management
Jarosovska 1117/II, 37701, Jindrichuv Hradec, Czech Republic
E-mail: katerina.trubacova@seznam.cz

Abstract. *In the Czech Republic and other countries, the effective use of funds from public sources in the health care sector is a long-term research topic. There is pressure to increase the efficiency of healthcare providers. The paper deals with the analysis of the methods used to determine the effectiveness of hospitals in the Czech Republic. Many tools of financial analysis are used to assess financial health. In particular, various ratios, but only those situations that relate to them. However, there are a number of methods dealing with a more comprehensive view of the overall effectiveness of the subject. The aim of the paper is to discuss and assess whether the detection of financial health by various methods will contribute to the improvement of the financial situation of Czech hospitals. For assessing the benefits, account is taken of the financial position of the investigated hospitals found in research and research by other authors. Contributions will be used by hospitals from the calculation of the Ohlson O-Score Index, the Financial Strength Index, the Polish Collective Index by A. Bem and H'index in 2013-2016. The output of the contribution is the H'index financial health information compared to other indexes.*

Keywords: hospitals, performance, financial health

JEL Classification: I11, C6

1 Introduction

The health system is the most comprehensive component of the entire nonprofit sector amongst which the health services are generally the most commercial. More and more gainful activity of these services depends more on management than on volunteers (Worth, 2012).

The economic outturn of a healthcare facility may be positive or negative. Ideally, any economic subject should achieve long-term profitability. In healthcare, there may also be situations where it is not possible to say whether profit is a positive or negative aspect. General economic theories may be contrary to the criteria of success in health care (Pekova at al., 2012)

Since the end of the last century, a number of authors have been researching the economic effectiveness of hospitals (Sherman,1984) (Zuckerman et al., 1994). In this millennium, researching the measurement of hospital efficiency and its determinants is a major concern of the healthcare economy (Jacobs, 2001) (Hofmarcher, 2002). To evaluate efficiency, quantitative economic analysis methods, including envelope analysis, are a useful tool. Their disadvantage is the difficulty of aggregating diverse data (Dlouhý, 2007). A summary of articles on efficiency assessments in health care is published by Hollingsworth (Hollingsworth, 2003).

2 Methodology and Data

For comparison, models that were created for and are applicable to hospitals were selected. The models differ from each other by the number of indicators and by their selection. Various limitations have been made in analyzing and evaluating results. Foreign models

appeal to the use of financial indicators that do not have the exact equivalents in the Czech Republic, such as the Cleverley Financial Strength Index and its "Days cash on hand" indicator. Czech hospitals often deal with loss and are perceived negatively in this respect. While calculating foreign indexes, Czech hospitals with negative economic outcomes are often ranked amongst the most stable and financially healthy.

Ohlson's O-Score is a multi-factor formula for the approaching bankruptcy's prediction. Ohlson, a big critic of Altman's Z-score, built his model on the data of 2000 bankrupt US companies. His model is considered to be more accurate than Altman's Z-score even due to the influence of internal and external factors (Ohlson, 1980).

The O-score formula (Ohlson, 1980):

$$O = -1{,}32 - 0{,}407\, log\left(\frac{TA_t}{GNP}\right) + 6{,}03\,\frac{TL_t}{TA_t} - 1{,}43\,\frac{WC_t}{TA_t} + 0{,}0757\,\frac{CL_t}{CA_t} - 1{,}72X - 2{,}37\,\frac{NI_t}{TA_t} - 1{,}83\,\frac{FFO_t}{TL_t} + 0{,}285Y - 0{,}521\,\frac{NI_t - NI_{t-1}}{|NI_t| + |NI_{t-1}|} \quad (1)$$

- TA total assets,
- GNP Gross National Product price index level,
- TL total liabilities,
- WC working capital,
- CL current liabilities,
- CA current assets,
- X=1 if TL > TA, 0 otherwise,
- NI net income,
- FFO funds from operations,
- Y=1 if a net loss for the last two years, 0 otherwise

The Financial Strength Index (FSI) was designed by William Cleverley specifically for American hospitals. This prevents problems arising from the use of bankruptcy and creditworthiness models and indexes designed for manufacturing companies. In his research, Cleverley dealt generally with health care systems. FSI is a composition of four dimensions: profitability, liquidity, financial leverage and age of physical equipment (Cleverley, 2002).

Basic FSI formula (Cleverley, 2002):

$$FSI = \left(\frac{total\ margin - 4{,}0}{4{,}0}\right) + \left(\frac{days\ cash\ on\ hand - 50}{50}\right) + \left(\frac{50 - debt\ financing\ \%}{50{,}0}\right) + \left(\frac{9{,}0 - average\ age\ of\ plant}{9{,}0}\right) \quad (2)$$

Polish indicators by Agnieszka Bem et al have been designed and tested to assess the financial health of Central European hospitals. The synthetic pointer is constructed using a gradient method. In Table 1 the indicators are divided into 4 categories - profitability, liquidity, debt and efficiency (Bem et al, 2015).

Table 1 Selected Financial Indicators

Label	Formula	Group
OPM	EBIT/Sales	profitability
CR	Current Assets/Current liabilities	liquidity
D%	Total debt/Total Assets	debt
CF/Debt	(Net profit + Depreciation) / Total debt	debt
TAT	Sales/Total Assets	efficiency
CES	Employee benefit expense/Sales	efficiency
ROCF	(Net profit + Depreciation) / Total Assets	profitability

Source: own edit (Bem et al, 2015)

Czech H'index is still the youngest model compiled through logistic regression on the data of Czech hospitals. It was built on the basis of extensive analysis of existing indexes and indicators (Hajdíková, 2016).

Basic H'index formula (Hajdíková, 2016):

$$\mathbf{H'index} = \mathbf{0,8277} + \mathbf{80,8714}\boldsymbol{U1} + \mathbf{9,5314}\boldsymbol{U}2 + \mathbf{1,7580}\boldsymbol{U}3 - \mathbf{10,8281}\boldsymbol{U}4 \quad (3)$$

- U1 = EBIT/operating income
- U2 = Net profit + depreciation/total debt
- U3 = Operating income/total assets
- U4 = Cost of employee benefits/operating income

There are weighing coefficients in front of individual indicators (Ui). The constant in the formula is 0.8277, which increases the sum of the weighted values of the indicators. The basis for the goal of this paper is to select a correct research sample. Between 2013 and 2016 there were from 188 to 189 hospitals registered in the Czech Republic (ÚZIS, 2018). Secondary data from publicly available sources and the websites of individual hospitals were used in the research. The data from the website has coincided and can be considered as correct. Despite the legal obligation, some business entities do not publish their financial statements, which is also the case of some hospitals. The sample of hospitals that published and were included in the research sample is shown in Table 2.

Table 2 Number of Hospitals for the Research sample

Year	Number of hospitals
2013	99
2014	98
2015	85
2016	84

Source: ÚZIS (ÚZIS, 2018)

This research sample was selected using the cluster analysis. The clusters created contain units that are similar. Individual clusters vary considerably between each other. The final sample of examined hospitals is 84. The published evaluation applies the benchmarking method to the top 10 hospitals.

3 Results and Discussion

When calculating the O-score, a problem arises when an indicator within the equation is equal to zero. Ohlson pronounced the conclusion where the boundary value is 0,5. Values higher than 0,5 indicate the financial distress and, on the contrary, lower than 0,5 the financial health. Table 3 presents hospitals that can be considered financially sound and stable. Hospitals with financial loss have never been among the top 10 best-rated hospitals.

Table 3 Comparison of the Best Hospitals in the Czech Republic by O-score in 2013-2016

Hospital	Year			
	2013	2014	2015	2016
Centrum léčby pohyb. aparátu, s. r. o.	-9,43011	0	-5,51343	-6,54636
RHG spol. s r. o.	-7,82853	-6,38471	-8,64625	0
Poličská nemocnice, s. r. o.	-6,47412	-6,28977	-6,23757	-6,22558
Sdružené zdravot. zařízení Krnov, p. o.	-4,17787	-5,25399	-4,74197	-4,08734
Fakultní nemocnice Hradec Králové	-4,17593	0	-4,18853	-4,09987
Nemocnice Vyškov, p. o.	0	-5,11317	-4,56641	-5,23112
Nemocnice Ivančice, p. o.	0	-4,91298	-4,67252	-4,78224

Source: own research

Cleverley's Financial Strength Index considers indicators that are barely used in the Czech Republic for the assessment of financial health. The calculation of the index itself was seamless. Cleverley divides hospitals into three categories. The FSI ranging from -2,0 to 2,0 indicates that the hospital is financially unhealthy; values from 2,0 to 3,0 refer to hospitals with average financial health. The FSI with values greater than 3,0 refers to hospitals with excellent financial health. The results of the calculations were extremely high, which may be either due to a partial modification of the index indicators or due to the FSI not being suitable for assessing the financial health of Czech hospitals. It's also the only index considering different indicators and variables, so it tends to be more inappropriate than to misconduct. Table 4 shows the top 10 hospitals that have occupied the position for at least three of the four monitored years.

Table 4 Comparison of the Best Hospitals in the Czech Republic by FSI in 2013-2016

Hospital	Year			
	2013	2014	2015	2016
Nemocnice Žatec, o. p. s.	5229,64	48061,07	6018,765	5956,26
Středomoravská nemocniční, a. s.	4571,937	5604,65	5055,669	5323,665
Dopravní zdravotnictví, a. s.	4281,706	5274,472	4095,724	0
Oblastní nemocnice Kolín, a. s.	3928,919	0	5687,004	4987,923
Poliklinika Prosek, a. s.	3629,001	0	3772,078	3645,239
Nem. s poliklinikou Karviná – Ráj, p. o.	2722,068	804613,2	1798924	0
Sdružené zdravot. zařízení Krnov, p. o.	2584,261	395149,5	139047	138897
Nemocnice Ivančice, p. o.	0	632003,7	707935,1	686234,3
Masaryk. městská nem. v Jilemnici, p. o.	0	724249,4	867014,2	0
Nemocnice Vyškov, p. o.	0	227650,2	1174428	346787,76

Source: own research

The calculation of Polish financial health indicators in Table 5 differs slightly from previous calculations. There is no formula or equation that would be definitive and authoritative for application in assessing the financial health of hospitals. This is the calculation of seven indicators, which are further independently evaluated. After calculating the indicators, the OPM (EBIT / Sales) variable was chosen, according to which the hospitals were ranked downwards from best to worst. Subsequent analysis has shown that, according to the OPM, the financial condition of the hospitals is assessed as "bad". In addition, it is appropriate to state that all hospitals of the research sample were evaluated negatively. The use of these indicators is not appropriate for a person who did not participate in the research. It serves as a different view on the subject and the impetus for a deeper analysis and an subsequent research.

Table 5 Comparison of Hospitals Using the Polish Index (OPM) in 2013-2016

Hospital	2013	2014	2015	2016
Centrum léčby pohyb. aparátu, s. r. o.	0,264843	0	0,088895	0,345566
RHG spol. S r. o.	0,216902	0,234035	0,245868	0
Mediterra Sedlčany, s. r. o.	0,149217	0,061046	0	0,098457
Nemocnice Podlesí, a. s.	0,14225	0,147729	0,084195	0,108834
Nemocnice sv. Zdislavy, a. s.	0,141749	0,051459	0,053516	0
Poličská nemocnice, s. r. o.	0,099874	0,14088	0,123099	0,134766
Hornická nem. s polik., spol. s r. o.	0,091311	0,083072	0	0,089866
SANATORIUM Helios, s. r. o.	0	0,146503	0,190207	0,173322
Nemocnice Valtice, s. r. o.	0	0,108945	0,080747	0,090944
Nemocnice Český Těšín, a. s.	0	0,069887	0,078703	0,061233

Source: own research

H'index, as the only one outlined in Table 6, was designed to assess the financial health of Czech hospitals. It responds to the trend when hospitals have a need to compare their achievements with competition, while the competitive fight is quite large. H'index operates with Czech data and considers indicators that are commonly used in the Czech Republic to assess financial health.

Table 6 Comparison of the Best hHspitals in the Czech Republic Using the H'index

Hospital	Year			
	2013	2014	2015	2016
Centrum léčby pohyb. aparátu, s. r. o.	44,02907	0	17,34271	22,43736
RHG spol. s r. o.	31,7627	28,53735	38,99768	0
Nemocnice Podlesí, a. s.	19,28659	18,31247	10,8022	17,8765
Hornická nem. s poliklinikou, spol. s r. o.	16,94159	15,15379	0	16,87655
Poličská nemocnice, s. r. o.	14,0115	18,13052	16,7603	16,7822
Nemocnice Valtice, s. r. o.	12,35539	11,01899	9,058287	11,00878
SANATORIUM Helios, s. r. o.	0	15,03902	22,19845	22,26766

Source: own research

To make it more accurate to determine whether the researched indexes are suitable for assessing the financial health of Czech hospitals, it is necessary to compare them with real results or with a similar research. Because there is no similar research, where these indexes would be tested on Czech hospital data, a benchmarking method was used. It is based on HCI's list of success rate of hospitals (Health Care Institut, 2018). The list is made on the data of Czech hospitals. The results of H'index in this paper are the same as those in the list, or only slightly different depending on the origin and method of collection of the researched data. Another comparison is devoted to the FSI index. FSI values are completely different in size, often in hundreds of thousands. The FSI results can hardly be grasped and evaluated. The listed index contained the most unknown indicators and its modification could distort the results. The formula of the Ohlson's index has overturning results. Negative values mean financially sound hospitals and positive values mean hospitals with financial problems. It was not possible to compare numerical values, so hospitals were compared only in terms of whether they were placed in the top 10 list. Polish indicators are deliberately omitted because of the lack of interpretation. The base for the evaluation was probably not chosen appropriately, therefore it is not possible to evaluate the suitability of the indicators.

4 Conclusions

Healthcare is currently a widely discussed topic. Even in this sector, the trend of the present time - the comparison with the competition - is interfering. Indexes help the economic subjects with fast comparison between each other. It is related to the need for leadership, being the best in the group. A key compromise in the management of hospitals and other healthcare facilities is to ensure prosperity and fulfillment of the mission in the care of the health and well-being of the population. The main benefit of aggregate financial health assessment indexes is their easy and quick application. The result is one value that has a clear message. The resulting value is a determinant for the management and may be followed by a more thorough financial analysis. It is advisable to combine both methods, not relying on just one. In the Czech Republic there are widely used other methods of financial analysis and also indexes that are not suitable for Czech hospitals. Indexes built primarily for hospitals were introduced in this paper. Also, the capability of the new H'index was introduced. From the selected foreign indexes, the O-score index for the Czech Republic has the greatest information. Of all the indexes examined, the Cleverley FSI index is the least appropriate.

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Level of Industry Automation 4.0 in the Czech Republic and Impact on Unemployment

Martina Hedvičáková, Martin Král

[1] University of Hradec Králové
Faculty of Informatics and Management, Department of Economics
Rokitanského 62, 500 03 Hradec Králové, Czech Republic
E-mail: martina.hedvicakova@uhk.cz

[2] University of Hradec Králové
Faculty of Informatics and Management, Department of Economics
Rokitanského 62, 500 03 Hradec Králové, Czech Republic
E-mail: martin.kral.2@uhk.cz

Abstract: *The Czech Republic has the lowest unemployment rate throughout the European Union. According to Eurostat and the Czech Statistical Office, in March 2018, the unemployment rate in the Czech Republic reached 2.2%. Such a low unemployment rate causes an excess of demand over supply. Companies are looking for ways of meeting the demand of their customers. One of the possibilities is technological progress. For this reason, both the Czech Republic as well as the European Union are promoting the Industry 4.0 initiative and at the present time also the Work 4.0. The aim of the paper is to analyse the impact of Industry 4.0 and Work 4.0 on the labour market. The paper contains an analysis of the share of unemployed people in individual regions and the development of wages. The manufacturing industry is one of the key sectors of the Czech economy. The following hypotheses are tested: The impact of Industry 4.0 is markedly different in the Czech Republic regions and second As a result of the enforcement of Industry 4.0 (production automation), unemployment varies across regions.*

Keywords: Region, Industry 4.0, wages, cluster analysis, unemployment

JEL codes: J21, E2, L16, O33

1 Introduction

Originally initiated in Germany, Industry 4.0, "the fourth industrial revolution", has attracted much attention in recent literatures. It is closely related with the Internet of Things (IoT), Cyber Physical System (CPS), information and communications technology (ICT), Enterprise Architecture (EA), and Enterprise Integration (EI). (Lu, 2017). Industry 4.0 is defined as "the integration of complex physical machinery and devices with networked sensors and software, used to predict, control and plan for better business and societal outcomes" (Industrial Internet Consortium, 2014) or "a new level of value chain organization and management across the lifecycle of products" (Kagermann H, Helbig J., 2013). or "a collective term for technologies and concepts of value chain organization" (Hermann, Pentek, 2015). Thus, the concept of Industry 4.0 can be perceived as a strategy for being competitive in the future. It is focused on the optimization of value chains due to autonomously controlled and dynamic production (Acatech, 2013, 2017, Mrugalska, Wyrwicka, 2017, Hedvicakova, 2018, Soukal, et al. 2012)

The impact of Industry 4.0 on the labour market will be very complex and also contradictory. So far their research in the Czech Republic hasn't been given the right attention. One of the exceptions is Chmelař (2015) from the Strategy and Trends Department of the Czech Republic Government Office, who prepared a study: The Impact of Digitisation on the Labour Market in the Czech Republic and the EU. The paper deals with the effects of narrow digitalisation and attempts to estimate employment threats in professional groups based on coefficients that are taken from a US labour market study. Calculations made so far on the disappearance and creation of jobs are different in relation to the methodology used. Specifically for the Czech Republic, it's estimated that 10% of jobs are seriously threatened by automation over the next 20 years, and 35% of jobs will experience significant changes in the activities carried out. If this estimate, published in

the OECD study (Employment Outlook 2016), counts on the number of people employed in 2015, about 408,000 jobs will be significantly threatened, and 1.4 million jobs will experience major changes. (Work Initiative 4.0). (Hedvicakova, 2018a)

2 Methodology and Data

Mainly secondary sources were used when processing this paper. Secondary sources include specialised literature, gathering information from professional press, websites, databases, discussions or previous attendance on specialised seminars or conferences within the chosen subject area. (Hedvičáková, Svobodová, 2017) Key information was obtained from the official websites of the Czech Statistical Office, the Ministry of Industry and Trade, OECD, Eurostat, as well as from specialised servers and portals such as iHned.cz, etc. Not enough attention has been devoted to Labour market research in connection with Industry 4.0 yet. This topic was dealt with by Chmelař, 2015 The Impacts of Globalisation on the Labour Market in the Czech Republic and the EU and the Ministry of Labour and Social Affairs 2015 by anticipating the qualification needs. The Ministry of Labour and Social Affairs has elaborated the Work 4.0 study that this paper is based on. (Hedvičáková, Svobodová, 2016, 2017, Svobodová, Hedvičáková, 2017,)

The paper uses the general unemployment rate according to the CSO's calculation methodology, where the unemployment rate is calculated within Selected Survey of Labour Force (SSLF, based on the recommendations of Eurostat, ILO International Labour Organisation) as the so-called general unemployment rate. Furthermore, the values of the share of unemployed people. (Hedvičáková, 2018)

The aim of this paper is to analyse the possible impacts of the Industry 4.0 Initiative, which can be expected on the labour market in the Czech Republic with a focus on individual regions.

The following hypotheses are tested:

H1: The impact of Industry 4.0 is markedly different in the Czech Republic regions.

H2: As a result of the enforcement of Industry 4.0 (production automation), unemployment varies across regions.

The secondary data of the Czech Statistical Office were used to test the hypotheses mentioned above. The data were both aggregate for the whole of the Czech Republic, as well as individual data only for individual regions including the capital city of Prague. Some of the most significant characteristics were the number of industrial companies with 100 or more employees, the sales of industrial goods and services, the average gross monthly wage in industry, GDP, GDP per capita, emissions data (solids, sulfur dioxide, etc.) and gross fixed capital increase (GFC).

Based on the data for the period 2000 to 2016, incremental indices of individual indicators were calculated. Further, based on data from 2016, cluster analysis was performed. A hierarchical method of clustering with the Euclidean distances of the centroid of each cluster was used. Its aim was to merge regions with similar characteristics to make it easier to determine whether Industry 4.0, by replacing labor with capital, has the potential to increase unemployment in individual regions. In the last phase, Pearson's correlation coefficients were calculated for the number of unemployed registered by the Labor Offices and the selected above-mentioned characteristics.

3 Results and Discussion

Share of unemployed people in individual regions

According to the Czech Statistical Office, the share of unemployed people was 5.19% in 2016. In the following year, the share of unemployed people in the Czech Republic fell to 3.77%, which is lower than the natural rate of unemployment. For this reason, in 2017 the labour market experienced excess of demand over the supply. Companies complained that

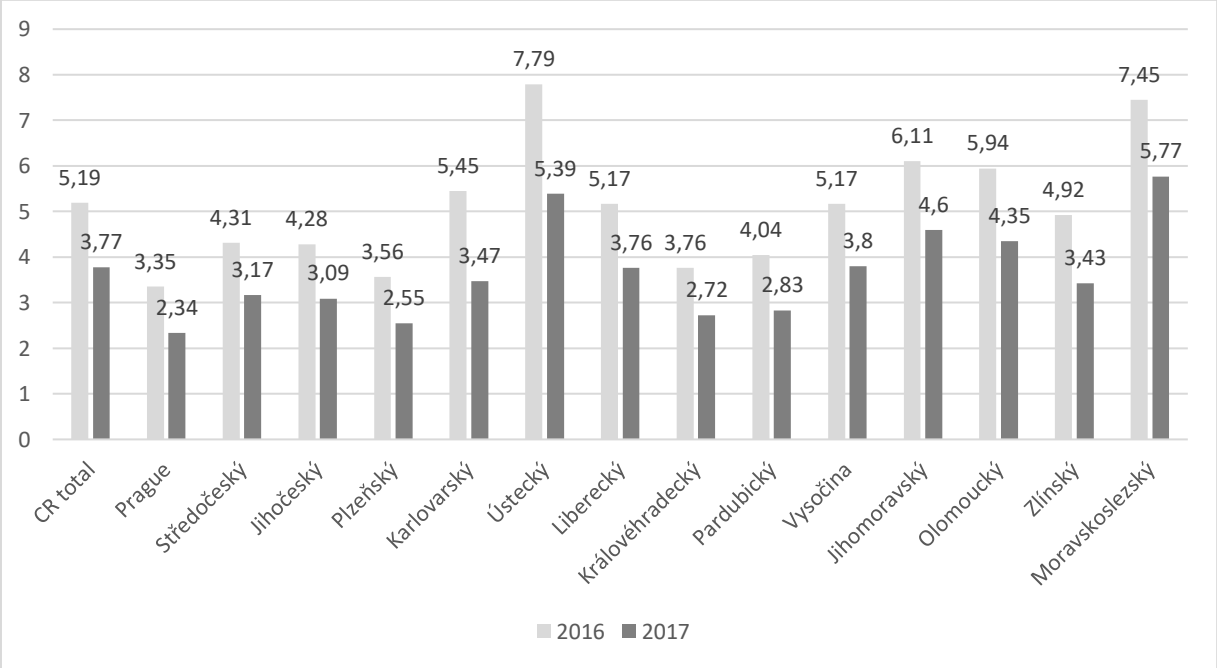
they couldn't find a sufficiently skilled workforce at a given wage rate. In all analysed regions, the proportion of unemployed people decreased in 2017.

The highest share of unemployed people was in the Ústí nad Labem Region, where it was 7.79% in 2016, it then fell to 5.39% in 2017. The second highest share of unemployed people in the Moravian-Silesian Region was 7.45% in 2016 and in the following year it dropped to only 5.77%. In 2017 this region has the highest share of unemployed people within the Czech Republic.

The lowest share of unemployed people was in the Capital City of Prague where the share of unemployed people reached 3.35% in 2016 and fell to 2.34% in the following year. Three percent of the share of unemployed people in 2017 also wasn't exceeded by the Pilsen, Hradec Králové and Pardubice regions. 3.09% was the share of unemployed people in the South Bohemian Region. The share of unemployed in the Central Bohemia Region was 3.17%.

The Figure 1 below shows that the share of unemployed people was below the natural rate of unemployment in most regions in 2017 and that the firms didn't have sufficient qualified work. At a time of economic growth, capital substitution is appropriate and the share of investment is growing in the Czech Republic. (Hedvicakova, 2018a)

Figure 1 Share of Unemployed People in the Czech Republic by Region (as on 31 December)



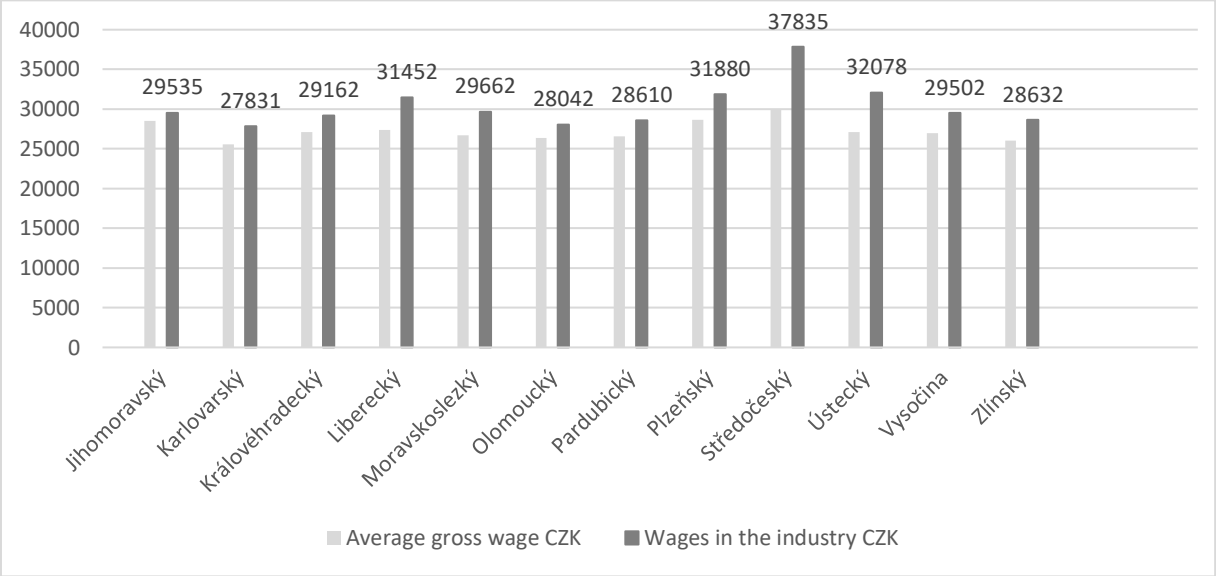
Source: Czech Statistical Office (2018), (Hedvicakova, 2018a)

Wage developments in the manufacturing industry

The manufacturing industry is significantly involved in GDP growth in the Czech Republic. A significant percentage of workers are also employed in the manufacturing industry. For this reason, manufacturing industry wages were analysed. (Hedvicakova, 2018a)

The development of personnel costs in the manufacturing industry over the period 2008 to 2016 corresponds to the development of sales with year-on-year relative changes being mostly lower. (See figure 2.) The proportion of individual divisions in personal costs varies between the share of sales and the share of value added. (Ministry of Industry and Trade, 2016a).

Figure 2 Wages in Industry in CZK in 2017



Source: Czech Statistical Office (2017), own processing

Main Region characteristics

The number of enterprises active in the industry differs significantly in the Czech Republic. The highest concentration of these companies (with 100+ employees) is according to the CZSO in Prague and the Central Bohemian Region, their total number in the last years was around 450, which represents approximately 20% of all such enterprises in the Czech Republic. On the contrary, the smallest number of industrial enterprises is in West Bohemia - the Karlovarský Region, but this may be due to some extent, in addition to its location, by its size. The number of companies is also related to total sales in the industry, which in the Central Bohemia reached almost CZK 1 billion in 2016, ie almost 30% of the industry's sales in the whole Czech Republic. This fact was also reflected in the average gross monthly wage in industry, as in 2016 it exceeded CZK 30 thousand only in Prague (CZK 32,295) and Central Bohemia (CZK 31,507), whereas the average wage in the industry for the whole of the republic was only 27,676 CZK.

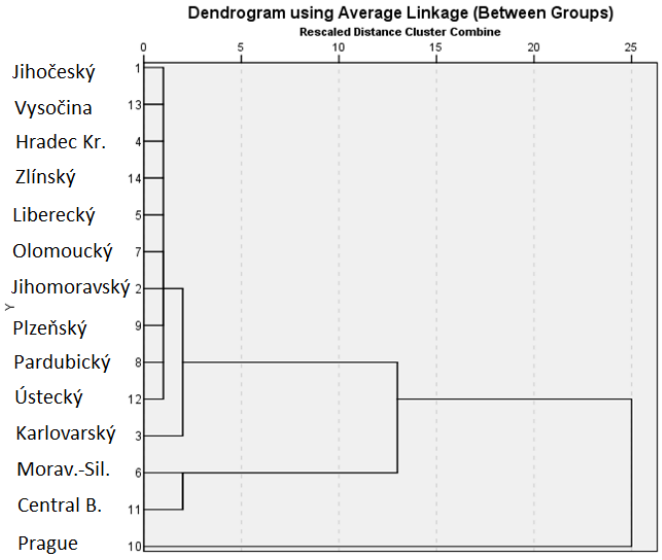
Other significant differences in connection with Industry 4.0 have also occurred in gross fixed capital formation (acquisitions and disposals of tangible and intangible fixed assets that have the character of an investment and the cost of improvements in capital goods) in the past years where was the trend of accumulation to the already industrially developed areas. From 2010 to 2015, gross fixed capital growth increased by 20% in only five of the 14 regions - Prague, Central Bohemia, Zlínský region, Moravian-Silesian region and Královéhradecký region, where it was even 36.7%, i.e. two and a half times the average in the Czech Republic, and due to the labor shortage in the labor market, it can be expected to increase further.

It follows from the above that the impact of Industry 4.0 is not the same in the whole Czech Republic. While in the industrially "developed" regions the growth rate of gross fixed capital is rising in the last years, in others it is slowing down (e.g. the Ústecký region or Karlovarský region).

In order to obtain more specific and aggregate characteristics common to each region, a cluster analysis was performed. Its aim was to include all regions and the Capital City of Prague in certain clusters with similar characteristics, which would allow for a more comprehensive estimation of the impacts of the development of the Industry of 4.0 regions. At the same time, it will be possible to determine which regions and for what reason they will be positively affected by Industry 4.0 and which regions are among the most vulnerable.

For the purpose of this cluster analysis, variables that affect industry and innovation are affected, i.e. the number of enterprises, industrial sales, average gross monthly wages in the industry, GDP per capita, emissions data (solids, sulfur dioxide, nitrogen oxide, carbon monoxide) and gross fixed capital formation per capita. A hierarchical method of clustering was used with the Euclidean distances of each centroid (see Fig. 3).

Figure 3 Dendrogram – Cluster Analysis



Source: own processing

Three clusters were created. The first contains only Prague, the second cluster consists of the Central Bohemian region and the Moravian-Silesian Region, and the third cluster consists of the other regions. The strongest predictor for the inclusion of the region in the respective cluster was GDP per capita and gross fixed capital formation per capita, while sales, wages and emissions data were rather complementary. Table 1 gives the following characteristics:

Table 1 Final Cluster Centers

	Cluster 1 - Prague	**Cluster 2 – Central Bohemia region, Moravian-Silesian region**	**Cluster 3 – Other regions**
Number of industry companies (100+ employees)	228.00	229.00	150.00
Industry - turnover	304,183.85	606,456.84	173,917.04
Industry - wages	32,295.00	29,487.00	24,104.00
Unemployed	30,179.00	51,501.00	22,563.00
GDP per capita	937,542.23	399,812.66	384,340.99
emissions - solids	1.79	0.76	0.52
emissions - solids	0.50	2.55	1.54
emissions - sulfur dioxide	11.83	3.20	1.89
emissions - nitrogen oxide	22.10	17.80	4.38
emissions - carbon monoxide	271,213.55	103,834.60	88,420.02
GFCF per capita	228.00	229.00	150.00

Source: Czech statistical office (2018a), own processing

A correlation analysis was carried out on selected data for the period 2000 to 2016. Its aim was to find out a relationship with unemployment to other characteristics in individual regions - clusters. The results are shown in the following table 2.

Table 2 Pearson Correlations Between Unemployment and Other Characteristics

	Number of industry companies (100+ employees)	**Industry - turnover**	**Industry - wages**	**GDP per capita**	**GFCF per capita**
Other regions	0.584	0.514	0.116	-0.094	-0.026
Central Bohemia region + Moravian-Silesian region	0.579	0.511	0.107	-0.102	-0.032
Prague	0.575	0.526	0.117	-0.092	-0.036

Source: Czech statistical office (2018a), own processing

Table 2 shows that for all three clusters there are equally directed relationships with respect to each characteristic. The strongest positive relationship with unemployment in the 2000 - 2016 period was demonstrated in the number of industrial enterprises and industrial sales. With average wages in the industry, correlations are very low, with negative ratios of GDP per capita negative (the higher the GDP, the lower the unemployment rate). Somewhat strange, however, is the almost zero relationship of unemployment with the increase in gross fixed capital per capita. However, this is due to the labor shortage in the labor market - despite the significant replacement of labor by capital, unemployment is not increasing in any cluster.

4 Conclusions

It follows from the above that the industrial revolution will have negative impacts on unemployment. But it will be a longer time horizon and if there is an education reform, the labour market will be prepared for these changes. The Czech Republic has one of the lowest unemployment rates across the EU and companies currently have the problem of finding a skilled workforce. The second aspect is average wages, which are among the lowest in the EU. This prevents the rapid take-up of modern technologies. The economic cycle, when economists are already discussing the "overheated economy" (e.g. the Governor of the Czech National Bank, Jiří Rusnok, 2018) and the political determination, to bring wages in the Czech Republic closer to the European Union’s average, will be affected by the onset of modern technologies and massive purchasing of technologies. Because the Czech Republic is a small open economy, a big impact will be on the rapid rise of Industry 4.0 as well as the inflow of foreign investment. (Hedvicakova, 2018a)

The paper was devoted to two parts and an analysis was carried out in order to determine whether the industry is significantly different in individual regions of the Czech Republic and whether the unemployment in the regions differs due to the enforcement of Industry 4.0 (production automation). From the point of view of industrial production data, the regions of the Czech Republic differ greatly. While the center of the Czech Republic and the Moravian-Silesian region are among the areas where industry plays a very important role, Western and Northwest Bohemia in the current period are experiencing a decline in their industrial significance. This is reflected not only in rising wages but, in particular, in the differential increase in gross fixed capital, which is concentrated in more developed areas. By automating industrial production there is and is likely to be a further increase in disparities between richer regions (especially Prague and Central Bohemia) and poorer regions (northwestern Bohemia). These differences, however, do not show up in the current economic growth in the growth of unemployment, and from the economic point of view it can be said that the Czech Republic is in a unique period in which it can exploit the potential of Industry 4.0.

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Industry 4.0 Aimed at Accounting System

Irena Honková

University of Pardubice
Faculty of Economics and Administration, Institute of Business Economics and Management
Studentská 95, 532 10 Pardubice, Czech Republic
E-mail: irena.honkova@upce.cz

Abstract: *Industry 4.0 means a current trend of digitalisation and related automation of production and changes at the labour market brought together with the Industry 4.0. More and more internal as well as external integration occurs, more and more data is collected for analysis and decision making, top management requires access to data in real time, we transfer to unified protocols, the quantity of wireless communication devices grows and thus the level of isolation of company systems is considerably reduced. This text discusses the digitisation within the accounting sphere. With its case study it shows how the requirements on presentation and information sharing of accounting and taxation sphere change: options to send tax documents in electronic form, links to Internet banking, XML communication, Internet shops or accounting in mobile phones. This text aims to provide the view not only on the accounting software but also on work of book-keepers. Thus the text presents the view on the whole accounting system within the environment of Industry 4.0. The final part of this text discusses the readiness of companies to the Industry 4.0.*

Keywords: Industry 4.0

JEL codes: M41

1 Introduction

The scientific and technical development can be divided in several revolutions (Tab. 1). First three of them resulted from the technical revolution and the revolution in electronics and mechanics. (Halenár, 2016).

The first industry revolution was based on the production mechanisation with the use of water and vapour energy. The second one included the electricity in the industrial production, the third one than has brought the automation using the electronics and information and communication technologies. (Vacek,2016)

The current stage of the industry development can be described as the revolution of informatics and communication. This causes the high level of globalisation and foundation of companies of which the existence is based on the communication (Halenár, 2016). This trend is called as the Industry 4.0.

The Industry 4.0 related to the previous wave but there is a convergence of technologies that tears down wall among physical, digital and biological worlds. The convergence technologies usually include information and communication technologies, biotechnologies and nanotechnologies and cognitive technologies.

Table 1 Four Waves of the Industrial Revolution

Wave	Year	Characteristic features
1	1784	Vapour, water, mechanic production
2	1870	Division of labour, electricity, mass production
3	1969	Electronics, ICT, automated production
4	?	Cyber physical systems

Source: Schwab, 2016

Schwab (2016) mentions three reasons why the current transformation is not a simple prolongation of the third industrial revolution: these are its speed, scope and system effect. When compared to previous industrial revolutions the fourth one develops rather exponentially than linearly, with all resulting consequences.

Kopp and Basl (2017) state that it namely means the combination of new IT technologies, especially of Internet things and new production, transportation and industry, handling technologies plus new materials and related processes.

The German Institute of normalisation characterises the Industry 4.0 as a fusion of real and virtual world. There will be a world in which the information technologies are fully integrated in production processes. Systems in production, logistics or services will communicate with each other in a new, intelligent way. Thanks to the Industry 4.0 the production cycles get shortened, need of clients are registered in real time or the maintenance is mostly automatized (DIN, 2017).

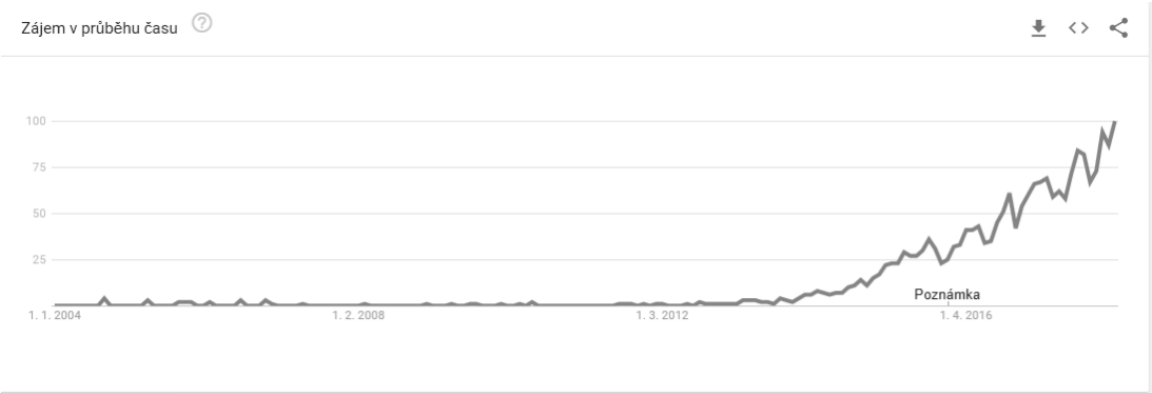
The term Industry 4.0 is characterised by the European Union (namely the European Parliament) as a notion for a group of quick transformation in design, production, operation and use of systems (European Union, 2015).

The Industry 4.0 trend is also important for the Czech Republic. That is why the government of the Czech Republic have approved its "Industry Initiative 4.0". The goal of the government is to strengthen the long-term cooperation of the competitiveness of the Czech Republic. In addition, this initiative tries to show possible directions that could support the Czech economy and industry and at the same time help to prepare the company for absorbing of this trend (Mařík, 2015).

In general, we can define the concept Industry 4.0 as a transformation of production as a separate automatized plant into a fully automatized and optimised production environments.

The interest in the issue of the Industry 4.0 nearly exponentially grows in last days, as shows the figure 1.

Figure 1 Interest in Searching of the Notion "Industry 4.0" at Google as per 30.4.2018 (100 % = maximum within the monitored period.



Source: Google (2018)

Although the Industry 4.0 namely relates to new approaches in implementation of new technologies in the production, this process is closely linked to financial records of inputs, intermediate outputs and outputs – to the accounting system. Many authors Chena and Thais (2016), Veza, Mladineo and Gjeldum (2015), Schuh, Popente, Varandani and Schmitz (2014) discuss the production optimisation. The other discuss the standardisation of communication tools and software interfaces but the way how the accounting systems are changing and will change during the fourth industrial revolution have not been described yet.

This text aims to analyse, using a case study, the readiness for the Industry 4.0 and to describe the accounting system within the context of incoming industrial revolution.

2 Methodology and Data

The company that was chosen for the case study is a small engineering company that deals with modular production, it has 25 employees and the annual turnover about 70 million CZK.

It is evaluated based on five levels of digital company maturity (MPO, 2018).

1. The company has its established information system for production management, its Internet presence is passive (web page). The company starts to consider the digitalisation of processes, production, maintenance, product design etc. It has no defined digital strategy. There is even a partial capability to be linked in information flows within customer-client relations. The basic economic software enables it to communicate with some public administration authorities.

2. There is its interactive web presence, the company is software-controlled, it starts to understand the importance of data. There are fist integration projects, partial automatization, they consider the setting of digital strategy. There is a connection to information flows of customer-client chains (interconnected digital component codebooks, interactive digital catalogues, semi-automated orders, etc.).

3. Multi-channel presence (web, mobiles and tablets, social networks, etc.), the company has its defined digital strategy. The presence of data culture foundations projects, integration of data architecture, integrated automatization controlled in real time (MES), personalised products with virtual component.

4. Integrated multi-channel presence in digital world. In the company, there is a distributed and personalised digital strategy. The data architecture is integrated within whole production chain, from the communication and data sharing with the client up to the sub-suppliers. The use of digital diagnostics for prediction of failures and non-conformances in systems (production systems, measurement systems, etc.).

5. The company is a digitalisation platform connecting the online and the offline worlds in one fully integrated and economically effective ensemble. It offers a unique personalised experience to its clients through virtual products/assistants communicating with clients during the whole life cycle of the partnership relation. Through the advanced and most effective approaches (full automatization, 3D print, etc.) it performs the cyber-physical system able of individualised performance of eventual physical part of the product. It provides digitalised services to its partners and sub-suppliers and thus it globally controls the domain area.

3 Results and Discussion

It was found that the monitored company does not achieve at all nor the first level of readiness for the Industry 4.0. It has no implemented information system for production control. The production is scheduled based on physical book of orders. The order sheets are made in simple office programs but for the production itself they are passed in printed form. Nor the supplier-customer relations are controlled with information systems. The administered web pages are only passive.

Within the production the start of third industrial revolution rather comes in the analysed company as only two year ago the first automatized machine was bought, using a grant.

Kopp and Basl (2017) has found in their empiric research that only 11,17 % of companies is today preparing or performing pilot projects regarding this topic of the Industry 4.0.

In addition they found that micro companies (up to 10 employees) was not taking care of the industrial trend 4.0. What is more important, even the small and middle companies (from 50 to 250 employees) do only little for it. To date only 14,81 % of companies within the research of small companies are getting acquainted with this trend and only 11,6 % of middle companies within this category are about solving this trend.

The situation is different as for the accounting software, probably thanks to the fact that there is a pressure from public authorities and legislation so that the company is forced to present accounting outputs in electronic form.

When creating the documents for the public administration, the file undergoes the check of data and the erroneous file is automatically refused. This control removes the sending of error messages.

The company has adopted well the electronic form of accounting documents so that it receives and sends its accounting documents in electronic form.

This was supported with the amendment of VAT Act that allowed, since 2013, the electronic tax document without electronic signature. Provided both parties agree on it and the document has all appurtenances it can be considered as valid. (Act on accounting No. 563/1991 Sb.)

The tax document does not need to contain nor a stamp nor a signature of document issuer. (Strouhal, Židlická, Knapová, Cardová, 2012).

It shall be noted that about seventy percent of tax documents are still in printed form in the company. The tax documents are send in electronic form only due to costs and time savings. They are in pdf format and after being received they are printed and processed as the documents received in paper form.

It is highly probable that the electronically sent invoices in current pdf format will be replaced by invoices in xml format, QR codes, etc. in the future that will enable their reading directly into the accounting system of the receiver. In addition to data copying, the error rate shall also disappear.

Now they have a format enabling the import of bank statements through the Internet banking. Before it was necessary to account every item of the statement separately. Today it works so that the bank statement is imported, but also its items are automatically accounted, with conforming value and variable payment symbol.

The XML formats enable the transfer of large volume of data in relatively small file. Such format are used not only for the communication with the public administration, but they could be also used within the company.

The analysed company owns a common accounting program that can currently import also document and list agendas: invoices, orders, offers, demands, receipt vouchers, release notes, transfer notes, production internal documents, cash documents, sale notes, jobs, addresses, storages, division of stocks, storages, stocktaking list, account coding, user´s lists, code series, groups of stocks, etc. All such agenda is also able to export, including balances and account day books. These exports/imports are not used by the company, besides the bank statements.

Till today no business partner has asked for sending of an invoice in XML format.

Besides the analysis of accounting system it is necessary to discuss also effects of the Industry 4.0 on the work of book-keepers.

Vacek (2016) thinks over competencies, knowledge and skills that will be necessary for working with smart technologies. He notes that today the computers still do not manage to perform a simple work with people. The division of work, based on substitutability of people by machines, includes four groups:

- Work that can be done by people but robots can do it better (weaving machines, autopilot, mortgage pricing, tax declarations, evaluation of x-ray images),
- Work that the people cannot do but the robots can (serial processing, computer chips, web browsers)
- New works that can be done by robots (robotic surgery, remote control, computer games)
- Work that can be done only by people (personal services – taking care, education, doctors, art, athletics)

Brynjolfsson and McAfee (2014) state that the technological progress will bring, with advantages, also the loss of jobs based on performance of routine tasks, not only manual but also cognitive ones.

The question what jobs will be most endangered by the automatization is answered by Carl. B. Frey and Michal A. Osborne in their study "The Future of Employment" (2013) and they have concluded that during next 20 years about 47 % of jobs will be endangered, whereas the most secure, i.e. not endangered, are those that are hardly automatized and require developed cognitive knowledge, creativity, social and emotional intelligence.

There is a study that presents the methodology for estimation of job loss endangered by the automatization (Batten Institute, 2015).

Chmelař (2015) has performed the similar study in the Czech Republic. The general dministrative workers, index of endangering by digitalisation 0,08, other officers 0,96, cashiers 0,93. On the contrary, the managing workers are endangered much less.

It result from the above stated that the routine work of book-keepers is much endangered.

Vacek (2016) note that the best way how to keep the job is to equip people with correct knowledge and skills.

Hennies and Raudjärv (2015) write that the employees shall accept other way of thinking and learn the integration in modern processes.

The role of book-keepers will change more and more quickly than in other professions.

In the future, the book-keepers shall have such knowledge and competencies to be able to manage and program new events. Their job will include not data insertion but data administration.

4 Conclusions

It was found that the monitored company does not reach nor the first level of readiness to the Industry 4.0 and that it has automatized its operation recently and thus launched its third industrial revolution.

It results from the above stated analysis of accounting system that the monitored company is conservative and passive to changes and that the largest move forward is made there where it is required by legislative conditions.

Within the performed analysis and outputs of other empiric studies this trend can be generalised for most of micro and small companies

As soon as the legislative requirements will change or under the pressure of large business partners it is probable that the work of book-keepers would change. The documents will be automatically loaded into the accounting system and thus the routine work of book-keepers will change in a highly professional and qualified work.

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Capital Creation Factors in Selected Banking Sectors of Europe

Jan Horvat[1], Eva Horvatova[2]

[1] Jan Horvat graduated University of Economics in Bratislava
E-mail: jhorvat@gmail.com

[2] University of Economics in Bratislava
Faculty of National Economy, Department of Banking and International Finance
Dolnozemská cesta 1, 85235 Bratislava, Slovakia
E-mail: eva.horvatova@euba.sk
&
Masaryk University Brno
Faculty of Business Administration
Lipová 41a, 800 00 Brno, Czech Republic
E-mail: eva.horvatova@econ.muni.cz

Abstract: *This article has the objective to examine the impact of the financial crisis on the banking sector, especially in terms of whether the change in approach to the regulation of banks contributed to the reduction of cyclical developments of the European banking sector. We analyzed the banking sectors of Germany, France and the Central and Eastern European banks for the period 2000-2013 (72 banks from Germany and France and 39 banks of Central and Eastern European countries). We have examined capital formation and pretax profit as a prerequisite for capital formation through panel regression. We used data from BankScope. We have come to the conclusion that there were different trends in capital formation in the countries of Western Europe on the one hand and in CEE countries on the other hand during the financial crisis.*

Keywords: financial crisis, bank capital

JEL codes: G01, G18

1 Introduction

Globalization and the strong interconnectedness of economies and financial systems have caused that local crises and inequalities have the potential to trigger a global crisis. These are signals that point to the need to use regulatory mechanisms that can respond quickly to stimuli of the real economy and financial markets, anticipate further developments in time and prevent the negative consequences of such developments.

Regulatory issues are at the forefront of financial theory and practice in the context of the financial crisis. In this context, the issue of banking regulation represented by Basel III, its interaction with the banking sector, the financial market and the real economy is also particularly relevant. Use citation continuously in the text.

The role of regulation and supervision of the financial system is mainly to limit risks in financial intermediation and in financial services.

The primary task of regulation and supervision of banks is to ensure stability in terms of the stability of the banking system or the internal stability of individual banks. Ensuring the stability of the banking system requires the fulfillment of a number of conditions in macroeconomic and microeconomic approaches, in setting up the business environment of financial institutions in a way that promotes sustainable economic growth and the stability of financial institutions.

The relationship of the individual authors of the regulation is varied. In some opinions, the view is that the problem of banks is caused by insufficient regulation; in others, on the other hand, it is stated that over-regulation can be a problem.

There are unequal attitudes to valuation. There are supporters of valuation at market prices, seeking to realistic representation of risk; on the other hand, there are opinions

that suggest that market prices are significantly influenced by cycles and further exacerbate pro-cyclicality.

Many views take into account partial issues, but a comprehensive view of the problem is to take account of several aspects of the solution, and seek a healthy degree of regulation that should support the stability and sustainable profitability in the banking sector.

For example, Stiglitz, J. (Stiglitz, 2010) states that "regulation can greatly contribute to the prevention of negative phenomena, but it may also be that an inadequate form, scope or method of regulation is a source of new crises."

The interdependence of the development between the real economy and the financial sector needs to be analyzed from a number of perspectives. Individual regulatory acts have different specific objectives, but most regulatory measures are motivated by creating conditions for greater financial and banking stability and the elimination of moral hazard.

Especially important is the look at the pro-cyclicality of regulation and the relationship between the economic cycle and the financial crisis, especially the influence of regulation on the cyclicality of developments in the banking sector and the real economy. There are many models that focus on predicting financial crises or leading indicators. We are told that financial crises can be predicted, but they cannot be avoided; just mitigate their impacts or timely regulatory measures. Significant leading indicators include, for example, composite leading indicators that can predict in the short term the potential negative development of the economy (Jakubíková, Tkáčová, Bánciová, 2014).

According to Van Hoose (Van Hoose, 2007), the primary effect of any system of capital requirements is to change the leverage effect of the bank's portfolio, the ratio between capital and assets. It is clear that the result will be a change in the asset portfolio of the financial institution.

Van Hoose states that the authors Koehn and Santomero (Koehn, Santomero, 1980) pointed out that banks that were not risk averse had higher capital requirements but also a higher probability of bankruptcy. It is not possible to effectively reduce the risk by regulation as subject to regulation is not the composition of assets.

Van Hoose finally raises the question of whether risk-based capital regulation really makes individual banks and the banking system as a whole "safer". Relative growth of "capital cushion" can quickly dissipate if the banks do not respond by not holding the portfolios of risky asset classes or will not generate sufficient measures to evaluate the adverse selection or moral hazard. Author defends the idea that banks are portfolio managers, and that this approach gives qualified support for capital regulation.

We have also been inspired by research that addressed the relationship between capital and risk decision, behavior of banks, because this is a key link in the regulation of capital (Tanda, 2015). The author points out the differences in behavior of banks according to the selected characters. Its benefit is mainly in comparison to several studies and methods used in them.

The positive impact on capital may be found when the asymmetry of information (Gropp, Heider, 2010) suggests that large banks hold higher capital buffers to offset their increased complexity. The author reports recent studies confirming that banks could hold liquidity as a shock insurance and use it as a bumper, which limits the need for additional capital (Jokipii and Milne, 2011), while other banks (such as small banks) capital to compensate for the lack of liquidity (Distinguin et al., 2013).

2 Methodology and Data

We compiled models that would allow determining the relationship between capital, loans and bank profits. Panel regression combines cross-sectional data over time. The informative value of it is higher compared to linear regression. The data structure is compiled to capture each bank (i) at all times (t). The cross-sectional dimension is expressed as i, which takes values from 1 to N, in our case the number of banks (72 banks

from Germany and France and 39 banks of Central and Eastern European countries). We have had observations for the period 2000-2013. The advantages of panel regression are that we can get a more accurate estimate of the parameters of the proposed model.

Model Specification (Other heading – not numbered, Verdana 10, bold)

Our data was "balanced panel", meaning we had data for the same time period for each of the same banks without missing values.

The basic model for panel regression is a linear model in shape

$$y_{it} = \alpha_{it} + \beta_{it}^{T} * x_{it} + u_{it} \quad (1)$$

where:

i = 1,..., N = cross-sectional index,

t = 1,...,T = time index,

u_{it} = random error.

Component α_{it} contains omitted observations, such as some bank characteristics that are not part of explanatory variables.

In practice, two models are used: Fixed Effects Model and Random Effects Model. For the purpose of deciding which model is significant, we will use the Hausman test.

3 Results and Discussion

Research is focused on the analysis of the largest banking sectors, in Germany and France, because we consider these banking sectors to be crucial to the stability of the Eurozone and the economies of Germany and France are the most powerful economies of Western European countries.

The panel regression was done in several alternatives. The first was the analysis of the German and French banks within one set for the period 2000-2013. We then divided the banks by country, on the German banks and on the French banks into separate files.

We then analyzed the time-sharing data, German banks from 2000 to 2013, and German banks for the period from 2008-2013, in order to find out the differences in the period of financial crisis.

Table 1 The Results of the Panel Regression on a Set of all Banks (Germany, France and CEE countries) for the Time Period 2000-2013

Type of Panel Regression Model	**Pooling**	**Fixed**	**Random**
Model 1: Common_Equity ~ Gross_Loans + Pretax_Profit + Total_Assets+ Fixed_Assets + Personnel_Expenses			
(Intercept)	686.029 ***		687.887 ***
Gross_Loans	0,0758 ***	0,042 *	0.0490 *
Pretax_Profit	-0,063 *	-0.052 .	-0.052 .
Total_Assets	0.069 **	0.044 .	0.044 .
Fixed_Assets	-0.0386	-0.018	-0.022
Personnel_Expenses	-0.067 *	-0.015	-0.029
Model 2: Common_Equity ~ Gross_Loans + Pretax_Profit + Total_Assets + Fixed_Assets			
(Intercept)	645.565 ***		670.230 ***
Gross_Loans	0,073 ***	0,041 *	0,048 *
Pretax_Profit	-0.064 *	-0.050 .	-0.054 .
Total_Assets	0.066 **	0.038	0.044 .
Fixed_Assets	-0.035	-0.019	-0.022
Model 3: Common_Equity ~ Pretax_Profit + Total_Assets			
(Intercept)	692.084 ***		701.12 ***

Pretax_Profit	-0.054 .	-0.045	-0.047 .
Total_Assets	0.049 *	0.029	0.033 .
Model 4: Pretax_Profit ~ Total_Assets + Bank_Deposits + Customer_ Deposits + Net_Loans			
(Intercept)	553.654 ***		511.035 ***
Total_Assets	-0.017	0.042 *	0.029 .
Bank_Deposits	-0.041 *	-0.018	-0.023
Customer_Deposits	0.051 **	0.035 *	0.038 *
Net_Loans	0.069 **	0.070 **	0.070 ***

Source: Data from BanScope, own processing

As first we analyzed the complex of all banks (Western European and Eastern European banks).

Common equity creation supported gross loans and total assets. Pretax profit has a negative relationship with the creation of common equity. It points to the fact that the pro-cyclicality of banks in dataset for the period 2000-2013 was not overcome. Net profit and customer deposits supported the creation of pretax profit. In all 1-4 models, Hausman's test recommended a fixed-effect model.

Table 2 The Results of the Panel Regression on a Set of Banks of Germany and France 2000-2013

Type of Panel Regression Model	**Pooling**	**Fixed**	**Random**
Model 1: Common_Equity ~ Gross_Loans + Pretax_Profit + Total_Assets+ Fixed_Assets + Personnel_Expenses			
(Intercept)	462.4057 ***		465.869 ***
Gross_Loans	-0.022185	-0.0547 *	-0.0490 *
Pretax_Profit	-0.016511	-0.0138	-0.0148
Total_Assets	0.098646 ***	0.05191	0.0597 *
Fixed_Assets	-0.019975	-0.0124	-0.0117
Personnel_Expenses	-0.069995 *	0.02827	-0.0012
Model 2: Common_Equity ~ Gross_Loans + Pretax_Profit + Total_Assets + Fixed_Assets			
(Intercept)	430.565 ***		465.41 ***
Gross_Loans	-0.02516	-0.0540 ***	-0.0491 *
Pretax_Profit	-0.01283	-0.0136	-0.0148
Total_Assets	0.098055 ***	0.0506	0.0596 *
Fixed_Assets	-0.014588	-0.0110	-0.0117
Model 3: Common_Equity ~ Pretax_Profit + Total_Assets			
(Intercept)	414.812		439.064 ***
Pretax_Profit	-0.015862	-0.0224	-0.0226
Total_Assets	0.093326	0.0450	0.0544 *
Model 4: Pretax_Profit ~ Total_Assets + Bank_Deposits + Customer_ Deposits + Net_Loans			
(Intercept)	303.394 ***		274.294 ***
Total_Assets	-0.0337	0.0331	0.0162
Bank_Deposits	-0.0331	-0.0193	-0.0236
Customer_Depo	0.0281	0.0233	0.0242
Net_Loans	0.0954 ***	0.0894 ***	0.0910 ***

Source: Data from BanScope, own processing

In the observed banks of Germany and France, the gross loans growth did not lead to capital growth, which may mean that loans were low-risk or that other items of balance (for example securities) were growing more. Capital growth is accompanied by a fall in profit. It points to the fact that the pro-cyclicality of the banks in this dataset for the period

2000-2013 was not overcome. Growth of assets contributed to capital growth from 0.02 to 0.059 per unit of capital growth. The fourth model shows that assets contributed to profit making and that customer deposits supported the bank's profit creation. In all 1-4 models, Hausman's test recommended a fixed-effect model.

Table 3 The Results of the Panel Regression on a Set of Banks of Germany 2000-2013

Type of Panel Regression Model	**Pooling**	**Fixed**	**Random**
Model 1: Common_Equity ~ Gross_Loans + Pretax_Profit + Total_Assets+ Fixed_Assets + Personnel_Expenses			
(Intercept)	1.5743e+05 *		1.7708e+05 *
Gross_Loans	-8.3173e-03 *	-0.052443 ***	-1.8117e-02 ***
Pretax_Profit	1.0528e+00 ***	0.9160364 ***	1.0199e+00 ***
Total_Assets	7.8964e-03 ***	0.01161073***	8.8705e-03 ***
Fixed_Assets	2.7751e+00 ***	-0.10846301	2.6265e+00 ***
Personnel_Expenses	2.7902e+00 ***	2.21013379***	3.1522e+00 ***
Model 2: Common_Equity ~ Gross_Loans + Pretax_Profit + Total_Assets + Fixed_Assets			
(Intercept)	1.4478e+05		1.7478e+05*
Gross_Loans	1.4646e-02***	-0.044119 ***	6.6787e-03***
Pretax_Profit	1.1232e+00 ***	0.9410463***	1.1076e+00***
Total_Assets	1.1793e-02 ***	0.0116712***	1.3154e-02***
Fixed_Assets	5.3427e+00***	0.15231367	5.6720e+00***
Modle 3: Common_Equity ~ Pretax_Profit + Total_Assets			
(Intercept)	3.6526e+05***		7.9228e+05**
Pretax_Profit	1.0516e+00***	0.7292069***	7.9112e-01***
Total_Assets	1.9271e-02***	0.0073521***	1.0397e-02***
Model 4: Pretax_Profit ~ Total_Assets + Bank_Deposits + Customer_ Deposits + Net_Loans			
(Intercept)	8.2294e+03	-0.001342***	2.6190e-03 ***
Total_Assets	-1.0539e-03 **	0.0424408***	1.1271e-02 ***
Bank_Deposits	1.5060e-02 ***	0.00248213	-3.4823e-02 ***
Customer_Deposi	-1.0685e-02 ***	-0.01663 ***	1.5966e-02 ***
Net_Loans	3.2428e-03	-0.001342***	2.6190e-03 ***

Source: Data from BanScope, own processing

In the observed German banks, capital growth and profit growth are positively correlated. Growth of assets most prominently contributed to capital growth (from 1.03% to 8.8% per unit of capital growth). On this basis, it is possible to assume that other groups of assets contributed to the risk of the banking sector, which was subsequently taken into account in capital formation.

In the observed German banks, capital growth was not accompanied by credit growth, which shows, as in the previous set (Germany and France), in the better case, that the loan was similarly low risk, or worse, pro-cyclicality in these banking sectors was present.

Loans have contributed to profit growth, which can be considered as positive, because loans are the most yielding asset. Customer´s deposits are in negative terms with the profit. We could also see that banks could not make money on deposits during the period of general decline in interest rates.

4 Conclusions

As first we analyzed the complex of all banks (Western European and Eastern European banks).

Common equity creation supported gross loans and total assets. Pretax profit has a negative relationship with the creation of common equity. It points to the fact that the pro-

cyclicality of banks in dataset for the period 2000-2013 was not overcome. Net profit and customer deposits supported the creation of pretax profit.

In the set of banks of Germany and France, the gross loans growth did not lead to capital growth and capital growth is accompanied by a fall in profit. Growth of assets contributed to capital growth. The used model shows that assets and customer deposits contributed to profit creation.

In the observed German banks, capital growth and profit growth are positively correlated. Growth of assets most contributed to capital growth, capital growth was not accompanied by credit growth. Loans have contributed to profit growth, which can be considered as positive, because loans are the most yielding asset. Customer´s deposits are in negative terms with the profit. We could also see that banks could not make money on deposits during the period of general decline in interest rates.

It points to the fact that the pro-cyclicality of the banks in this dataset for the period 2000-2013 was not overcome and that support for anti-cyclicality in regulation is the right way.

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Efficiency of Banks in Slovak Republic

Eva Horvatova

University of Economics in Bratislava
Faculty of National Economy
Department of Banking and International Finance
Dolnozemská cesta 1, 85235 Bratislava, Slovakia
E-mail: eva.horvatova@euba.sk
&
Masaryk University Brno
Faculty of Business Administration
Department of Finance
Lipová 41a, 800 00 Brno, Czech Republic
E-mail: eva.horvatova@econ.muni.cz

***Abstract**: The objective of this article is to examine the efficiency of Slovak banks in the time period 2000-2013. Slovak banking system faced serious problems connected with the process of transformation of the Slovak economy. They were manifested by difficulties in obtaining of long-term resources, with keeping of capital adequacy requirements and with the rapid growth of the non-performing loans. Transformation and privatization of large banks led to improvement of financial stability and efficiency of banking sector. As first we used a combination of fixed assets and staff costs as input and net interest margin as output in terms of CCR and BCC-I models. In the next analysis we used the combination of three factors - fixed assets and loan-loss provisions as inputs and volume of credits as output in terms of CCR and BCC-I models. Both cases show that the banks in Slovakia have too many fixed assets and high personnel costs with respect to the measured outputs; to the loans and to the net interest margins.*

Keywords: technical efficiency of banks, data envelope analysis

JEL codes: G01, G21

1 Introduction

Slovak banking system has undergone a major change and faced serious problems connected with the process of transformation of the Slovak economy. The three largest banks were VUB, SLSP and IRB. The deposits were concentrated in SLSP; the loans were concentrated in the VUB. IRB was specialized in the credits for cooperative housing.

The problems were manifested by difficulties in obtaining of long-term resources, with keeping of capital adequacy requirements and with the rapid growth of the non-performing loans. Money market instability was connected with the problem of high interest rates.

With regard to the extent of funds required to cover losses in the Slovak banking sector as an appropriate solution was the restructuring and subsequent sale of state-owned banks.

The role of pre-privatization restructuring of banks was to get banks into such a condition as to reach the required capital adequacy ratio and decreasing of the proportion of classified loans.

The bank as a business unit realizes economies of scale. These are resulting from economies of fixed costs. Fixed costs motivate debtors and creditors to form the coalitions in order to buy or sell together and so to reduce fixed costs per unit of transactions. Economies of scale are changing with the size of the banks.

DEA analysis belongs to the non-parametric methods of measuring efficiency. The disadvantage is the fact that it is impossible to separate the effect of random errors and errors in the measurement of inefficiency. DEA measures the relative efficiency of production units in the examined group of units.

Technical efficiency refers to the ability of banks to obtain the maximum amount of output from a given volume of inputs and indicates the minimum necessary input to produce a

given volume of output. In contrast, allocative efficiency takes into account the size of the bank as a production unit.

The efficient production units are located on the efficient frontier. Efficiency frontier indicates the maximum possible output for a given input using a given technology.

It is also necessary to take into account whether the production units operate in conditions of constant (CRS) or variable (VRS) returns to scale.

To the development of the theory and practice of using DEA models in the Czech Republic contributed authors such as Jablonský, J. and Dlouhý, M., Novosádová, I. (2004),

With the application of DEA Analysis deal for example Řepková, I. (2012).

In Slovakia, we can mention the works of Halická, M. (2014) and Vincová, K. (2006).

DEA model is used to assess the efficiency of the various production units - banks, universities, hospitals and others where we compare the inputs and outputs. For example, the work of authors Asanduluia, L., Roman, M., Fatulescua, P. (2014) deal with the efficiency of EU health system. The efficiency of investments to information technologies evaluates the paper of authors Yao Chena, Liang Liangb, Feng Yangb, Joe Zhuc (2006).

In the article, the analysis of technical efficiency of Slovak banks uses the data of BankScope and National Bank of Slovakia. The analysis uses the standard tools of descriptive and analytical statistics and statistical program IBM SPSS. Statistical program MaxDEA is used for the DEA (Data Envelopment Analysis) applied to the example of the Slovak banks. Our aim was to examine whether the banks, which underwent a process restructuring and privatization have become more efficient after privatization.

2 Methodology and Data

For evaluation of Slovak banks efficiency was chosen the data envelope analysis (DEA) models. The DEA models are divided into two main groups: model with constant returns to scale - CCR model, and model based on variable returns to scale - BCC model. The models are further subdivided into input and output oriented models.

DEA analysis shows the relative efficiency. The theoretical nature of the DEA requires that subjects observed in the group of decision making units (DMU) have to be banks with similar focus.

Therefore, we omitted specialized banks (housing saving banks and state development and guarantee banks). The number of production unit has an impact on the number of analyzed factors in efficiency measurement.

Respecting the rules of DEA, the number of analyzed inputs and outputs was no more than one third of analyzed production units. It was analyzed 9 banks and the number of inputs and outputs was no more than 3.

Therefore, the analysis was conducted in combinations of several inputs and outputs.

Model Specification (Other heading – not numbered, Verdana 10, bold)

CCR-I (Charnes-Cooper-Rhodes-Input) model can be written in the (Jablonský, Dlouhý, 2004):

$$\max z = \sum_{i=1}^{m} u_i * y_{iq} \tag{1}$$

Under the conditions:

$$\sum_{i=1}^{m} u_i * y_{iq} \leq \sum_{j=1}^{r} v_j * x_{jk\,;} \qquad k = 1,2,\ldots..n$$

$$\sum_{i=1}^{m} u_i * y_{iq} - \sum_{j=1}^{r} v_j * x_{jk} \leq 0 \quad k = 1,2,\ldots..n$$

$$\sum_{j=1}^{m} v_j * x_{jk} = 1$$

$$u_i \geq 0, i = 1,2,\ldots..m$$

$$v_j \geq 0, i = 1,2,\ldots..r$$

BCC-I (Banker-Charnes-Cooper-Input) model can be written (Jablonský, Dlouhý, 2004):

$$\max z = \sum_{i=1}^{m} u_i * y_{iq} + \mu \tag{2}$$

Under the conditions:

$$\sum_{i=1}^{m} u_i * y_{iq} + \mu \leq \sum_{j=1}^{r} v_j * x_{jk;} \quad k = 1,2,\ldots..n$$

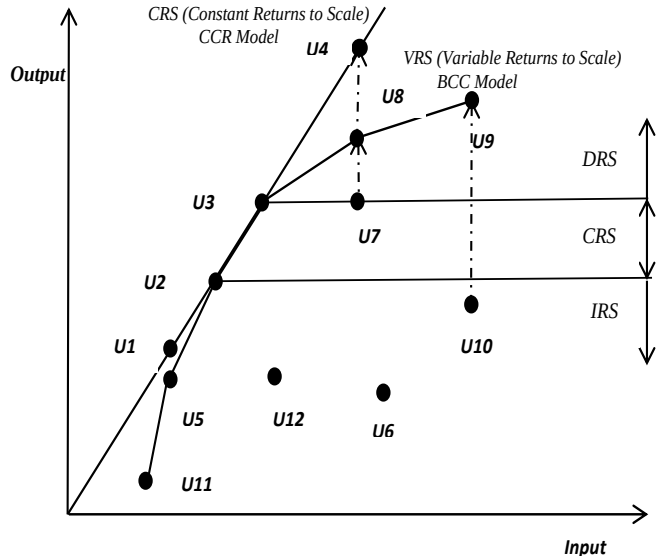
$$\sum_{j=1}^{m} v_j * x_{jk} = 1$$

$$u_i \geq 0, i = 1,2,\ldots..m$$

$$v_j \geq 0, i = 1,2,\ldots..r$$

Parameter μ reflects the conditions of convexity of the BCC-I model.

Figure 1 Efficiency Frontier at Constant Returns to Scale and Variable Returns to Scale

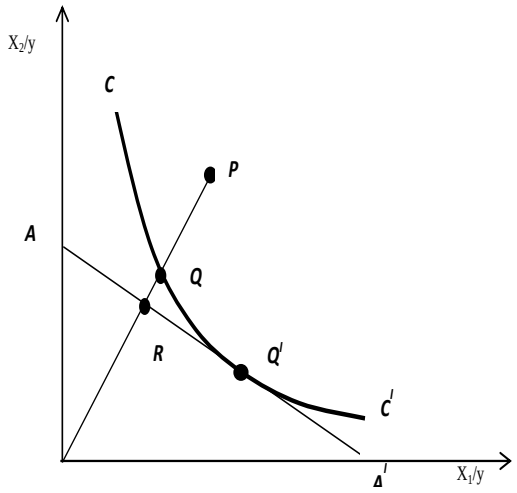


Source: Jablonský, J., Dlouhý, M.: Modely hodnocení efektivnosti produkčních jednotek. Praha: Professional Publishing, 2004

Where:
DRS = Decreasing Return to Scale
CRS = Constant Returns to Scale
IRS = Increasing Return to Scale

The efficiency frontier expresses the maximum possible output for a given input using a given technology. The efficient units are located on the CRS or VRS frontier. On the frontier CRS are efficient units U1, U2, U3 and U4, which operate under constant returns to scale. It means, if increase the input, the output will be increased in the same range. Units U11, U5, U2, U3, U8 and U9 are efficient at the efficiency frontier VRS. Increasing input is reflected by increasing or decreasing output growth (DRS = Decreasing Return to Scale, IRS = Increasing Return to Scale). Units U12, U6, U7 and U10 are inefficient. In order to become efficient, they should increase the output to reach to the frontier of efficiency. For example, unit U7 can get to the border VRS on the position of U8, or to efficiency frontier CRS on the position U4.

Figure 2 The Relationship Between Technical and Allocative Efficiency of Input Oriented Model



Source: Jablonský, J., Dlouhý, M.: Modely hodnocení efektivnosti produkčních jednotek. Praha: Professional Publishing, 2004

On the chart, the efficient frontier is on Isoquant CC^I. Production unit P is technically inefficient because it does not lie on CC^I. The rate of technical inefficiency is reflected by the distance to the CC^I. Production unit at Q produces the same amount of output as a unit P, but Q uses only part of inputs equal to 0Q/0P.

Technical efficiency is therefore expressed as the ratio 0Q/0P. The line AAI is the isocost, its slope is determined by the ratio of input prices. Allocative efficiency will be expressed as the ratio 0R/0Q. The total efficiency is expressed as the product of technical and allocative efficiency, on the basis of which we obtain that the total efficiency is equal to the ratio 0R/0P.

3 Results and Discussion

The restructuring of the banking sector in Slovakia was an important factor for of establishing macroeconomic equilibrium, and further privatization of banks. Foreign capital entered into the privatized banks. Into VUB entered Italian banking group Intesa BCI, into SLSP entered Austrian Erste Bank and into IRB - Hungarian OTP Bank. The aim of privatization was to create and maintain a stable banking system, banking system comparable to developed countries, as well as its involvement in the European financial structures (Chudják, F., Hallon, Ľ:, Leková, A, 2016).

The privatization of the largest Slovak banks has brought pluses in form of standard professional banks managements. These changes have contributed to improving the functioning of banks and to increase their efficiency and stability. The analysis assesses the efficiency of banks studying the relationship of inputs to the selected outputs indicators.

DEA analysis of selected Slovak banks

In the next section we will discuss the issue of efficiency banks that were included in the process of state restructuring and subsequent privatization.

To set the analyzed banks were included commercial banks; specialized banks, state guarantee bank and housing-saving banks we have excluded. It remained in the file 9-12 banks, so we had to use a combination of inputs and outputs in the total number of three indicators.

As first was used a combination of fixed assets (F), staff costs (C) as input and net interest margin (M) as output, which further will be referred to as a combination of inputs and outputs "FCM". The results in terms of CCR and BCC-I Models are in following Table 1.

Several cases of inefficiency banks indicate that Slovak banks persist at a high level of fixed assets and personnel costs. The privatized banks had to reduce staff costs, which contributed to their effectiveness. Net interest margin as output assumes that banks fulfil a mediating function in standard conditions. Reducing interest rates on deposits is not a sufficient condition for growth of the interest margin; a very significant is the volume of credits.

The values in the table can be represented graphically clearer and points out that the banks that were included in the restructuring and privatization were more efficiently above average in the coming periods after 2001.Our analysis also showed that Bank 6 and Bank 9 during the reporting period were according to the criteria highly efficient. In case of Bank 9, has confirmed the high efficiency even at other combination of inputs and outputs.

In the next analysis was used the combination of three factors: fixed Assets (A), loan-loss provisions (P) as inputs and volume of credits (L) as output. In the next text will bet his combination signed as „FPL". The results in terms of CCR and BCC-I Models are in the Table 2.

Taking into account fixed assets and loan-loss provisions as the inputs and credits as an output; the highest efficiency reaches the Bank 9, which was efficient by the BCC–I Model for all the observed period.

From the privatized banks the best level of efficiency has had Bank 1, and Bank 2; both banks were privatized by foreign banks. Weaker results reached Bank 3.

Graphical values can be expressed in the Figure 2 and Figure 2.

In this case, the input (FPM) fixed assets (F) and personnel costs (P) and the output, the net interest margin (M).

Table 1 The Coefficients of Efficiency in Terms of CCR and BCC-I Model for the Combination of Inputs and Outputs "FCM"

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average
Bank1 CR	1	0,99	0,73	0,79	1	0,99	0,32	0,95	0,94	0,9	0,77	0,91	1	0,86	0,867
Bank1 BCC	1	1	0,77	1	1	1	0,32	1	1	1	1	1	1	1	0,935
Bank2 CCR	0,91	0,93	1	0,74	0,89	0,94	1	1	1	1	1	0,99	1	0,96	0,954
Bank2 BCC	0,91	1	1	0,94	0,89	1	1	1	1	1	1	1	1	1	0,981
Bank3 CCR	0,7	1	0,55	0,51	0,77	0,75	0,28	0,67	0,67	0,65	0,55	0,63	0,81	0,85	0,670
Bank3 BCC	0,88	1	1	0,56	0,8	0,76	0,31	0,71	0,77	0,72	0,59	1	1	1	0,792
Bank4 CCR	0	0	0	0	0,8	0,72	0,26	0,67	0,79	0,72	0,59	0,58	0,77	0,67	0,469
Bank4 BCC	0	0	0	0	0,8	0,76	0,27	0,68	0,82	0,74	0,59	0,58	0,82	0,74	0,485
Bank5 CCR	0	1	1	0,5	0,5	0,85	0,37	0,93	0,64	0,57	0,55	0,55	0,86	0,71	0,645
Bank5 BCC	0	1	1	0,5	0,56	0,85	0,38	0,94	0,65	0,59	0,56	0,69	0,87	0,76	0,667
Bank6 CCR	0,69	0,84	0,1	1	0,79	0,87	1	1	1	1	1	1	1	1	0,877
Bank6 BCC	1	1	1	1	0,83	0,89	1	1	1	1	1	1	1	1	0,98
Bank7 CCR	0	0	0	0,78	0,89	1	0,33	0,77	0,5	0,53	0,36	0,52	0,35	1	0,502
Bank7 BCC	0	0	0	0,78	0,95	1	0,33	0,79	0,55	0,58	0,39	0,92	1	1	0,592
Bank8 CCR	0	0	0	0,81	0,86	0,83	0,26	0,69	0,52	0,62	0,48	0,5	0,61	0,55	0,480
Bank8 BCC	0	0	0	0,81	0,96	0,85	0,31	0,73	0,6	0,69	0,52	1	1	0,83	0,592
Bank9 CCR	0,51	1	0,96	1	0,9	0,88	0,53	0,8	0,7	0,64	0,55	0,58	0,72	0,76	0,752
Bank9 BCC	1	1	1	1	1	1	0,54	1	1	1	0,98	0,84	0,72	0,86	0,921
Average	0,48	0,653	0,562	0,707	0,849	0,886	0,484	0,851	0,786	0,77	0,693	0,793	0,862	0,863	

Source: Data from BankScope, own processing

Table 1 The Coefficients of Efficiency in Terms of CCR and BCC-I Model for the Combination of Inputs and Outputs "FCM"

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average
Bank1 CR	1	0,43	1	0,31	0,32	0,24	0,19	0,5	0,58	0,57	0,12	0,66	0,83	1	0,553
Bank1 BCC	1	0,43	1	1	1	0,93	0,58	1	1	1	1	1	0,83	1	0,912
Bank2 CCR	1	0,02	0,3	1	0,38	0,3	0,14	0,34	0,33	0,26	0,11	0,34	1	0,75	0,447
Bank2 BCC	1	0,23	0,39	1	0,88	1	0,46	0,45	0,33	0,34	0,34	0,78	1	1	0,657
Bank3 CCR	0,57	0,21	1	0,3	0,6	0,47	0,29	0,62	0,58	0,52	0,09	0,56	0,74	0,59	0,51
Bank3 BCC	0,9	0,41	1	0,44	0,83	1	0,6	0,66	0,61	0,57	0,41	1	1	1	0,745
Bank4 CCR	0	0	0	0	1	1	0,25	0,37	0,52	0,48	0,34	0,63	0,81	1	0,457
Bank4 BCC	0	0	0	0	1	1	0,54	0,44	0,52	0,59	0,69	1	0,89	1	0,547
Bank5 CCR	0	1	0,34	0,33	0,46	0,28	0,45	1	1	0,84	0,28	1	1	0,91	0,635
Bank5 BCC	0	1	1	0,51	0,54	0,71	1	1	1	0,9	1	1	1	1	0,832
Bank6 CCR	0,54	0,19	0,23	0,17	0,14	0,02	0	0,35	0,55	0,55	0,07	0,66	0,48	1	0,353
Bank6 BCC	1	1	1	0,21	0,16	0,07	0	0,4	0,56	0,62	0,5	0,8	1	1	0,594
Bank7 CCR	0	0	0	1	1	0,38	0,3	0,29	0,94	1	0,1	0,65	0,37	0,79	0,487
Bank7 BCC	0	0	0	1	1	0,85	0,97	0,7	0,95	1	0,6	0,99	1	1	0,718
Bank8 CCR	0	0	0	1	0,48	0,27	0,23	0,56	0,66	0,71	0,06	0,96	0,38	0,79	0,435
Bank8 BCC	0	0	0	1	0,48	0,52	0,48	0,56	0,67	0,77	0,73	1	0,96	0,92	0,577
Bank9 CCR	1	1	0,89	0,66	0,67	0,49	0,41	0,82	1	0,92	0,49	0,77	1	1	0,794
Bank9 BCC	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Average	0,50	0,384	0,508	0,607	0,663	0,585	0,438	0,614	0,711	0,70	0,440	0,822	0,849	0,930	

Source: Data from BankScope, own processing

4 Conclusions

As first we used a combination of fixed assets (F), staff costs (C) as input and net interest margin (M) as output, which further will be referred to as a combination of inputs and outputs signed as "FCM". We than combined three factors: fixed assets (A), loan-loss provisions (P) as the inputs and volume of credits (L) as an output. This combination was signed as „FPL".

In both cases it appears that the banks in Slovakia identified as inefficient have too many fixed assets and high personnel costs with respect to the measured outputs, i.e., to the loans and to the net interest margins.

DEA analysis clearly shows by a several criteria examined by the banks in Slovakia that were privatized banks from Western Europe. These banks are long-term stable and more efficient than other banks in Slovakia. A comparable result gave Bank 9, which was from its start owned by the Reiffesen Zentralbank.

Figure 3 and figure 4 show that the restructured and privatized banks 1-3 have overcome the crisis with greater efficiency. DEA analysis provides interesting results because it highlights the efficiency as the ratio between inputs and outputs, as a view on performance. This is not identical with profitability.

From the privatized banks the best level of efficiency has had Bank 1 and Bank 2.

Restructuring and privatization of banks in Slovakia so fulfills its historic role, as banks privatized by Western European banks are efficient and investors are strategic because they hold their investments to present.

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Impact of Macroeconomic Factors on the Value of Loans Granted to Non-Financial Enterprises by Monetary Financial Institutions in the Euro Area Countries

Agnieszka Huterska[1], Robert Huterski[2], Justyna Łapińska[3]

[1] Nicolaus Copernicus University in Toruń
Faculty of Economic Sciences and Management
ul. Gagarina 11, 87-100 Toruń, Poland
E-mail: huterska@umk.pl

[2] Nicolaus Copernicus University in Toruń
Faculty of Economic Sciences and Management
ul. Gagarina 11, 87-100 Toruń, Poland
E-mail: robhuski@umk.pl

[3]Nicolaus Copernicus University in Toruń
Faculty of Economic Sciences and Management
ul. Gagarina 11, 87-100 Toruń, Poland
E-mail: justlap@umk.pl

Abstract: *The use of low interest rates by the European Central Bank as an instrument to counteract the effects of the financial crisis in 2008 seemed to create favorable conditions for a significant increase in demand from non-financial corporations for loans granted by monetary financial institutions. Indeed, the demand for loans in individual euro area countries reported by non-financial corporations is shaped by both conditions common for the entire euro area and numerous factors reflecting the specificity of a given national economy. The aim of the article is to assess the impact of key macroeconomic factors on the size of lending to non-financial enterprises by monetary financial institutions in the euro area countries. The macroeconomic factors examined include GDP growth rate, unemployment rate, wage growth, inflation and the long-term interest rate according to the Maastricht criterion. The survey covers the euro area countries in 2008-2015, without Estonia and Latvia due to incomplete data for these countries for the above period. The data comes from the databases of the European Central Bank and Eurostat. For the purpose of assessing the above-mentioned factors, an econometric model based on panel data will be created.*

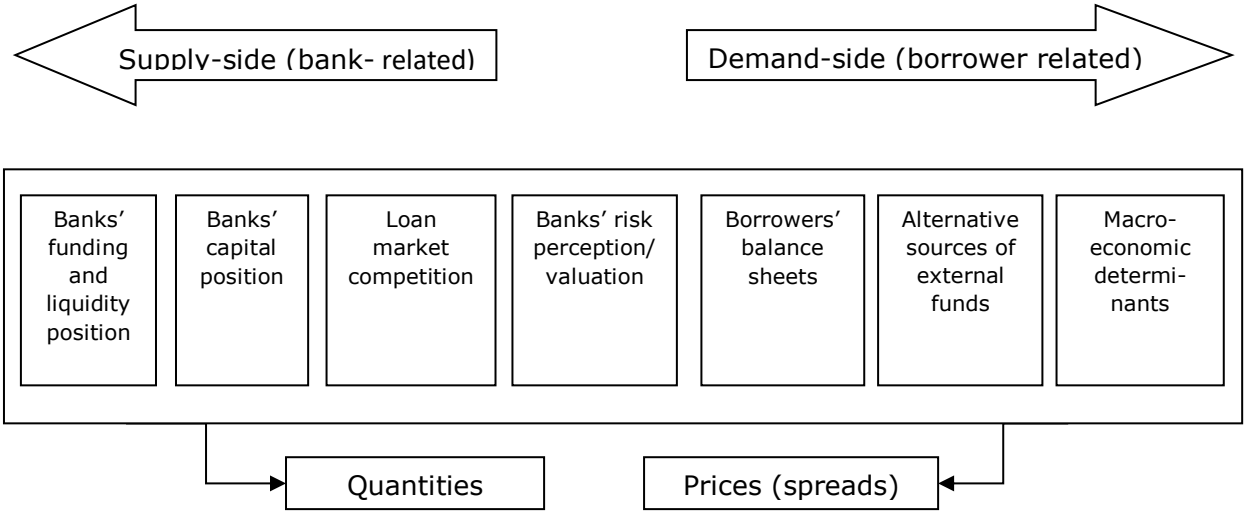
Keywords: loans, credit, monetary financial institutions, non-financial corporations, panel data model

JEL codes: C23, E51, F45, G21

1 Introduction

Geographically, the conducted research involved 17 out of 19 Eurozone countries. Only Estonia and Latvia were excluded due to lack of complete data from the studied period. When analyzing the potential factors which shaped the nominal value of loans granted by monetary financial institutions (MFI) to non-financial corporations (NFC) in Eurozone countries one should bear in mind the specificity of the 2008-2015 period under investigation. It was the beginning of a serious economic crisis leading to a breakdown in the total economic situation, which after a temporary improvement in 2011 suffered another, yet not so serious decline in years 2012-2013 (Dajcman 2016, p. 129). Years 2014-2015 brought a halt to this negative trend, but the improvement was still rather insignificant and meant only partial rebound after the losses suffered during the crisis. It influenced both the shape of macroeconomic independent variables, as well as the ones related to companies' financial results (Deutsche Bank 2017, p. 54).

Figure 1 Schematic Presentation of Supply and Demand-side Factors that Influence Loan Developments



Source: ECB (2011). Recent developments in loans to the private sector, ECB Monthly Bulletin, p. 65

The following sections will outline the potential mechanisms of impact exerted by independent variables on the value of loans granted by MFI to NFC (hereinafter referred to as MFI/NFC loans), which according to the used model proved to be statistically significant. As regards the macroeconomic indicators, they are real GDP growth rate, total unemployment rate and inflation rate. From the group of data related to companies' economic performance, the ones selected include production value, value added at factor cost (both output related) and gross investment in tangible goods (capital input related).

2 Methodology and Data

In order to identify the factors influencing the value of loans granted to NFCs by MFIs in the Eurozone, an econometric model for panel data has been created.

The dependent variables in the study were selected macroeconomic variables in particular Eurozone countries in the years 2008-2015. In the set of dependent variables there were: real GDP growth rate, total unemployment rate and inflation rate. The dependent variables, on the other hand, were also data concerning the results of company operation, such as production value, value added at factor cost (both output related) and gross investment in tangible goods (capital input related).

Model Specification

The model has the following form:

$$Loan_{jt} = \alpha_0 + \alpha_1 GDP_gr_{jt} + \alpha_2 Unemp_{jt} + \alpha_3 Inf_{jt} + \alpha_4 Prod_{jt} + \alpha_5 Val_add_{jt} + \alpha_6 Gross_Invest_{jt} + v_{jt} \quad (1)$$

$$v_{jt} = e_t + u_j + \varepsilon_{jt} \quad (2)$$

Table 1 presents the description of individual variables. The source of data was the Eurostat database.

Table 1 Variables Used in Empirical Investigation

Variables	Variables description
$Loan_{jt}$	Loans vis-a-vis euro area NFC reported by MFI excluding ESCB in the euro area (stock EUR mln)
	Explanatory variables
GDP_gr_{jt}	Real GDP growth rate, percentage change on previous year,
$Unemp_{jt}$	Total unemployment rate (%)
LCI_wag_{jt}	Wages and salaries (total), percentage change on previous period
LCI_other_{jt}	Labour costs other than wages and salaries, percentage change on previous period
$Infl_{jt}$	HICP - inflation rate, Annual average rate of change
$Bonds_{jt}$	EMU convergence criterion bond yields (%); EMU convergence criterion series - annual data
$Prod_{jt}$	Production value (mln EUR)
Sur_{jt}	Gross operating surplus – SBS (mln EUR)
$Total_purch_{jt}$	Total purchases of goods and services (mln EUR)
Val_add_{jt}	Value added at factor costs (%)
$Gross_Invest_{jt}$	Gross investment in tangible goods (mln EUR)
v_{jt}	The random error in the object j, in the time period t, which consists of the following components: e_t – impulses affecting all observations in the time period t, u_j – impulses affecting all the observations in the object j, ε_{jt} – impulses affecting only observations in the object j, in the time period t.

Source: elaborated by the authors

3 Results and Discussion

In this study, for the purpose of describing the dependencies between macroeconomic variables and the value of loans granted by MFI to NFC in the Eurozone countries, a panel model defined by Formula (1) was used. The data was collected for 17 Eurozone counties. They concern an 8-year period (annual data for 2008-2015).

The panel data model (1) was estimated using GRETL (GNU Regression Econometrics Time-Series Library) software. The choice of estimation method was made based on the decision-making procedure proposed by subject literature in econometrics (Baltagi 2001). First, the estimation of a simple panel model was made using a classical least squares method (without individual effects), and the model's diagnostic tests were conducted. The following values of test statistics were obtained: Wald test (F=50,7397; p-value≈0,0000), Breusch-Pagan test (LM=249,124; p-value≈0,0000) and Hausman test (H=27,3913; p-value=0,00225757).

When analyzing the Wald test results it can be concluded that the appropriate model describing the dependencies between macroeconomic variables and the value of loans granted by MFI to NFC in the Eurozone is a fixed effects one (FEM). The results of Breusch-Pagan point to a random effects model (REM) as a more reliable one. Finally, the results of Hausman test allow to conclude at the risk of error at the level of 0,05 (α=0,05) that the best model for describing the studied relationship the best tool will be fixed effects model (FEM). Further analysis of the model's properties, however, has confirmed the present of heteroscedasticity of the random component. In order to eliminate this flaw, for the purpose of estimating the model's parameters weighted least squares (WLS) method was used.

Table 2 presents the results of estimation for the above model.

Table 2 The Results of Estimation of the Model Describing the Determinants of Loans Granted by MFI to NFC in the Eurozone Countries

Dependent variable $LOAN_{jt}$					
Independent variables	**Coefficient**	**Std. Error**	***t*-ratio**	***p*-value**	**Significance[a)]**
Constant	−217819	38094,9	−5,718	<0,0001	***
GDP_gr_{jt}	−1713,32	693,088	−2,472	0,0147	**
$Unemp_{jt}$	4157,04	995,310	4,177	<0,0001	***
Inf_{jt}	3676,36	1707,40	2,153	0,0332	**
$Prod_{jt}$	0,210133	0,0243009	8,647	<0,0001	***
Val_add_{jt}	5011,94	863,832	5,802	<0,0001	***
$Gross_Invest_{jt}$	2,08509	0,328226	6,353	<0,0001	***
Observations		136			
Standard error of residuals		0,771125			
R^2		0,979654			
Adjusted R^2		0,978708			
F (6, 129) = 1035,221		*p-value* for test F< 0,00001			

a)*** The statistically significant variable at the level of 1%; ** The statistically significant variable at the level of 5%.

Source: the author's own calculations

The estimated model is correct in statistical terms. Among eleven potential independent variables six turned out to be statistically significant. All the obtained signs of the evaluations of structural parameters of independent variables are in accordance with the theoretical predictions.

The obtained results allow to conclude that five independent variables have a positive influence on the dependent one (i.e. the value of loans granted by MFI to NFC). Among those variables there are: total unemployment rate ($Unemp_{jt}$) inflation rate (Inf_{jt}), production value ($Prod_{jt}$), value added at factor cost (both output related) (Val_add_{jt}) and gross investment in tangible goods (capital input related) ($Gross_Invest_{jt}$). Interpretation of parameter estimation in the cases of particular variables is relatively simple. For example, a parameter estimation for the $Unemp_{jt}$ variable (4157,01) should be interpreted as follows: if the unemployment rate grows by one percentage point, then the value of loans granted by MFI to NFC in the surveyed group of countries will as a result grow by approximately EUR 4157.01 mln, assuming the stability of other variables.

The research findings confirm that the factor which has a strong, and at the same time negative, influence on the shape of dependent variable is the real GDP growth rate (GDP_gr_{jt}).

In the estimated model, the variables which turned out to be statistically insignificant were: labour cost index - wages and salaries (LCI_wag_{jt}), labour costs other than wages and salaries (LCI_other_{jt}), EMU convergence criterion bond yields ($Bonds_{jt}$), gross operating surplus (Sur_{jt}) and total purchases of goods and services. ($Total_purch_{jt}$).

The econometric model for panel data used in the study does not take into account time shifts as a reaction of dependent variable to the shape of independent variable. It means that the model's results do not determine the possibility of observing the results of the impact of dependent variables on the stock of MFI/NFC loans in the subsequent period or periods (Louri and Migiakis 2016, p. 40).

Regardless of the above, the clearly negative impact of real GDP growth rate on stock of MFI/NFC loans revealed by the model within a given time unit (year) has a logical explanation, confirmed by other observations. In the periods when the total economic situation improves companies have better possibilities of funding their activities from current revenues. However, if the improvement is not strong enough to encourage companies to radically expand the range of their activities, including funding their turnover-related needs or investments by means of loans from MFI, then the demand for such funds may decrease in relation to periods of worse economic situation (ECB 2009, p. 19). It is a phenomenon also known from the studies of the channels of transmission of the impulses of the central bank's monetary policy. It proves that in countries that are inflation-stable the factor of greater influence on banks' loan-related activities than loan availability to enterprises (including the costs of loans reflected in interest rates), is companies' optimism concerning adequately large increase in the market's power of absorption of their production at the prices which are satisfactory for them (Mishkin 1996, p. 3 and 10). This results in a broader assumption which is crucial for this model and any elaborations based on it, according to which the stock of MFI/NFC loans is shaped to a much greater extent by the described significant variables than the other way round.

As noted above, due to the outcomes of the financial crisis, at the beginning of the studied period the real GDP growth rate in the Eurozone experienced a breakdown, and its later increase was related to the reconstruction of the size of economic activity to the level from before the crisis, which was uneven in the course of time. One should also consider other factors, such as the increase in the attractiveness of financing large companies' needs by emission of securities on the capital market (both shares and bonds), which typically accompanies improvements in the total economic situation (Covas and den Haan 2006, p. 30).

The impact of the rising unemployment rate shown by the model on the growth of the stock of MFI/NFC loans should also be associated with the specific economic situation in connection with the financial crisis. Companies make more people redundant in the periods of economic downturn, when they become more dependent on sustaining their financial condition with loans. At the same time, a radically growing unemployment rate is evidence of increased size of a low-income social group, which reduces the society's consumption potential, influencing companies' financial results (PwC 2010, p. 22). State-funded unemployment benefits may to a certain extent reduce the decline, but not eliminate it. The process of companies' adapting to the new circumstances is neither immediate nor complete (Verick and Islam 2010, p. 36). In terms of increased unemployment, the financial crisis from 2008 created an especially difficult situation for countries from southern Europe, such as Greece, Portugal, Spain, Italy, as well as Ireland.

The impact of inflation on the stock of MFI/NFC loans (expressed in millions of EUR) seems obvious due to the very essence of inflation as a common increase in prices (and salaries) and its impact on the values expressed nominally in money. The results of the calculations, however, have confirmed that the impact was at a lower level of significance than in the case of unemployment. The article deliberately makes use of the HICP measure of inflation and not the industrial producer price index, which has a very direct impact on the stock of loans granted to enterprises. A separate analysis would be required for the potential influence on the results exerted by the inflation (and interest rates) level which is close to zero, or even by deflation (and negative real interest rates) in the Eurozone countries in the studied period (Plasil et al. 2013, p. 129).

Production value (millions of EUR) measured as the amount actually produced by the unit, based on sales, including changes in stocks and the resale of goods and services demonstrates a significant influence on the stock of MFI/NFC loans. It can be treated as evidence that an increase in the production value contributed to increased optimism by NFCs in the Eurozone regarding the profitability of further expansion with the use of loans from MFI. The loans taken may, of course, have a reciprocal influence on the increase in the production value (Martinez and Landesberger 2010, p. 12).

Also, the value added at factor costs (in %), which is the gross income from operating activities after adjusting for operating subsidies and indirect taxes, according to the used model, has significant influence on the stock of MFI/NFC loans. Due to its nature, the mechanism of influence described at the production value should be even more visible in relation to gross income from operating activities (Cesaroni et al. 2016, p. 4). An increase in the production value does not always translate into an increase in the gross income, for instance due to falling profit margins or growing costs of production and prices, which means that an increase in the production value may be accomplished even with the same profit margin and smaller amount of product sold.

According to the definition by Eurostat, gross investment in tangible goods (expressed in millions of euro) is defined as investment during the reference period in all tangible goods. Included are new and existing tangible capital goods, whether bought from third parties or produced for own use, having a useful life of more than one year. However, the measure also includes non-produced tangible goods such as land, but investments in intangible and financial assets are excluded from it (EIB, p. 31). When analyzing the significant influence of investments on the stock of MFI/NFC loans, one should thus bear in mind that what is meant here is a special type of investments in relations to loans in general, which include both investment loans, as well as working capital loans and others. Essentially, an increase in the investment in tangible goods, apart from causing an increase in demand for investment loans, should at least partially increase the demand for working capital loans, and even other types of loans.

4 Conclusions

Interest in factors which influence the value of loans granted by MFI to NFC gained a new dimension when from September 2016 the Bank for International Settlements (BIS) started publishing time series on the credit-to-GDP gap for more than 40 economies. According to BIS, the credit-to-GDP gap is defined as the difference between the credit-to-GDP ratio and its long-run trend, and captures the build-up of excessive credit in a reduced-form fashion. It has been found to be a reliable early warning indicator of impending financial crises for a broad array of countries and a long time span that includes the most recent crisis. According to ECB data, the value of loans granted by MFI to NFC reacted to the 2008 crisis with greater downturns than the value of household loans (ECB 2011, p. 63).

Analyses conducted in the course of research indicate that the shaping of the value of loans granted by MFI to NFC in the Eurozone is influenced not only by selected macroeconomic factors, but also values related to the results of companies' economic activity. As regards the macroeconomic indicators, they are real GDP growth rate (GDP_gr_{jt}), total unemployment rate ($Unemp_{jt}$) and inflation rate ($Inflation_{jt}$). From the group of data related to companies' economic performance, the ones selected include production value ($Prod_{jt}$), value added at factor cost (Val_add_{jt}) – both output related – and gross investment in tangible goods ($Gross_Invest_{jt}$ – capital input related). An important one, whose influence is negative, is real GDP growth rate. A positive impact of macroeconomic indicators on the value of MFI/NFC loans in the Eurozone was discovered in the case of the total unemployment rate and inflation rate. All indicators of the results of the economic activity of enterprises that turned out to be statistically significant, that is production value, value added at factor cost and gross investment in tangible goods, have a clearly positive impact on the value of loans granted. The tendencies shown by all the factors which determine the value of MFI/NFC loans in the Eurozone countries have turned out to be in line with the theoretical assumptions.

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Convergence of the Government Bond Yields in Estonia, Latvia and Lithuania

Jana Hvozdenska

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipova 41a, 602 00 Brno, Czech Republic
E-mail: 174974@mail.muni.cz

Abstract: *The aim of this paper is to analyse the influence of the European Union accession and financial crisis to convergence and integration of the bond yields and bond markets. The results show the deepening of bond market convergence after the European Union accession and the integration has continued until the end of the observed period. The chosen indicators are monthly mid-term bond yields (10-year bond yields). The period of 1/2000 to 12/2017 was chosen in order to show the impacts of the changes. The time period was divided into periods 1/2000 - 4/2004 (before the European Union accession), 5/2004 - 7/2007 (after the accession and before financial crisis), 8/2007 - 3/2009 (period of the deepest financial crisis), 4/2009 - 12/2016 (period after the financial crisis). Used methods are 1) spread between the 10-year bond yields of countries of Estonia, Latvia, Lithuania and German 10-year bond yield, 2) analysis of alignment, 3) β-convergence. These findings can be beneficial for the financial market observers.*

Keywords: β-convergence, bond yields, integration of bond markets

JEL codes: E43, E44, E47, G01

1 Introduction

The financial turmoil during 2007-2009 affected the euro area financial sector in ways that differ considerably across market segments and countries. A consequence was a temporary reduction of market activity within national borders. The impact was felt most strongly in the money markets, and relatively less in bond activities. However, economic growth stopped and still many countries are not able to follow Maastricht Convergence Criteria.

On one hand, the integrated financial markets and the common currency may help protect the countries from the negative impacts of a financial crisis, because the countries are part of a large, stable economic unit. On the other hand – financial instability may spread easily from country to country, since barriers to the capital movements have been reduced.

Across the economic literature, there is a range of acceptable definition of financial integration. In a broader sense, it is possible to achieve financial integration when all the conditions necessary for the continuous implementation of financial transactions and market functioning are met.

Commonly-used definition of financial integration is expressed by (Baele et al., 2004). The market for a given set of financial instruments and services is fully integrated if all potential market participants with the same relevant characteristics (1) face a single set of rules when they decide to deal with those financial instruments and services; (2) have equal access to the above-mentioned set of financial instruments and services; and (3) are treated equally when they are active in the market.

Financial markets are integrated when the law of one price holds (Adam et al., 2002). This states that assets generating identical cash flows command the same return, regardless of the domicile of the issuer and of the asset holder. Given this definition, financial market integration can be measured by comparing the returns of assets that are issued in different countries and generate identical cash flows.

(Czech National Bank, 2012) states that it is possible to speak about the achievement of full integration of financial markets only if financial assets with comparable risk factors and yields are evaluated by the markets in the same way, regardless of the country where the

assets are traded. Fully integrated markets without any barriers permit to use an arbitration opportunities which lover the importance of local factors characteristic for given countries and enable direct comparison of the prices of financial assets in individual markets.

The aim of this paper is to analyse the influence of the EU accession and financial crisis to convergence and integration of the bond yields and bond markets.

2 Theoretical Concepts

In general, the convergence of government bond yields to a stable level with reduced risk aids the overall economy, by allowing cheaper access to debt financing with less uncertainty regarding the value of such funds over time. This, in turn, stimulates investment and output within converging countries.

The methods described below are used for measuring of bond market integration.

Spread between Yield on a Local Asset and a Well-Chosen Benchmark Asset

Germany is the biggest and most solid economy within the EU. For that reason it can be chosen as the benchmark asset for the countries of European Union. The smaller the spread is the bigger the integration is.

Formally we can write the convergence in time t and t+1 as:

$$|y_{1,t} - y_{2,t}| > |y_{1,t+1} - y_{2,t+1}| \quad (1)$$

where y1,t and y2,t are relevant economic variables of two countries in time t.

The case with opposite sign is called divergence. This is a situation when the countries in terms of economic maturity are moving away.

Analysis of Alignment

Analysis of alignment is the first step of the concept of financial integration. It is based on the correlation analysis in standard or rollover form. This analysis indicates the strength of a linear relationship between two variables. Its value may not be sufficient for the evaluation of this relationship, particularly in those cases where the assumption of normality is incorrect. The correlation coefficients, being aggregated statistics, cannot substitute for individual evaluation of the data (Babecký et al., 2007).

Concept of β-convergence

β-convergence (2) is used to determine the approximation rate of asset returns in financial markets. It was first used by (Adam et al., 2002). In order to quantify β-convergence, it is possible to apply regression according to the following formula:

$$\Delta R_{i,t} = \alpha_i + \beta R_{i,t-1} + \sum_{l=1}^{L} y_i \Delta R_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

where Ri,t represents the distribution rate of specific assets between a country i in time t with respect to the reference territory, Δ is the reference operator, αi is a specific constant for the given country, ε̇i,t is a white noise disturbance. Lag length L is based on Schwarz Criterion, maximal length is set to 1, because monthly data are applied and financial market memory is relatively short. β-coefficient is a direct criterion of the rate of global market convergence.

The concept of beta-convergence enables identification of the speed with which eliminated differences in yields on individual financial markets. If the beta coefficient is negative, then signals the existence of convergence and the amount of beta coefficient expresses the convergence rate, i.e. the rate of elimination of shocks to the yield differential pricing of individual assets to the euro area. The closer beta coefficient is to -1, the greater the speed of convergence is.

3 Methodology and Data

The selected countries are Estonia, Latvia and Lithuania.

As a measure of the yield was used 10-year government bond yield in all countries mentioned above and Germany (monthly basis). Germany is the biggest and most solid economy within the EU. For that reason it can be chosen as the benchmark asset for the chosen countries (and whole European Union). The data of 10-year sovereign bonds of the selected countries were taken from Bloomberg database (2018, [4]). The sample period starts from 1/2000 and ends on 12/2017. This time range covers the period before the accession of the countries to European Union (1/2000 – 4/2004), after the accession (5/2004 – 7/2007), period of financial crisis (8/2007 – 3/2009) and period after financial crisis (4/2009 – 12/2017). The beginning of the pre-crisis period (or the period of spectacular growth) coincides with an accession of the countries studied to the European Union. We decided to start the crisis period with a different date than that of the Lehman Brothers bankruptcy and major panic in the markets. We wanted to capture an earlier market, which was when the 2007 banking crisis changed from high expectations to the fear of a looming sovereign debt crisis. The pre-crisis period depicts a long run-up in prices followed by a significant price drop during the crisis period.

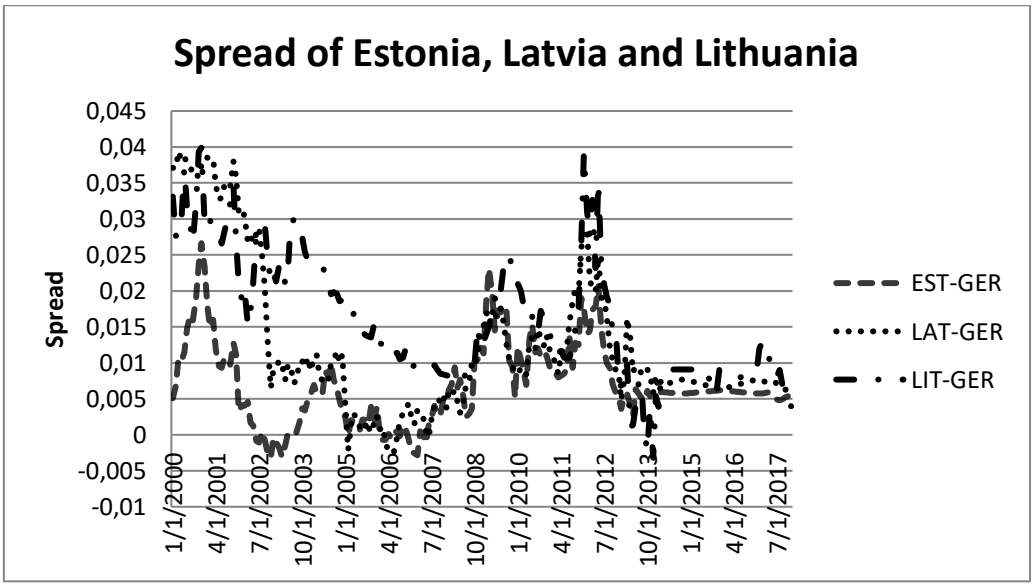
The used methods are: spread between the yield on a local asset and a benchmark asset, analysis of alignment and concept of β-convergence.

4 Results and Discussion

We used the methods described above to measure the bond markets integration.

Spread between Yield on a Local Asset and a Well-Chosen Benchmark Asset

Figure 1 Spread of Estonia, Latvia and Lithuania



Source: author's calculations

As we mentioned above, the benchmark asset is German 10-year government bond yield. The spreads between Estonia and Germany, Latvia and Germany, Lithuania and Germany are possible to see in Figure 1.

The closer the spread is to zero the bigger the convergence is. It is clearly visible that regarding to the Estonia and Latvia the spreads are the closest to zero between the years 2002 and 2007. The biggest spreads has Lithuania – in 2008 and 2013 the spreads are bigger than 2.5 %. The financial crisis and later on debt crisis had the biggest impact on Lithuania (because of the highest spreads), however we can see that the spreads were quite similar in all countries.

It is possible to say that according to this criterion, the most integrated country is the Estonia (because of the lowest spread).

Analysis of Alignment

Simple period average correlations of 10-year bond yields, shown in Table 1, show that Estonian, Latvian and Lithuanian markets are strongly linked (in whole period) among themselves (correlations between 0.68 and 0.89), on the other hand with the Germany as well (correlations between 0.65 and 0.88). Bold numbers indicate strong and significant correlation coefficients.

Table 1 Correlations during 1/2000 –12/2017

1/00-12/17	EST	LAT	LIT	GER
EST	1			
LAT	**0.897542**	1		
LIT	**0.689547**	**0.75958**	1	
GER	**0.884586**	**0.84783**	**0.654875**	1

Source: author's calculations

Table 2 Correlations during 8/2007 – 3/2009

8/07-3/09	EST	LAT	LIT	GER
EST	1			
LAT	0.32033	1		
LIT	0.36646	0.123614	1	
GER	0.16006	0.220882	-0.2907	1

Source: author's calculations

Table 2 shows the time period with the lowest correlation coefficient. It is the period of financial crisis. In this case it is possible to see that countries are not correlated at all among themselves. No country is correlated to Germany. Table 3 shows the best results – time period from April 2009 to December 2017. It is the period after financial crisis and it was expected that the government bond yields should show the highest correlations.

Table 3 Correlations during 4/2009 – 12/2016

4/09-12/17	EST	LAT	LIT	GER
EST	1			
LAT	**0.95859**	1		
LIT	**0.815875**	**0.92458**	1	
GER	**0.82535**	**0.764582**	**0.795685**	1

Source: author's calculations

Concept of β-convergence

The results of β-convergence are in Table 4. All the values in the table are negative. It means that there is a convergence in the bond markets of the selected countries. The p-values are mainly less than chosen significance level of $\alpha=0.01$, therefore we can contribute the models as significant.

Table 4 β Coefficients

	1/00 – 4/04		5/04 – 7/07		8/07 – 3/09		4/09 – 12/17	
	Coeff.	**P-value**	**Coeff.**	**P-value**	**Coeff.**	**P-value**	**Coeff.**	**P-value**
EST	-0.758	**1.11e-021 *****	-0.842	**1.68e-07 *****	-0.586	0.866	-1.145	**3.89e-12 *****
LAT	-0.359	**1.49e-044 *****	-0.742	**1.78e-09 *****	-0.765	0.9308	-1.215	**5.47e-06 *****
LIT	-0.895	**2.42e-045 *****	-0.824	**9.87e-015 *****	-0.832	0.1020	-1.057	**6.49e-07 *****

Source: author's calculations

The only exception is in all selected countries (Estonia, Latvia and Lithuania) in the period of financial crisis (8/07-3/09).

Relatively high values of β coefficient indicate that individual financial markets of observed economics integrated relatively easily with the German market. The β coefficient was relatively low in Lithuania during the financial crisis. It means that Lithuania started to diverge and in the period after financial crisis started quickly converge to benchmark. The divergence may be caused by increased nervousness of financial market participants and the associated increase in the volatility of market assets. Both investors and investment services providers in fear of their liquidity position restricted their market activities, including cross-border activities and integration process more or less weakened.

The absolute values of the β coefficients are close to one for all the countries in the period after financial crisis. It means that the levelling of newly arising differences between the chosen country and the Germany is fast.

The tests of normality and homoscedasticity are shown in the Table 5. For the evaluation of the normality test is probably the easiest to observe the result from graph of the assumed normal distribution in comparison to the actual distribution of residues and analyse p-values of Chi-square test. We test the hypothesis H0: Residuals are normally distributed, against the hypothesis H1: Residuals are not normally distributed, the significance level of α was chosen as 0.01. If the p-value is greater than α then we cannot reject the H0, therefore the residuals are normally distributed.

For the testing of heteroscedasticity we chose the White's test. We test the hypothesis H0: Constant variances of residuals – homoscedasticity, against H1: Heteroscedasticity. The significance level of α was chosen as 0.01. If the p-value is greater than α then we cannot reject H0, therefore it contributes homoscedasticity.

Table 5 Tests of Normality and Homoscedasticity

	1/00-4/04		5/04-7/07		8/07-3/09		4/09-12/17	
	P-value norm.	**P-value heteros.**	**P-value norm.**	**P-value heteros.**	**P-value norm.**	**P-value heteros.**	**P-value norm.**	**P-value heteros.**
CZ	0.378	0.277	0.150	0.633	0.178	0. 475	0.225	0.345
SK	0.827	0.597	0.592	0.258	0.267	0.526	0.268	0.236
PL	0.0204	0.157	0.448	0.270	0.367	0.873	0.194	0.275

Source: author's calculations

5 Conclusions

In this paper we have discussed the selected aspects of bond integration of Estonia, Latvia and Lithuania. The aim of this paper was to analyse the influence of the EU accession and

financial crisis to convergence and integration of the bond yields and bond markets of selected countries.

Are the bond markets of the selected countries group convergent? Answering this question requires a surprising amount of preliminary work. According to all used methods the markets converge more after the financial crisis then before, however they converge for the whole observed period of time. Surprisingly all methods showed and confirmed lower pace of integration in Lithuania in the period of financial crisis, which rose in the period after the financial crisis. The divergence in the period of financial crisis may be caused by increased nervousness of financial market participants and the associated increase in the volatility of market assets.

Future research could be extended to a wider examination of integration of the stock markets. It would be interesting to test if there would be a change in results when using data of EU15 as an average of the oldest members of European Union instead of Germany as the most stable economy.

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A Relationship between Gender and Age Diversity among Board Members and Firm Performance

Lenka Janošová[1], Petr Mikuš[2]

[1] Masaryk University
Faculty of Economics and Administration, Department of Business Economics and Management
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: lenkajanosova@mail.muni.cz

[2] Masaryk University
Faculty of Economics and Administration, Department of Business Economics and Management
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: 62765@mail.muni.cz

Abstract: *This paper provides an evidence that age diversity in managing and supervisory boards among Czech joint-stock companies has impact on firm´s performance indicators. Age diversity is becoming widely discussed topic due to population ageing, which is reflected in corporate governance area as well. Age diversity can influence decision-making process, risk attitude or structure of assets, that´s why it has impact on overall profitability of businesses. The main goal of our paper is to test possible relationship between age composition of supervisory and executive board members in Czech stock companies and firm performance. The initial sample included 364 companies with Czech domicile operating in manufacturing industry, especially in IT industry. Randomly chosen sample is composed of 70 Czech companies from IT industry. For this sample we gained basic data describing the number of board members, their age, gender as well as current key performance indicators published financial statements (ROA, ROS, liquidity, indebtedness). We use these indicators to assess the relation between age diversity and profitability through basic statistic and mathematic methods.*

Keywords: age diversity, gender diversity, Key Performance Indicators (KPI), ROA, ROS

JEL codes: M14, M21, M12, L25, L22

1 Introduction and literature review

With an increasing rate of globalization, a growing public interest and increasing competitive pressure, an interest in the efficiency and functioning of corporate governance is increasing. Although it's been decades since Eastern European markets opened their boarders for free trade and transited from a centrally-planned to a market economy, there are still considerable differences between the operation of businesses in Western and post-communist countries. The sale of assets to private hands did not ensure its effective management. Administrative functions should focus on setting targets and corresponding policies to fulfilling the interests of owners.

Currently, the most widely used system in Central Europe is the continental-European model, including the existence of three bodies: the General Meeting, the Supervisory Board and Board of Directors. This model was recently the only possible in the Czech Republic. From the above it is clear that the a way how the business will prosper (ie. to achieve the desired financial performance) depends on the decisions of firm´s organs that are made up of groups of people of different ages, nationalities, gender and having different ways of professional development, other education and experience . This heterogeneity in the group is called diversity, Pelled (1999) distinguishes demographic diversity (= degree to which the organization is heterogeneous with respect to demographic attributes) and functional diversity of backgrounds (= degree of heterogeneity in education and experience).

The corporate governance is rather new term, and the number of studies is rising in these days. A topic of corporate governance is very broad and consists of legal setting of the companies in a country and, in many cases, the free-will setting of a company management

and corporate governance rules. In the Czech Republic, there is no strict or mandatory script for corporate governance. When thinking of the connection between corporate governance and the performance, the numbers of scientific papers is rather low. This article is new contribution to this topic from the very actual point of view of age diversity and age in the company – effectively connecting two actual topics – corporate governance and the age management in the ageing environment of the European Union as well as an area of gender issue among board members.

The problem in the research, and this is proven in many studies setting and researching often very different factors, is to set the proper variables. Those, that influence the performance most significantly. In our paper, we have focused on the age and gender diversity among the managing and supervisory boards in the companies as bearer of the strategic management in the companies and thus one of the factors of the corporate governance. Our contribution is to research on the sample of the Czech companies, whether the age and gender diversity in the company's bodies have an effect on the key performance indicators.

Performance measurement

The word performance is widely used in all fields of business management. Nevertheless, performance as a term is not precisely explained. Dictionary explanation of the term varies and is frequently defined from the concrete point of view. One of many definitions (Neely et al., 2003), (Wholey et al., 1996) of performance is the one of Richard and Devinney (2009):

Organizational performance encompasses three specific areas of firm outcomes:

(a) financial performance (profits, return on assets, return on investment, etc.);

(b) product market performance (sales, market share, etc.);

(c) shareholder return (total shareholder return, economic value added, etc.).

In the Czech Republic, the financial performance is the most suitable, as the financial data are believed to be most precise, although there are some limitations – tax policies of company etc. The product market performance is hard to observe, as we have chosen the general IT companies in the Czech Republic market and the sales or market share are not part of the financial statements, those are base of our research. Shareholder return is not usable in the Czech Republic because most of the companies in the sample are not publicly traded and there is no evidence of sharing the profit.

Financial performance of the company is usually depicted using key performance indicators. In this paper there will be consistency with most used traditional indicators mentioned by Hult (2008) ROA, ROE, ROS. In addition, there will be used liquidity ratios and indebtedness as an indicator of financial responsibility and stability.

Construction of the performance indicators is standardized, using EBIT in both ROA and ROS. For the liquidity ratio, the sum of short term liabilities with short term loans and financial aids will be used. For the indebtedness, there are two ratios, general indebtedness and the investor´s risk. We will use only general indebtedness is rate of equity another sources as a measure for the stability of the company.

Table 1 Key Performance Indicators Overview

KPI	**Target**	**Characteristics**
ROA	maximization	performance
ROS	maximization	performance
Liquidity (current ratio)	Optimization towards optimum (adequate)	Carefulness approach – insurance against market risk

General indebtedness	Optimization towards optimum (adequate)	Carefulness approach – risk of control loss

Source: own creation based on literature mentioned above

Corporate governance and performance

State or find a concrete factor, that has an important or key impact on performance of the companies is not trivial. General problem of humanities is the number of factors influencing the operations of the company. Many studies proof relation of corporate governance and the performance of the companies expressed by financial indicators. This linkage was declared specifically in Bebczuk's (2005) research of Argentinian companies and Gruszczynski's (2006) research in Poland. More generally the impact of good corporate governance is expressed in Gompers's, Ishii's and Metrick's (2003) research paper, Bhagat and Bolton's (2008) study and predominantly Milstein report of good corporate governance in general. In all studies it is declared, that the good corporate governance, regardless the meaning of adjective good, doesn't mean higher performance, but bad corporate governance means undoubtedly lower performance. In these studies, authors were using the EVA or Tobin q. In the study of Ooihi a Lecomt (2013), the principle of the stock market valuation was used. These approaches are not feasible in the Czech Republic, due to low number of companies being publicly traded on stock market – the financial data will be used instead.

Corporate governance as an operation – good managing of the company includes also taking managerial risk, decision making process and in this area predominantly targeting of the KPI in the company. This process might be influenced by the nature and the composition of management boards in the companies – the bearers of the "strategic" corporate government. In this paper we focus mainly on age and gender composition of the boards in the selected Czech companies.

Gender and Age diversity

Discussion about importance of demographic characteristics of board members is coming to the researchers´ attention. A Ratio of women participating at the labour markets has been getting bigger since Second World War. So, gender diversity is not only the current topic in the management area, but also in overall society. Heidrick and Struggles (2007) proved in their report that women proportion at the European labour markets are increasing in the last years, from 5% in 2001 to 8.4% in 2007. But we are still not at the same level as American companies and big differences among European countries exist. The Scandinavian countries are widely known for their progressive approach in involving older people and women into the working process at higher positions. However, in the central-European context, gender and age diversity is out of the primal research focus of most researchers. There are some studies aiming at gender diversity, because it is easer for statistical study rather than age diversity, which is hard to define. An interest in gender diversity is also supported by European policy, which is trying to introduce women quotas for executive and supervisory bodies of companies at the level of 20%. (Matsa, Miller, 2013). Campbell (2008) provides us two reasons, why women should be included among members of companies´ bodies more often. At first, there are ethical arguments. Excluding women from executive and supervisory bodies only because of gender can be considered as discrimination. And no firm wants to build up an image of low Corporate Social Responsibility. Secondly, economic arguments are related to the assumption that every company should choose for each job position the most suitable candidates, who reflected all requirements for that position. If you exclude women, your financial performance can decline, since you didn´t have to choose the best candidate. So the higher diversity can bring a competitive advantage for a company.

Age diversity is getting more popular with ageing tsunami topic. According to the higher percentage of older people (above 50 years) at the labour markets, employment, inter-generation teams operation or their engagement in organizational culture is becoming interesting for researchers. Robinson (1997) presents that company´s costumers are

diverse as well, so more diverse working teams can understand needs of your target groups easier. As a result you can provide more customize products and penetrate additional markets. Second, it is argued that diversity increases creativity, innovation and new approaches for problem solving. In addition, a process of knowledge creation and sharing is encouraged by members´ diversity, which is extremely important in a case of original, not repeated tasks requiring high level of creativity for solving. (Van Knippenberg and Schippers, 2007). At third, it is argued that diversity can support problem-solving process as the variety of perspectives and opinions are emerging from more diverse board members bring more alternatives for evaluation. An understanding of high complex system, which undoubtedly business environment is, can improve decision making process. Decision will be right with higher probability. It may also lead to improvement of firm´s image as well as benefits from customer behaviour. (Smith et al., 2006)

Based on literature overview provided in previous text, we propose these hypothesis and research questions:

1) Firm´s performance is diminishing with increasing age among members of the company bodies.
2) Firm´s performance is diminishing with higher ratio of women among members of the company bodies.
3) Firm´s security is stronger with higher ratio of women among members of the company bodies.
4) Firm´s security is stronger with higher age among members of the company bodies.

2 Methodology

Our initial sample included 364 companies with Czech domicile operating in manufacturing industry, especially in IT industry. Randomly chosen sample is composed of 71 Czech joint-stock companies from IT industry. Two of examined companies had no data in evidence, thus the final number of researched firms is 69. For this sample we gained basic data describing the number of supervisory and managing board members, their age, gender as well as current key performance indicators (ROA, ROS, liquidity, indebtedness) for selected fiscal year 2012. We have chosen this year after first data scan, in 2012 there is the highest completeness of required data. All data had to be obtained manually from public business register, since in the Czech Republic there is no central database, where everybody can download mentioned data automatically (as it is in American business environment). That´s also the main reason, why we need to handle with lower sample than it is usual in American research literature.

Gender diversity is calculated as the proportion of women to the total number of members on the supervisory and managing board. Age diversity is problematic for statistic testing since there is no clearly defined way how to measure it. So, we decided to make an average age from all managing and supervisory board members for each examined company. To asses firm performance we used various Key Performance Indicators - return on assets (ROA), return on sales (ROS), current ratio (CURRAT), indebtedness (DEBT). For testing the relationship between age and gender diversity and firm performance, we used Kendall tau. All calculation were accomplished by software IBM SPSS, version 23.

3 Results and Discussion

In the table 2 we can find the basic characteristics of our research sample. Return of assets is around 7.4%, which is slightly higher than average rate in the Czech Republic. Return of sales is 6.5% that number doesn´t deviate from common range. Average age among managing and supervisory boards´ members is around 50. This number is lower than in German companies (Janošová et al., 2016), since German promotion system is based on senior principle, it means you build your career in one company, over time you are promoted according your experiences. Women share in Czech boards around 23 % falls into extremely high figure, typical more for Scandinavian countries rather than central European.

Table 2 Basic Sample Description

Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
ROA	69	,0743	,42572	,05125
ROS	69	,0654	,36887	,04441
CURRAT	69	22,6951	77,04534	9,27517
DEBT	69	2,9738	23,14120	2,78587
Avrage	69	50,0329	5,58147	,67193
Womenshare	69	,2309	,21710	,02614

Source: own computation

For the hypothesis testing, we have chosen the Kendall tau, which is suitable for testing of association of interval and ordinal variables. The results are provided in the table 3.

Table 3 Kendall Tau Test

		ROA	ROS	CURRAT	DEBT	Women share	Avr. age
ROA	Correlation Coefficient	1,000	,734**	0,011	0,126	0,052	0,049
	Sig. (2-tailed)		0,000	0,897	0,127	0,564	0,555
	N	69	69	69	69	69	69
ROS	Correlation Coefficient	,734**	1,000	0,008	0,125	0,087	0,000
	Sig. (2-tailed)	0,000		0,926	0,130	0,336	0,996
	N	69	69	69	69	69	69
CURRAT	Correlation Coefficient	0,011	0,008	1,000	-,251**	,204*	-0,063
	Sig. (2-tailed)	0,897	0,926		0,002	0,023	0,446
	N	69	69	69	69	69	69
DEBT	Correlation Coefficient	0,126	0,125	-,251**	1,000	-,309**	-0,017
	Sig. (2-tailed)	0,127	0,130	0,002		0,001	0,840
	N	69	69	69	69	69	69
Women share	Correlation Coefficient	0,052	0,087	,204*	-,309**	1,000	-0,004
	Sig. (2-tailed)	0,564	0,336	0,023	0,001		0,966
	N	69	69	69	69	69	69
Avr. age	Correlation Coefficient	0,049	0,000	-0,063	-0,017	-0,004	1,000
	Sig. (2-tailed)	0,555	0,996	0,446	0,840	0,966	
	N	69	69	69	69	69	69

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Source: own computing

Of the association, the awaited association is between ROA and ROS. These two key performance indicators are functionally connected. The same logical connection is among

the current ratio and indebtedness. When talking about the aim of the article, it must be assumed, that average age has no connection to any of observed dependent variables. The second, share of women in the bodies of the companies has significant correlation coefficient to current ratio and indebtedness, which means that higher percentage of women between board members will result in lower level of firm indebtedness. Similar score can be found for a relationship between women share and current ratio. With raising women share, current share is also heightening. Both of the key performance indicators are part of the firm security.

4 Discussion and Conclusion

Age diversity and gender diversity were studied in the way as researched by Byrnes and Miller (1999), ea. in the connection to risk-taking tendencies. The meta-analysis resulted in support of the idea, that male participants are less risky avoidant than females and the variety also fluctuated according to respondents´ age. On the contrary, Bonem (2015) states, that the older people see more danger in ethical and health problems, but in the social area they can accept more risk. The social area can be connected to the decision-making process through negotiating and propagation of own opinion on problems in the company and finding solution. In our research, age diversity among the average age of the bodies´ members in the Czech IT companies showed no significant results. Average age of the members was around 50 years, what might be surprised in IT sector. The question is, what is the nature of these people being in such innovative sector and if holding the position in bodies of the company means also furthering and strengthening the corporate governance principle of transparency – the owners are also managers in the company and have control.

Rolison (2003) states that "Financial risk taking reduced steeply in later life for men but not for women". As there are not direct studies of connection between managerial style and gender/age, this study can be approximation of financial risk of the company management. The older the managers are, the more conservative the managerial decision should be, unless there are women at power in the board of director.

The main purpose of this research study was to present age and gender diversity topic in connection with key performance indicators. The initial research sample comprised from Czech joint-stock companies operating in IT industry, with Czech headquarters. Average and gender diversity was chosen as a topic based on theoretical studies mentioned in literature review, which consider these types of diversity as possible factor of firm´s competitive advantage. Age and gender structure was can potentially have influence on corporate performance, in case of this article measured using ROA, ROS, indebtedness and current ratio. Because we primarily proceeded from more general theories, which provide evidences about the positive effects of diverse teams (irrespective of the specific diversity type), demonstrating themselves in an increased level of innovation, creative environment and knowledge sharing, our research interest did not limit on age diversity, but also that of gender.

Our findings are restricted by the size and selectivity of research sample, which do not allow us to analyse data by more advanced statistical methods used in western literature. Most of Czech joint-stock companies are not publicly traded, so the number of possible tests is limited. Furthermore, the key performance indicators used are only some kind of the possible analysis instruments and by its very nature may be distorted by unexpected external or internal circumstances.

Within the sample of IT companies operating in the Czech Republic examined here, we can conclude that gender has significant impact on firm´s indebtedness and current ration. Lower indebtedness and higher current ration contribute to better security of company, which may be a competitive advantage within crisis time, but too expensive in boom years, since that firm policy binds financial resources. Concerning age diversity, we cannot prove any significant results. So, we could not prove any bias between board members´ age and key performance indicators. For future researches, it will be necessary to include other industries or pick out bigger sample from IT industry. It´s also possible, that IT area

demonstrates slightly different results than other fields from manufacturing industry, because of greatly unstable and creative environment. Therefore, we should conduct research in a few areas to compare results and prove trend.

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The Influence of Government Support on the Crop Insurance Uptake

Monika Kaczała

Poznań University of Economics and Business
Department of Insurance
Al. Niepodległości 10,61-875 Poznań, Poland
E-mail:m.kaczala@ue.poznan.pl

Abstract: *Rationales for government intervention in agricultural insurance market are widely approved. The main aim of this study is to identify the relationship between the crop insurance uptake and different government intervention on the Polish market. The local legislation restrictions as well as data available have been analyzed. The measure of crop insurance uptake was the amount of insured arable land. The most important instruments identified are: insurance obligation, premium subsidies and the possibility of insuring crops against a single risk (abolition of risk packages).*

Keywords: crop insurance, subsidies, demand, state intervention, Poland

JEL codes: Q14, R28, G22, H76, K12

1 Introduction

Agricultural insurance dates back several hundred years. In Europe it started as early as the end of the 17th century, when mutual insurance against hail was introduced; in the 19th century it was offered in several European countries and in the USA (Mahul and Stutley, 2010). In the past few decades, development of this type of insurance measured according to the volume of gross written premium and the range and scope of insurance products has intensified, which is connected with growing state activity in this market sector (Smith and Glauber, 2012).

In the USA the first state-subsidised crop insurance scheme was implemented in 1938. In the following years it was modified, which resulted in the growing commitment of the state (Goodwin and Smith, 2013). In 1939 governments introduced subsidised crop insurance in Japan and Brazil, in 1943 in Jamaica (UNCTAD 1994), and in 1959 in Canada. European countries began running similar programmes as of the 50's, e.g. in Austria in 1955, in Italy in 1970, in Spain in 1980 and in France as late as 2005 (from 1965 France ran a state-sponsored insurance programme called the National Guarantee Fund for Farming Calamities (FNGCA)), and in Poland in 2006 (Enjolras, Capitanio, and Adinolfi, 2012; Enjolras and Sentis, 2011; Kaczała and Wiśniewska, 2015; Mahul and Stutley, 2010; OECD, 2011).

The subject literature points at the three types of reasons for government intervention with regard to agricultural insurance, i.e. market failures, disparity in the availability of private insurance between regions and crops and reporting damage more promptly. Market failures result from three phenomena, generally present in the insurance market and in agricultural insurance in particular: moral hazard (Coble et al., 1997), Goodwin, 2001), adverse selection problems (Skees and Reed, 1986; Just, Calvin, and Quiggin, 1999) and systemic risk (Kleindorfer and Klein, 2003).

State intervention in the crop insurance market may take various forms, i.e. premium subsidy, reassurance backing for insurance companies, covering administrative or operating costs or providing support with reference to infrastructure needed for data collection connected with risk assessment. Several forms of support are likely to be used simultaneously within the framework of the same programme. WTO guidelines determine acceptability of a given form of intervention, along with CAP regulations for the EU members as well as local legislations.

The main aim of this study is to identify the relationship between the crop insurance uptake and various forms of government intervention on the Polish market.

2 Methodology and Data

To solve the problem, a legal and functional point of view will be applied. In order to identify intervention mechanisms one must analyse local legislation as well as superior regulations (WTO and the EU). Due to the fact that both of these superior regulations are well known and described in the subject literature, and Poland has been obliged, since its accession to the European Union, to conform to the legal regulations in force in the EU, and the EU members must comply with standards set by the WTO as for state intervention on the agricultural market – the present analysis focuses on local regulations. The description is complete with the analysis of the available data, which has been obtained from the Ministry of Agriculture and Rural Development (MARD), the Central Statistical Office of Poland (GUS) and state budget implementation reports. Application of advanced methods of statistical analysis is quite limited, due to a brief period of analysis determined by data accessibility and a high level of data aggregation. Auxiliary calculations have been conducted by means of Excel and Gretl. The measure of crop insurance uptake is the amount of insured arable land.

3 Results and Discussion - Main instruments of government support on the agricultural insurance market in Poland

Historical overview until 2005

State intervention has been seen on the agricultural insurance market for a very long time. It had two forms: establishing or very tight control of insurance companies which would offer this type of insurance and introduction of obligatory insurance.

The beginnings of the agricultural quasi-insurance funds in the form of brotherhoods date back to the 17th century, when representatives of several villages located on the island between the rivers of Vistula and Nogat along with people from towns near Elbląg and Gdansk, set up a brotherhood which guaranteed a payment of cash as a compensation for flood or fire depending on the amount of cultivated farmland (Szczęśniak, 2006). During the partitions period, i.e. from 1772 to 1918, three independent insurance systems were established, in the Prussian, Russian and Austrian partition respectively. Agricultural insurance was offered in each, at different time and in various scopes, and all of them were tightly controlled by the respective state authorities. Hence, in the Prussian partition in 1785 the Kwidzyń Society introduced obligatory insurance against fire which encompassed rural property (only the property of the gentry was exempt from it); in 1790 a Gentry and Landowners' Fire Society was founded, in 1804 a fire society for villages in South Prussia, followed by further establishments in Prussia (Szczęśniak, 2006a). Starting from 1873 it was possible to insure crops, and obligatory insurance against hail became available in the beginning of the 20th century. During the period of the Duchy of Warsaw (1807-1815) the Prussian organisations were dismissed and in 1807 the Fire Society for Towns and Villages came into being, introducing obligatory insurance against fire for villages (gentry property was exempt) (Szczęśniak, 2006b).

In the Kingdom of Poland (also known as Congress Poland, being the Russian partition from 1815) the above society was closed down and replaced by a new one, which imposed the duty of insuring all land property against fire (except for inherited property) and in 1833 it was made possible (through another society) to insure farming machines, loss of shipped goods, mill and oil press machinery, crops and farm animals. In 1843 the insured risks also included hail and cattle plague (Szczęśniak, 2008). In the Austrian partition insurance against fire existed from 1860, against hail from 1864 and cattle plague was first insured in 1906 (Szczęśniak, 2009).

When Poland regained independence (1918), in 1921 obligatory insurance against fire was introduces for farm buildings, and starting from 1929 in particular voivodships it was possible to insure crops against hail and animals against plague. (Stroiński, 1989).

After the Second World War and the change in the economic system it was assumed as a rule that the whole farm property should be insured. Gradually, from 1947, obligatory crop

insurance was introduced for rye, barley, wheat and oats, and with time the scope encompassing crops was broadened to include maize, potatoes, buckwheat, fodder plants, meadows and pastures. Insurance against hail and flood was obligatory (from 1972) although voluntary insurance also covered damage done by spring frost, winterkill, hurricane or drought (only in 1957-58). The terms of crop insurance assumed full cover of the loss, considering a 10% integrated deductible. Later, if the crop was entirely damaged in the early stages of growth, the level of loss was established according to the level of insurance amount. Apart from crops, the farmer also had an obligation to insure buildings against fire, movable property (livestock and inventory, household movables, reserves) and farm animals against plague. In the 1970's obligatory third-party liability insurance for farm owners was introduced, which transfers onto the insurance company financial liability for unintentional damage caused by the farmer while performing vocational activities. Obligatory insurance types (eventually, there were nine) were contractless, (concluded by *ex lege*) and the premium was included in the tax. Until 1984 the obligation only encompassed private farms with the farmland exceeding 0.5 ha, (which was an important exclusion, as PGR-s (state-owned collective farms) accounted for 10% of the land in 1950 and 20% in 1989). After 1984 the scope of obligatory crop insurance shrunk, as industrial, seed and horticultural plants were excluded from the obligation, and were covered by voluntary insurance. From that year, too, as a result of legal changes which allowed more insurance companies to be set up in Poland, the number of entities offering agricultural insurance grew from one to three.

After the collapse of communism in 1989 obligatory agricultural insurance was abolished, all except two types: firstly, insurance of farm buildings against fire or any other random incidents which oblige the insurance company to cover the costs of rebuilding or refurbishment of the damaged premises and secondly, third-party liability insurance for farmers. Therefore, the number of crop and animal insurance contracts fell dramatically (table 1).

Table 1 Number of Insurance Contracts Before and After the System Transformation

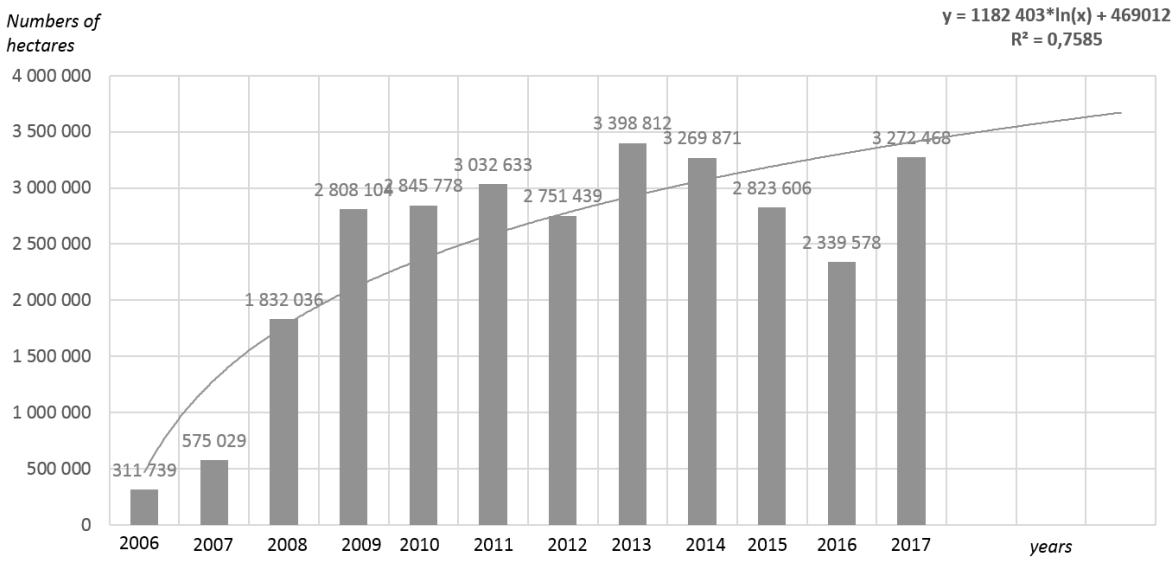
Years	Insurance of farm buildings (thousands)	Property insurance (thousands)	Crop insurance (thousands)	Livestock insurance (thousands)
1985	3 098	3 098	3 098	20 273
1986	2 966	2 966	2 966	22 936
1987	2 901	2 901	2 901	21 139
1988	2 886	2 886	2 886	22 155
1997	1 486	354	75	202
1998	1 449	373	61	187
2001	1 357	393	45	98

Source: Rojewski 2012

The period from 2006 to 2017

Introduction in September 2005 of the act on subsidised crop and animal insurance under the rule of which sales started in 2006, made it possible to initiate several government intervention instruments on the market, such as: premium subsidies (level of subsidy, maximum tariff levels which entitle farmers to a subsidy) introduction of obligatory crop insurance, a possibility to insure crops against one risk or a whole package of risks, defining the subjective scope of subsidised insurance (type of crop), defining the entities eligible for a subsidy, defining the maximum insurance amount, subsidies for insurance companies in the case of excessive damage caused by drought and support for drought monitoring in Poland. All of these actions have significantly increased the scope of insurance cover. Initially, only 3% of all crops were covered by subsidised insurance, while eleven years later it was as much as 31% (data from Ministry of Agriculture and Rural Development).

Figure 1 Amount of Farmland Covered by Subsidised Crop Insurance in 2006-2017



Source: MARD and CSO data for the years 2006-2017

Firstly, subsidies were offered with reference to premiums paid by the farmer for one policy annually. Over the first three seasons, i.e. until 3 June 2007 subsidies amounted to 40% for cereals, maize, rapeseed, turnip rape, potatoes, and sugar beets and 35% for potatoes or sugar beets; next, until 2016 it was 50% for all insured crops, and from 2016 onward 65% for all crops. Subsidy was allocated on condition that the tariff did not exceed the established limit. In this way a limit was set for the price which entitled the farmers to the subsidy. It was connected with limiting the state budget spending as well as prevented insurance companies from raising the prices because of the subsidies. In 2006 the upper limit of tariff accounted for 3.5% of the insurance amount, and if it should be exceeded, the subsidy was not granted. From April 2007 the limit was raised to 5% of the insurance amount for certain crops, such as winter rapeseed, outdoor grown vegetables, hops, tobacco, fruit trees and shrubs, strawberries or legumes, while for other crops (cereals, maize, spring rapeseed, turnip rape, potatoes or sugar beets) it remained at 3.5%. If a farmer exceeded the maximum tariff by less than 1 percentage point, they received a subsidy up to the maximum tariff, and if it was more than 6% of the insurance amount, they received no subsidy at all. This regulation was abolished in July 2015 for outdoor vegetables and fruit trees and shrubs. In 2017 new maximum tariffs were introduced - 9% of the insurance amount, and in the case of crops grown on poor quality soils 12% (class 5) or 15% (class 6). Initially, exceeding this limit caused the subsidy to be withdrawn. Four months later, however (i.e. before the spring season began) the regulation was changed. When the tariffs were exceeded, (calculated both for the whole package of ten possible risks and for the collective tariffs for selected risks) subsidies were reduced according to the percentage of tariff increase, with exclusion of tariffs for drought and winterkill. The above rule was slightly modified for fruit trees, shrubs and strawberries, in the case of which exceeding of the tariff entailed a subsidy according to maximum rates. The correlation between the insured area and the average amount of subsidy (in percentage) is moderately positive (r-pearson=0.57, p-value=0.025).

It is not statistically relevant (p-value >0.1) for cereals, rapeseed, fruit trees and shrubs, tobacco, strawberries and hops. It is moderately positive for maize (r-pearson=0.62, p-value=0.03), legumes (r-pearson=0.66, p-value=0.03), outdoor vegetables (r-pearson=0.61, p-value=0.04) and it is strong and positive for sugar beets (r-pearson=0.75, p-value=0.01) The correlation between the insured area and the average maximum tariff is weak and positive (r-pearson=0.40, p-value=0.1). It is statistically relevant and rather positive for maize (r-pearson=0.52, p-value=0.06), sugar beets (r-

pearson=0.65, p-value=0.02), legumes (r-pearson=0.61, p-value=0.04), and outdoor vegetables (r-pearson=0.61, p-value=0.04).

The value of annual premium subsidies and average subsidy per 1 ha can be seen in table 2. Although since 2011 premium subsidies have exceeded the planned annual limits, it was only in 2016 that sales were reduced significantly due to lack of financing from the budget (the subsidy pool dried out virtually a few days after the beginning of the autumn season as a result of increase in tariffs after the experiences connected with 2015 winterkill). This justifies the lack of correlation between the volume of planned subsidies and the insured area (p-value=0.15). The level of actual subsidies is in turn moderately positively correlated with the size of the insured area (r-pearson=0.67, p-value=0.01). A statistically relevant, positive and moderate correlation can be observed for cereals (r-pearson=0.48, p-value=0.08), maize (r-pearson=0.64, p-value=0.02), rapeseed (r-pearson=0.58, p-value=0.04), legumes (r-pearson=0.54, p-value=0.07), outdoor vegetables (r-pearson=0.56, p-value=0.06), and a very strong one for sugar beets (r-pearson=0.75, p-value=0.01).

Table 2 State Budget Subsidy for Crop and Animal Insurance System

	Crop and animal insurance subsidies (millions of PLN)		**Average subsidy per 1 ha (PLN)**	**Subsidies for insurance companies for excessive damage caused by drought (millions of PLN)**	
	actual	planned		actual	planned
2006	9,861	55	31,6	-	-
2007	39,348	59,902	68,4	209,902	210
2008	97,596	168,472	53,3	545	545
2009	131,139	150	46,7	150	150
2010	96,679	108,47	34,0	193,147	300
2011	126,141	100	41,6	100	100
2012	162,412	103,8	59,0	68,641	100
2013	164,407	103,8	48,4	80	80
2014	161,363	100,717	49,3	99,5	100
2015	173,177	100,717	61,3	100	100
2016	207,03	100,717	88,5	100	100
2017	397,9	725	121,6	n.d.	100

Source: Budget implementation report for the years 2006-2017

The connection between the volume of subsidies and the amount of insured arable land is clear and dependent on the subsidy level.

Another instrument was the introduction of obligatory insurance for farmers who had obtained direct subsidies for arable land in the previous year. The obligation refers at least to half of the area sown with crops which can be covered by state-subsidised insurance and must apply to at least one of the five occurrences: drought, flood, hail, winterkill or spring frost. Introduction of this requirement was directly enforced by the European Commission decree (1857/2009) which pointed at the connection between meeting the insurance requirement and the possible ad hoc assistance offered by the state. This instrument, although initially intended for a different purpose, appeared to be very effective in boosting popularity of crop insurance. Considering that there were no other relevant changes in the regulations at that time, introduction of obligatory insurance can be treated as the main cause of more than twofold growth in the amount of insured land. It must be stated, though, that farmers fulfilled this new obligation by purchasing insurance against the cheapest type of risk, namely hail.

The element which exerts an immediate influence on the price of crop insurance and, in presence of maximum tariffs, on accessibility and level of subsidies, is the possibility of insuring against single risks. Initially, subsidised crop insurance encompassed whole packages of risks, such as: hurricane, flood, torrential rain, hail, lightning, landslide, avalanche, drought, winterkill and spring frost (at the very start, during the first season, the list also included fire and explosion). In April 2007, however, a choice of a single risk to be insured against was enabled. Also, several times during the term of the act being in force definitions of some occurrences (drought, spring frost and winterkill, among others) were altered. This certainly resulted in an increase in access to insurance, although one has to remember that the 84%-growth in crop-insured area was also connected with the rise in the level of premium subsidy.

A few times, especially at the start of the subsidy system, the range of crops which could be subsidised, was broadened. Initially, subsidies were granted for insurance of cereals, maize, rapeseed, turnip rape, potatoes, or sugar beets i.e. essential/basic crops. From the beginning of 2007 subsidsed insurance could be used for hops, vegetables, fruit trees and shrubs and in April 2007 the list was complemented with tobacco, strawberries and legumes. Nevertheless, broadening the range of crops did not contribute to increasing the amount of insured land. The six initial crops accounted for at least 95% of the insured area throughout the analysed period. It must be said, however, that the structure of the insured crops changed despite the stable structure of sown plants. For instance, in 2006 the area of insured rapeseed made up 60% of the whole insured land, while in the years 2009-2017 30% on the average (MARD, 2006-2017). The drop in this crop insurance is particularly visible in 2015-16, when the winter package tariffs grew significantly. Cereals, despite the initial 39%, constituted an average 56% from 2009 to 2017.

Obtaining a crop insurance subsidy depends on assuming the insurance amount which does not exceed the maximum insurance amount per 1 hectare of a given crop which is regulated annually by the appropriate minister of agriculture. Maximum insurance amounts, which depend on the changes in market prices of a given crop (in the case of fruit trees and shrubs it is connected with the increase in the value of plantings) were introduced from 2008 and underwent changes in the analysed time period of up to 100%, the average change referring to a given crop from 3% to 17% (respective decrees by the MARD, 2007-2017). Their introduction was supposed to prevent overestimating insurance amounts by insurance companies. Reaching this goal, however, affected adversely the size of the insured area for cereals (r-pearson=-0.5, p-value=0.07) and maize (r-pearson=-0.6, p-value=0.03), which can be understood in the context of subsidy limits set for insurance companies. Interestingly, an increase in maximum insurance amount turned out to be very strongly correlated for legumes (r-pearson=0.94, p-value=0.00). This has probably allowed in the recent years to adapt the insurance amount to the actual market value of a given crop and thus has made this insurance more attractive.

The state has also defined the subjective scope of subsidy beneficiaries – initially the eligible farms were larger than 1 ha. However, in April 2007 this regulation changes and subsidies were available only up to 300 ha belonging to one agricultural producer. The regulation was abolished in August 2008. The definition of an agricultural producer was also changed several times. In April 2007 the subsidy was limited to entities which maintained the status of a small or medium-sized enterprise[2] which excluded from the subsidy system a whole range of enterprises, including strategic ones (e.g. owned by the Agency of Rural Property). Finally, after negotiations with the European Commission, starting from July 2015 larger farms were also admitted into the system, after they had met certain requirements. The impact of the above changes on the amount of the insured area is difficult to assess due to the lack of available data on the structure of the insured entities.

[2] As understood in the attachment I to the Commission decree (EU) 70/2001 of 12 January 2001 r. on application of art. 87 and 88 EU Treaty with reference to government aid for SME (Dz.Urz. WE L 10 z 13.01.2001, p. 33, with amendments.; Dz.Urz. UE Polskie wydanie specjalne, ch. 8, vol. 2, p. 141).

We also have to remember that the state can affect the supply side of the market. The only insurance companies which are allowed to offer subsdised insurance are the ones which have signed an agreement with the appropriate minister of agriculture and who meet statutory requirements. In reality, this tool did not serve as a means to limit the number of entities. When subsidised insurance was introduced onto the Polish market, there were only three insurance companies offering crop insurance and they all were admitted into the system. In the 2011/2012 season another insurer offered crop insurance, but it soon abandoned the market. In 2017 the number of companies grew to five entities. The small number of insurance companies involved constitutes a serious problem in subsidised insurance development.

Another instrument used by the state is a specific subsidy for insurance companies in the case of excessive damage caused by drought (table 1). The subsidy amounts to 60% of the difference between the total sum of compensation paid within a single calendar year for damage caused by drought and the amount which accounts for 90% of the total premiums paid in a single calendar year with respect to compulsory or subsidised crop insurance contracts (calculated in total with the subsidy). The solution, which was intended to encourage insurance companies to cover the risk of drought after risk "packages" had been abolished, came to nothing. In fact, there is no data referring to the amount of land insured against drought, but it may suffice to look at the figure concerning the number of signed insurance policies which include this risk. It decreased systematically from over 13.5 K in 2006 to a meagre 90 contracts in 2015 (the most recent available data from the Ministry of Agriculture and Rural Development, justification of the bill, 2015).

4 Conclusions

Intervention instruments applied on the agricultural insurance market come in a large variety: premium subsidies (level of subsidy, maximum tariff levels which entitle farmers to a subsidy) obligatoriness of crop insurance, a possibility to insure crops against a single risk or a whole package of risks, defining the objective scope of subsidised insurance (type of crop), defining the entities eligible for a subsidy, defining the maximum insurance amount, subsidies for insurance companies in the case of excessive damage caused by drought and support for drought monitoring in Poland.

Until 1989 the only explicitly used instrument was obligatory insurance. Nonetheless, we must not forget that the whole insurance system at that time was financed, managed and controlled by the state. Obligation was reintroduced in 2008, after approximately 15 years, under completely different market conditions. This clearly affected the amount of insured land, albeit well below the expected levels. This is due to the relatively weak sanctions which usually were not executed.

After the introduction of premium subsidies, i.e. from 2006, a systematic growth in the amount of insured land could be seen, although the correlation between these figures is rather moderate (r-pearson=0.67, p-value=0.01). Importance of the subsidy level in the context of increasing the amount of insured land was contingent on the type of crop. It mostly affected insurance of sugar beet sowings, and, to a slightly smaller extent, maize, legumes and outdoor vegetables. For the same crops, raising the upper premium limits, which were not exceeded, also had a stimulating effect.

The possibility of insuring crops against a single risk (abolition of risk packages) was at least partly responsible for the 84%-growth of insured area in 2007. Unfortunately, precise assessment of this influence is impossible due to lack of data. For the same reasons, it is also difficult to calculate the implications of admission of large enterprises into the system of subsidies. However, it is possible to state that increasing the objective scope of subsidised insurance (the types of insurable crops) resulted in only a slight increase in the amount of insured sowings.

The maximum level of insurance amounts, regulated by the government was relevant to the amount of insured cereal, maize, and legume sown land; in the first two cases it had a de-stimulating effect, while in the latter one it increased the insurance levels. One may

presume, however, that the negative correlation in the case of cereals and maize may become more feeble in the near future because the premium subsidy levels have been raised a few times; hence, accepting larger insurance amounts will not have to imply limiting the amount of insured land.

The specific subsidy for insurance companies which has been aimed at covering excessive costs of drought impact, and thus was to encourage insurance companies to offer cover for this risk turned out to be a complete failure.

The above analysis of the efficiency of government intervention instruments on the insurance market should be extended – as the next step – to encompass the effectiveness analysis. Such an analysis would look at the aspects (effectiveness for whom?), and would call for identification of the purpose of using certain instruments (what for?). One of such aims is, as one can suppose, the problem analyzed here, i.e. the extent of crop insurance which could achieve an assumed level (how high and why this high?). Such considerations on effectiveness would also have to refer to the fact that application of the presented instruments may lead to (and indeed it does) a different impact than the intended one and in various areas (sowings structure, environmental impact, capacity to reestablish production potential etc.).

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Structural Evaluation of Securities' Rates of Return in Selected Business Sectors on New York Stock Exchange

Marcin Kalinowski[1], Grzegorz Krzykowski[2]

[1] WSB University in Gdansk
Finance and Management Faculty, Finance Department
Grunwaldzka 238A, 80-180 Gdansk, Poland
E-mail: mkalinowski@wsb.gda.pl

[2] WSB University in Gdansk
Finance and Management Faculty, Finance Department
Grunwaldzka 238A, 80-180 Gdansk, Poland
E-mail: gkrzykowski@wsb.gda.pl

Abstract: *The share prices behaviour on the financial market is subject of numerous researches. Technical and fundamental analyses as well as theory of behavioural finance are attempting to demonstrate certain patterns in the share price behaviour of enterprises quoted on the stock exchange. The aim of this work is to evaluate the behavioural heterogeneity of rates of return on shares in selected sectors in the American market (NYSE). The research hypothesis of this work is the claim that share price behaviour, and rates of return on shares are sectors specific rather than global share market specific. Therefore, it is vital that we should conduct the analysis of the homogeneity of rates of return on shares of enterprises from diverse industries. The research is based on an enterprises representing four selected sectors from the American market (energy, trade, finance, health) has been instrumental in pursuing that goal. Detailed analyses have been conducted with the use of data mining methodology. The work has demonstrated the existence of behavioural heterogeneity of rates of return on shares in selected industries. The future research in this domain ought to concentrate on conducting a thorough analysis of homogeneity structure in selected industries so as to determine some regularities in the behaviour share prices in the particular industries.).*

Keywords: rate of return, market behaviour, stock market, NYSE

JEL codes: G100, G140, G150, G170, G190

1 Introduction

The behaviour of share prices on the market is subject to continual research. Technical and fundamental analyses as well as theory of behavioural finance are attempting to demonstrate certain patterns in the share price behaviour of enterprises quoted on the stock exchange.

Diverse models of functioning of the market endowed with a forecast potential are the outcome of such analyses.

The aim of this work is to evaluate the behavioural heterogeneity of rates of return on shares in selected sectors (industries) in the American market (NYSE).

The research hypothesis of this work is the claim that share price behaviour, and rates of return on shares are industry specific rather than global share market specific. Therefore, it is vital that we should conduct the analysis of the homogeneity of rates of return on shares of enterprises from diverse industries.

The research into enterprises representing four selected industries from the American market (energy, trade, finance, health) has been instrumental in pursuing that goal. Synthetic price indexes for particular sectors and representative enterprises have been created so as to carry out reliable research. Detailed analyses have been conducted with the use of data mining methodology.

The problem of functioning of financial markets is the subject of continuous research in economic sciences. Numerous theoretical and empirical studies tend to explain the

operation mechanisms on the markets, their place in the global market, the determinants of development at national and international level. Numerous theoretical models describing the functioning of financial markets are formulated. A special place in economics occupies classical financial theory, which assumes the rationality of investors in making investment decisions. Investors - according to this theory - make decisions that maximize their benefits, provided the information is properly interpreted.

Investors' investment decisions are inseparable connected with exposure to risk. Determining investor preferences and evaluating investment options are the starting point for any traditional equity valuation model.

The risk problem occurs in portfolio theory. It has become one of the basic theories of making rational investment decisions in the stock market under uncertainty. The decisions are made there due to two criteria: income and risk. H. Markowitz, Nobel Laureate is the creator of classic portfolio theory. He presented his concept for the first time in 1952 (Markowitz, 1952). The market where investors use Markowitz's portfolio theory as a tool for selecting an investment is described by the Capital Asset Pricing Model (CAPM). It is a continuation of Markovitz's theory. The CAPM model can be considered as a valuation model as it determines what is the level of return rate on the sustainable market. The CAPM theory was created in the mid-1960s. Its creators were: W. Sharpe (Sharpe, 1964), J. Lintner (Lintner, 1965), J. Mossin (Mossin, 1966) and J. Treynor (Treynor, 1961). W. Sharpe, for the CAPM was awarded the Nobel Prize in Economics in 1990. The Capital Asset Pricing Model was repeatedly criticized because it is impossible to identify in reality the market portfolio underlying the CAPM model (Fama, French, 1992), (Fama, French, 1996), (Roll, 1973). As a consequence, CAPM modifications and new pricing models for financial instruments using different valuation principles were introduced in subsequent years. An example of a capital market model that differs from the CAPM model is the Arbitrage Pricing Theory (APT). This pricing model was announced in 1976 by S. Ross (Ross, 1976). The APT model assumes the existence of law of one price on the financial markets and thus the functioning of the arbitration mechanism.

The different reasons for price changes on the stock market is described in the financial markets information efficiency theory. The determinant of investor behavior in the financial market is, according to this theory, information. The beginning of efficient market theory can be seen in 1965, when P. Samuelson argued that stock price volatility was unpredictable when all market participants had full access to information and where the information was reflected in prices (Samuelson, 1965). However, the creator of the market efficiency theory in the modern form is E. Fama. According to this author, an efficient market is a market where prices always fully reflect the information available ((Fama, 1970). Market information efficiency is an important element in evaluating these markets. It allows, by analyzing price behaviour, to evaluate the behaviour of investors in stock markets. It also makes it possible to assess the adequacy of valuation of shares on the market based on fundamental data.

2 Methodology and Data

The subject of the analysis are daily share prices at closing in the group of companies of the industry under consideration. Four sectors have been selected for the analysis: energy, trade, financial and health. Four companies have been selected in every industry. The energy industry is represented by Exxon Mobil Corporation (XOM), General Electric Company (GE), Chevron Corporation (CVX), Petro China Company Limited (PTR). From the trade industry Anheuser-Busch Inber (BUD), Coca-Cola Company (KO), Pepsico (PEP), Phillip Morris International Inc. (PM), has been selected. Financial industry is represented by JP Morgan Chase & Co. (JPM), Wells Fargo & Company (WFC), Bank of America Corporation (BAC), HSBC Holdings (HSBC) and the health industry by Johnson & Johnson (JNJ), Pfizer Inc. (PFE), Novartis (NVS), Merck & Company (MRK). The data comes from NYSE in the period from 2005-02-25 to 2016-11-02. The quotes for the two companies commenced at a later period. PM is quoted from 2008-03-17 and BUD from 2009-07-01. Within this period, 2944 of daily quotes were obtained for the 16 analyzed companies. As

share prices are too diversified in terms of nominal value, the research has been based on return rates expressed in per cent

$$R_{k+1} = \frac{Price_{k+1} - Price_k}{Price_{k+1}}\ 100, \qquad k = 0,1,\dots,2943. \tag{1}$$

The construction of the scaled return rate within the group of companies in the industry

The scaled return rate for the industry is based on the return rates for the selected companies within the industry and has the form of a weighted value of the rates. For the needs of this article this indicator will be called industry index (I2). The analytical form of the indicator of the daily combined return rate for the industry (I2) is as follows:

$$\sum_{i=0}^{p} \alpha_i\, R^{(i)} \tag{2}$$

where p is the number of companies in the industry, $R^{(i)}$ is the return rate for the index i $(i = 1,\dots,p)$ at the specific day and the coefficients α are nonnegative and sum to unity. In case of the analyzed industries the number of companies in every industry amounts to four, thus always $p = 4$. If for example we assume equal weights (i.e. $\alpha_i = \frac{1}{4}$ for $i = 1,2,3,4$), than the weighted index will be the mean value of return rates for the industry. The weights may be selected arbitrarily but usually are conditioned by the importance of the industry itself and additionally by the structure delineating the significance of each and every of the companies for the industry. The industry index, which is one-dimension transformation of the return rates in the industry, should be independent of the impact of those factors and take into consideration solely the internal structure of the return rates. In the analyses presented, the index construction for the industry should consider the long observation period and should be comparable across the industries. The proposed procedure of construction for the scaled return rate is based on the assumption that the distance measure between the daily return rates for the companies in the industry fits their one-dimensional counterparts.

It is assumed that each daily observations of return rates in the industry is the p dimensional vector. The data is presented in the geometrical form as a cloud of 2943 points in the four dimensional Euclidean space. At the subsequent stage, the measure of distance between the points in $\mathbb{R}^p$ is given by the following formula (Euclidean distance)

$$d_{r,s} = \sqrt{\sum_{i=1}^{p} \left(R_r^{(i)} - R_s^{(i)}\right)^2}, \tag{3}$$

where the indicators $r, s = 1,\dots,2943$ are the indicators of the daily observations and $R_r^{(i)}$ and $R_s^{(i)}$ are the empirical return rates of the i index in the days of r and s indexes. In the procedure of multidimensional scaling, we strive to find the linear transformation $a: \mathbb{R}^p \to \mathbb{R}^1$ meeting the optimality conditions of differences in distance between the points in $\mathbb{R}^p$ and $\mathbb{R}^1$. The daily return rates for the r index day for the entire industry will be approached as a vector and the marking $R_r = \left(R_r^{(1)},\dots,R_r^{(p)}\right)^t$, will be adopted where the operation "t" means the transposition of the vector. The linear transformation a yields the vector of return rates R_r into the number $a^t \circ R_r$, where the operation "$\circ$" signifies the scalar product of vectors. Thus, the name of the transformation has been identified with the vector determining this transformation. Additionally, let us introduce the symbol for the distance of linear transformation a for the return rate vectors in the days of the r and s indexes

$$\widehat{d_{r,s}} = |a^t \circ R_r - a^t \circ R_s|. \tag{4}$$

Formally the values $d_{r,s}$ are distances between return rates in the industry on different days and $\widehat{d_{r,s}}$ are distances between return rate in one-dimensional sub-space of $\mathbb{R}^p$. The idea of multi-dimensional scaling consists in finding such linear transformation a so that the value

$$V = \sum_{r=1}^{n} \sum_{s=1}^{n} \left(d_{r,s}^2 - \hat{d}_{r,s}^2\right) \tag{5}$$

is the minimal. This means selection of an appropriate transformation (coefficient vector α for $i = 1,2,3,4$) so that the distances between return rates in the industry on different days could possibly be precisely approximated by one-dimensional distances. The vector determining optimizing linear transformation is obtained from the empirical covariance matrix of return rates for the companies $R_r^{(i)}, = 1, \ldots, 2943$) of indexes $i = 1, \ldots, p$, which is marked $\sum$. The covariance matrix $\sum$ (of the p$\times$ p dimension) has the real and non-negative eigenvalues. Then making use of spectral decomposition of the matrix we discover that one - dimensional sub-space determining the scaled return rates is generated by the eigenvector of the maximal. Thus

$$\min_{a \in \mathbb{R}^p} val \left\{ \sum_{r=1}^{n} \sum_{s=1}^{n} \left(d_{r,s}^2 - \hat{d}_{r,s}^2\right) \right\} = v_1, \tag{6}$$

where vector v_1 is the eigenvector of the covariance matrix $\sum$ that is $\sum v_1 = \lambda_1$ where λ_1 is the maximal eigenvalue of the covariance matrix $\sum$. Additionally, the eigenvector has been selected in such a way so that it is normalized to unity and the project vector of the return rates on one-dimensional space generated on this vector has the positive covariance with each and every vector of empirical return rates for the companies within the industry.

Finally, the vector $R_r \circ v_1$ $(r = 1, \ldots, 2943)$is the vector of the scaled return rates (industry indexes). Let us observe that the index form is given by formula (1) where weight vector α_i for $i = 1,2,3,4$ is v_1, vector, that is the eigenvector of the covariance matrix $\sum$ corresponding the maximal eigenvalue. The construction of the industry index is based on the vector of return rate observations of the companies within the industry and generally the index values change as raw data changes for example by the increase in the amount of data.

The multidimensional scaling procedure is well known and frequently applied, but for tasks of a different nature. It is one of the basic procedures comprising data mining methods and is aimed at dimensionality reduction or cluster analysis. Technically, the multidimensional scaling procedure is analogical to Hotelling's Principal Component Analysis (1934). Proofs of the quoted values can be found in numerous monographs (Krzanowski, 2000), (Krzanowski, Marriott, 2010), (Mardia, Kent, Bibby, 1979), (Ripley, 1996).

3 Results and Discussion

Considering the industry indexes in the entire analysed period of observation we have noticed a minute dispersion level of the industry indexes (see table 1).

Table 1 Descriptive Statistics of the Industry Indexes

Industry index	N	Mean	SD	Min	Q05	Q50	Q95	Max
Energy	2939	0.060	3.202	-23.939	-4.855	0.108	4.561	24.887
Trade	1848	0.117	1.827	-9.030	-2.883	0.128	3.096	10.352
Finance	2942	0.076	5.003	-45.336	-6.397	0.037	6.211	51.369
Health	2942	0.058	2.180	-15.747	-3.276	0.089	3.303	21.853

Source: own research

The calculations indicate that regardless of the differences in the maximal values of indexes their extreme quantiles (order 5% and 95%) do not exceed 6,5%.

The aim of the research analysis is recreation of changes of the industry indexes in the observation period. It means the researchers are striving to find moments in time in which behavioural changes in the industry indexes are conspicuous.

The regression analysis is the first analysis aimed at evaluating return rates' behaviour. It has been observed that the regression line is a straight line almost identical to the abscissa in each of the industries (equation $y = 0$). As shown in table 2 the slope and intercept coefficients in all industries are insignificantly different than nought. However, quantiles of 5% and 95% order for residuals do not exceed 2%.

Table 2 Statistical Characteristics of Industry Regression Lines

Industry index	Min	Q05	Q50	Q95	Max	Slope	Intercept
Energy	-24.02	-1.47	0.06	1.54	24.81	0.473	-0.000028
Trade	-9.18	-1.08	0.01	1.12	10.18	1.025	-0.000058
Finance	-45.40	-1.62	-0.04	1.47	51.30	-0.171	0.000016
Health	-15.79	-1.02	0.02	1.08	21.81	-0.271	0.000022

Source: own research

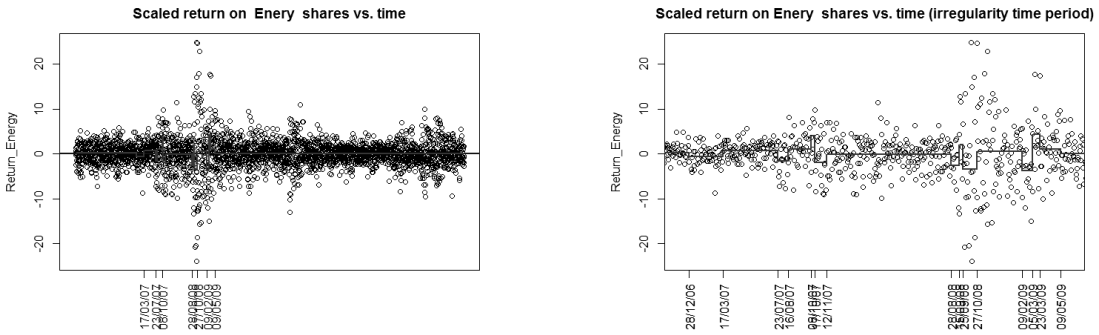
Applying simple regression analysis (CDA - confirmatory data analysis) it may seem that the industry indexes are insignificant. It is not the case, however, and indexes are endowed with structural changeability resulting from fluctuations in stock market. This changeability is relatively minor in comparison with the aggregate of observation containing approximately $2.5\,K.$ pieces of information. Analytical tools which hinge on parametrical procedures are not precise enough to detect minute dependencies.

The detailed industry index analysis is to be carried out with the application of the basic methods belonging to the set of exploratory data analysis (EDA) tools, frequently referred to as data mining. Tree-base method adopted for our research appear in the literature on the subject matter. First formal algorithms were presented in 1963 (Chambers, Hastie, 1993). Main outcomes are to be found in Brieman's monographs of 1984 (Breiman, Friedman, Stone, Olshen, 1984).

The method of recreating the structure of changes in the industry index is, in theory, based on the so called quantization process. At the first stage, we pinpoint a moment (date) separating observations into an earlier and a later one in relation to a given date. A moment in time is selected in a way which enables minimising the sum of variance of observations in two analysed aggregates. The same mode of operations is performed at subsequent stages. The process may be conducted until final single measurements are obtained. However, the image of results obtained would be illegible. For this reason it is imperative that we should introduce a selection of parameters allowing for termination of the process. Two conditions have to be adopted in the applied procedure. It has been assumed that each group at each stage of division includes at least seven days of observations. Additionally, it has been agreed that 180-day periods are indivisible. The standard division-stopping procedure based on the relative variance in division related to the variance before and after division has not been applied.

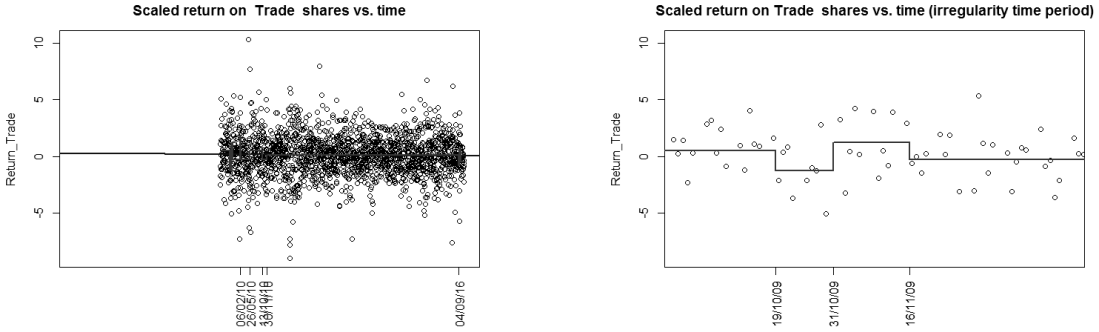
Please consider the following point graphs of variability in the industry indexes. Average index values in selected time periods have been attached to the industry indexes.

Figure 1 Changeability of the Energy Industry Index (EI2)



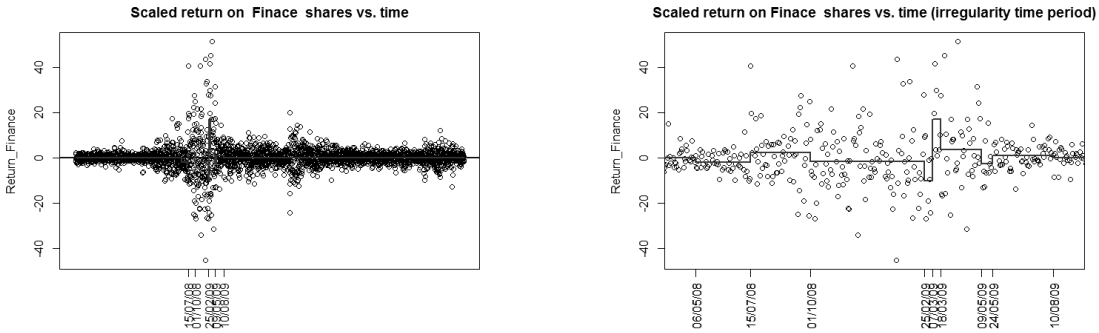
Source: own research

Figure 2 Changeability of the Trade Industry Index (TI2)



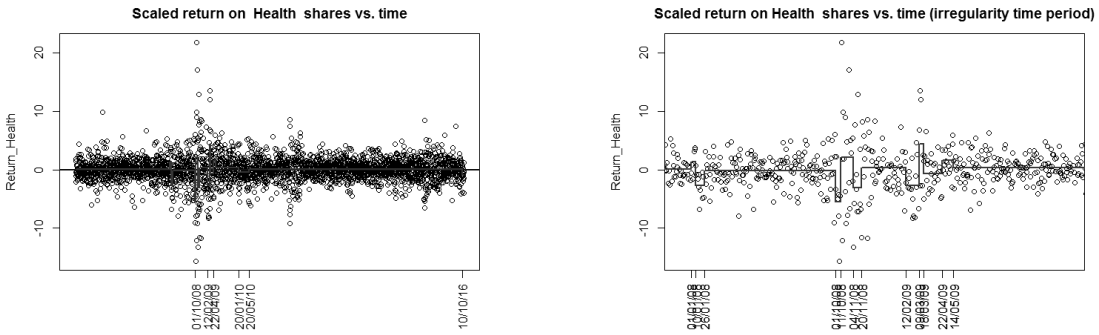
Source: own research

Figure 3 Changeability of the Finance Industry Index (FI2)



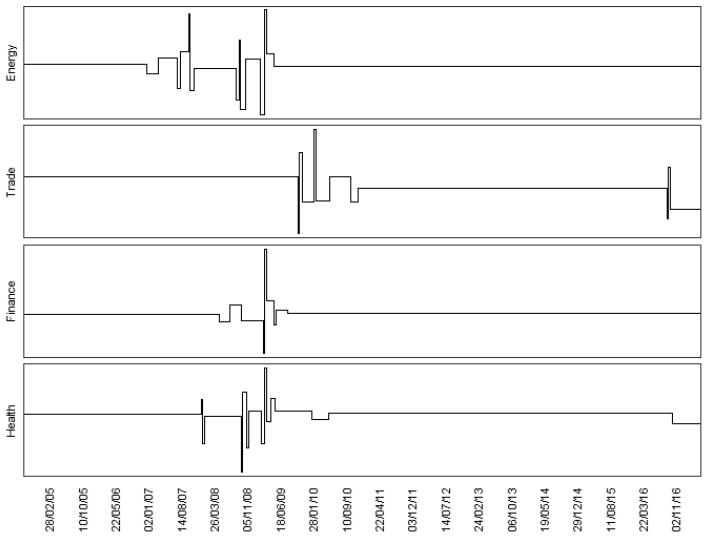
Source: own research

Figure 4 Changeability of the Health Industry Index (HI2)



Source: own research

Figure 5 The Structure of Behavioural Homogeneity of Return Rates' Indexes in Researched Industries



Source: own research

Figure 5 presents the structure of changes in industry indexes (I2) in the entire observation period. The conducted research leads to the conclusion that the changeability structure of industry indexes is heterogeneous in the time in the analysed industries. The energy industry is first to manifest the industry index instability. The middle ground belongs to the health and finance industries. Evidently, the trade industry is last to demonstrate the instability phenomenon. The final comparative analysis of instability requires rescaling of changes in industry indexes to achieve the same scale. The detailed pictures of changes in industry indexes is presented in figures from 1 to 4.

4 Conclusions

This article attempted to evaluate the behavioural homogeneity of return rates on shares based on American stock exchange (NYSE) and taking into account divers industries represented particular enterprises.

The research carried out proves that:

1. There appears to be behavioural homogeneity of industry indexes (at the level of regression analysis).

2. Behavioural heterogeneity in selected industries has been discovered owing to the application of the analysis incorporating data mining tools.

3. The energy industry has been first to reveal behavioural instability. Subsequently, it has appeared in the health, finance and trade industries.

4. Despite the lengthy research period the instability of industry indexes appeared at a similar time in all industries (2007-2010). Please note that this time period overlaps with the global recession in financial markets.

5. In addition it is worth noticing that behavioural instability of trade and health industries manifested itself at the end of the research time period (IX-X 2016). It justifies an increase in risk related to the next phase of crisis in the financial market. It may be correlated with the global political situation.

The work has demonstrated the existence of behavioural heterogeneity of rates of return on shares in selected industries. The future research in this domain ought to concentrate on conducting a thorough analysis of homogeneity structure in selected industries so as to determine some regularities in the behaviour share prices in the particular industries.).

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Stability Prerequisites of the Czech Republic Banking System (Cybernetic Point of View)

František Kalouda

MASARYK UNIVERSITY
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 BRNO, Czech Republic
E-mail: email@university.cz

Abstract: *The paper is devoted to further description and analysis the selected stability aspects of the Czech banking system (as a cybernetic system), with special focus to the influence of the managed or controlled system (commercial banks).The objective of the paper is to clarify the implications of the parameters of the regulator (Czech central bank) to behavior the managed/controlled system (Czech commercial banks). The paper draws on data published by the Czech National Bank (CNB, http://www.cnb.cz) as well as on data from literature and from previous studies of the author.Methodology of the paper is principally based on the economic cybernetics utilization in terms of study the stability of the Czech banking system as a cybernetic one. The usual description, literary research, comparison and analytic-synthetic methods are used here as well.The main expected results of the paper relate to the linkages between stability of the Czech banking system as a whole and behavioral parameters (characteristics) of the controlled system (commercial banks) - still not explored. Conclusions of the paper in a significant way redefine the options of the central bank in general (this means not only Czech central bank) concerning the stability control of the banking system.*

Key words: banking system, controller, stability, controlled system

JEL codes: C62, D22, E43, G21, G38

1 Introduction

The stability of the cybernetic system in general is result of interaction of the controlled system/plant and controller.

Their standard interconection in form of the simplest block diagram is a closed-loop (or feedback) control system with negative feedback (see Figure 1).

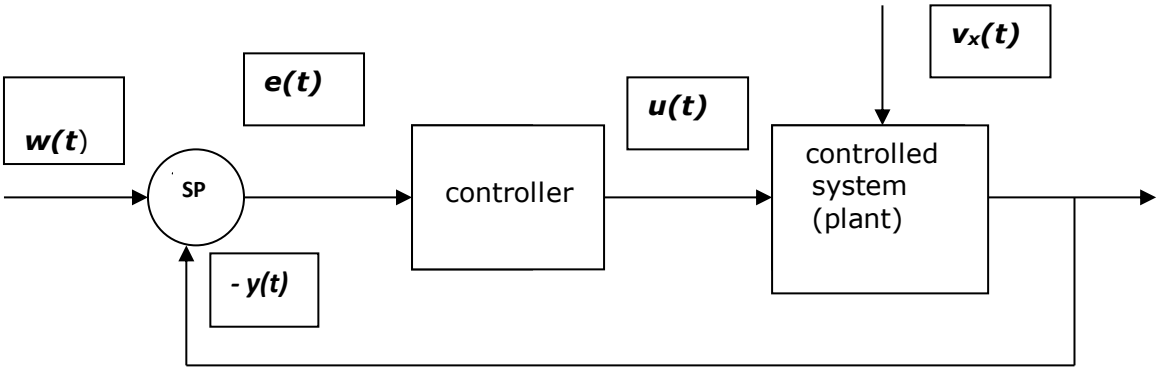
In our case we are specifically monitoring stability of the Czech banking system. The controlled system (plant) is system of Czech commercial banks (hereinafter Czech commercial banks). As the controller performs Czech National Bank (hereinafter CNB), Czech Central Bank.

We examine the stability of the Czech bankin system through relationships between the indicators (or variables) discount rate and commercial rate. The reason for choosing these indicators is the CNB´s view that commercial rate can be managed (with sufficient precision) by a discount rate.

The formal independence of the CNB leads to significant modification of the standard block diagram of a closed-loop or feedback control system (see Figure 2). The feedback control system is preserved indeed but its ability of target behaviour is in the absence of command variable *w(t)* - and implicitly also variable *e(t)* error - at least disputable.

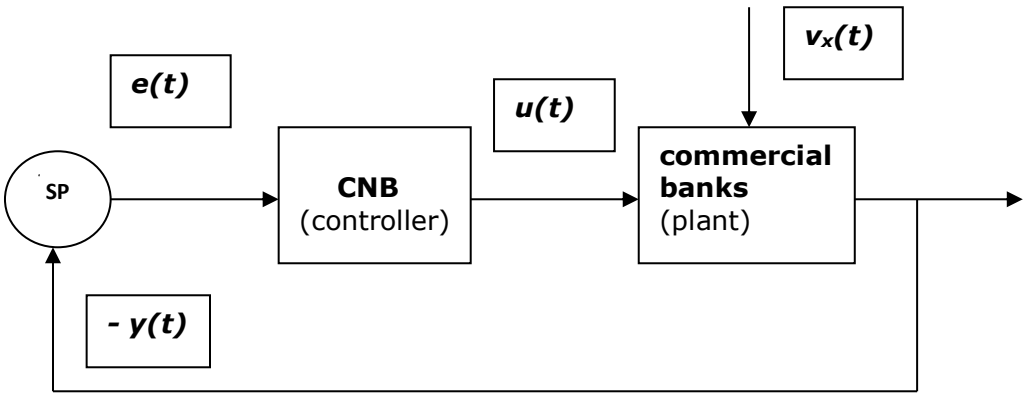
The other consequences of the CNB´s independence are here ignored.

Figure 1 Block Diagram of a Closed-loop (feedback) Control System – Classic Form



Legend:
w(t) …… command variable
e(t) ……error
u(t) …… manipulated variable
$v_x(t)$ …… disturbance variables
y(t) …… controlled variable
SP …… summing point (*e(t) = w(t) – y(t)*)
Source: Adapted from Švarc et al. (2011, pp. 38, 341), Stefani, R.T. et al (2002, p. 75)

Figure 2 Block Diagram of a Closed-loop (feedback) Control System – Consequence of CNB Independence



Legend:
w(t) …..command variable – unknown/missing signal/information, it cannot be interpreted
e(t) …….error - - „ -
u(t) …….manipulated variable
$v_x(t)$…. disturbance variables
y(t) ……controlled variable
SP ……..summing point (*e(t)=w(t)–y(t)*) - unknown component, it cannot be defined
Source: Own construction of the author based on Švarc et al. (2011, pp. 38, 341), Stefani, R.T. et al. (2002, p. 75)

The past results of identifying the parameters of commercial bank system (Balátě (2004), Fikar, Mikleš (1999), Kubík et al (1982), Švarc (2003) and Švarc et al (2011)) are relatively convincing. The dynamic behaviour of this system is analyzed using the step function response of the banking system *h(t).* The step function (or transient) response of commercial bank system *h(t),* as it has been analyzed to date ((Kalouda (2014a), (2014b), (2014c), (2015)), leads us to the partial conclusion that (from a dynamic point of view) system of commercial banks can be considered as proportional (static) system element.

Nevertheless, the available data does not rule out a tendency of this system to oscillations with a potential risk of destabilizing the system ((Kalouda (2014a), (2014b)).

It is clear that the risks of the system oscillating into an unstable regime is too large to be ignored. The step function response of the Czech banking system in its different periods are, after all, not identical to each other (Kalouda, 2015), which evokes a risk that the stability of the system may be lost.

This is why this paper is devoted to examining the dynamical behavior of the banking system in the Czech Republic with special focus to its stability. In this context the objective of the paper is to clarify the influence of controller´s (CNB) parameters on behaviour of the controlled system (Czech commercial banks, plant).

2 Methodology, Data and Model Specification

The limited extend of the paper makes impossible to provide a detailed presentation of all methodological procedures that led to the results presented below. Therefore, we will limit ourselves to the brief overview of the most important topics discussed, in connection with the relevant sources.

Methodology

The key importance of the methodological input for this paper results first of all from the interdisciplinary nature of the issues studied. On the other hand they are also relevant in this context the researches previously carried out and the publications of the results achieved, to which this paper is closely tied.

The methodical basis of the paper are the usual methodological procedures:

- description,
- analysis,
- comparison, and
- synthesis.

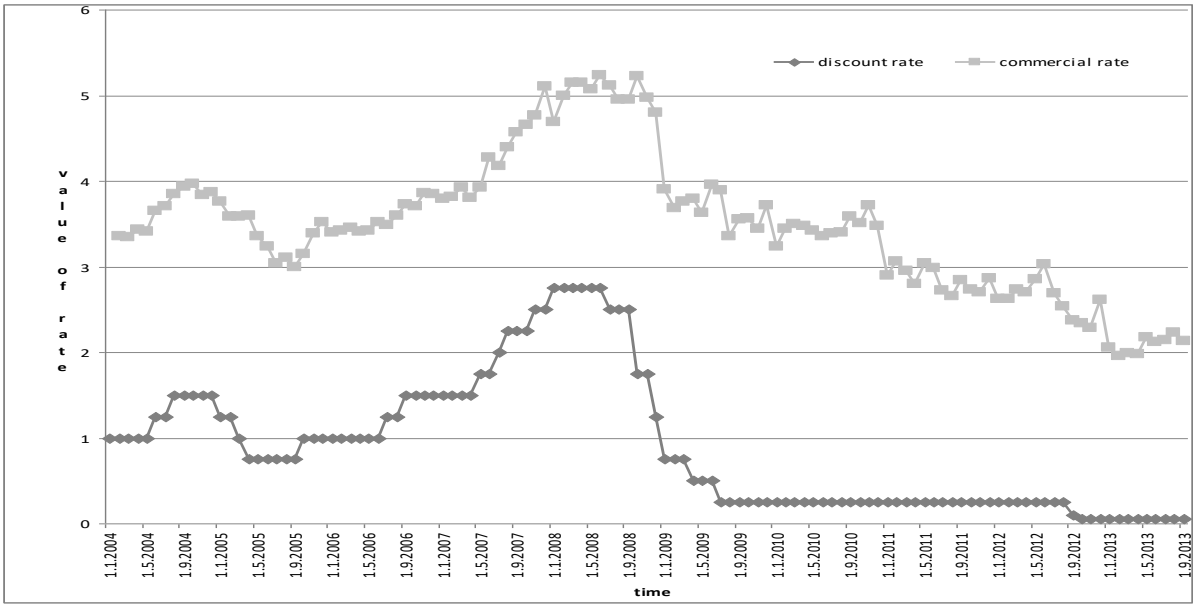
In addition, however, the specific topic and the objective of the paper virtually forced the application of methodological tools which have been less frequently used in the given context. These include, in particular:

- technical cybernetics, explaining the principles of automatic control in the form of feedback systems represented by Balátě (2004), Fikar and Mikleš (1999), Houpis and Sheldon (2014), Kubík et al. (1982), Švarc (2003), Švarc et al. (2011),
- economic cybernetics, transforming the methodology of technical cybernetics into the environment of economic systems, as discussed by Allen (1971), Šerý (2010), Kalouda and Svítil (2009), and Kisačanin and Agarval (2001) and
- financial business management in the form of applications of its access to economic cybernetics, as illustrated by Kalouda (2015, 2016).

Data

This paper is primarily based on freely available data published by the Czech National Bank (CNB) at http://www.cnb.cz/cs/financni_trhy/penezni_trh/pribor/rok_form.jsp, and at http://www.cnb.cz/cnb/STAT.ARADY_PKG.STROM_DRILL?p_strid=0&p_lang=CS, to which we link here. This data is taken from the period 31/01/2004 until 30/09/2013. The values of the variable discount rate and commercial rate are monitored (see Figure 3 Commercial rate = f (discount rate)).

Figure 3 Commercial Rate = f (discount rate)



Source: Prepared by the author using data from ARAD - Time series system - CNB. [on-line] Retrieved from: http://www.cnb.cz/cnb/STAT.ARADY_PKG.STROM_DRILL?p_strid=0&p_lang=CS [Accessed on 26/11/2013]

The above mentioned data are essentially unusable for the given purpose in their original form. The necessary modifications are described and justified in Kalouda (2017).

Model Specification

In this case, the modelled object is the banking system of the Czech Republic. We model the processes of managing cost of capital at the level of businesses (commercial rate) by the CNB using the discount rate. The model of this system is the graphical representation of the dependence of the commercial rate on the discount rate.

This relatively simple model is, in principle, based on the assumption that the requirement for the linearity of the modelled system is met (Švarc et al., 2011). Therefore we only consider the data that complies with the linearity condition, i.e. the reactions the commercial rate response to a rise in the discount rate.

However, this model is able to describe the expected non-linearities that are typical for the banking system with sufficient accuracy. The relative simplicity of the model used is thus not an obstacle to its use for describing the situation and identifying the problems in order to obtain the reference characteristics of the examined system (Fikar and Mikleš, 1999).

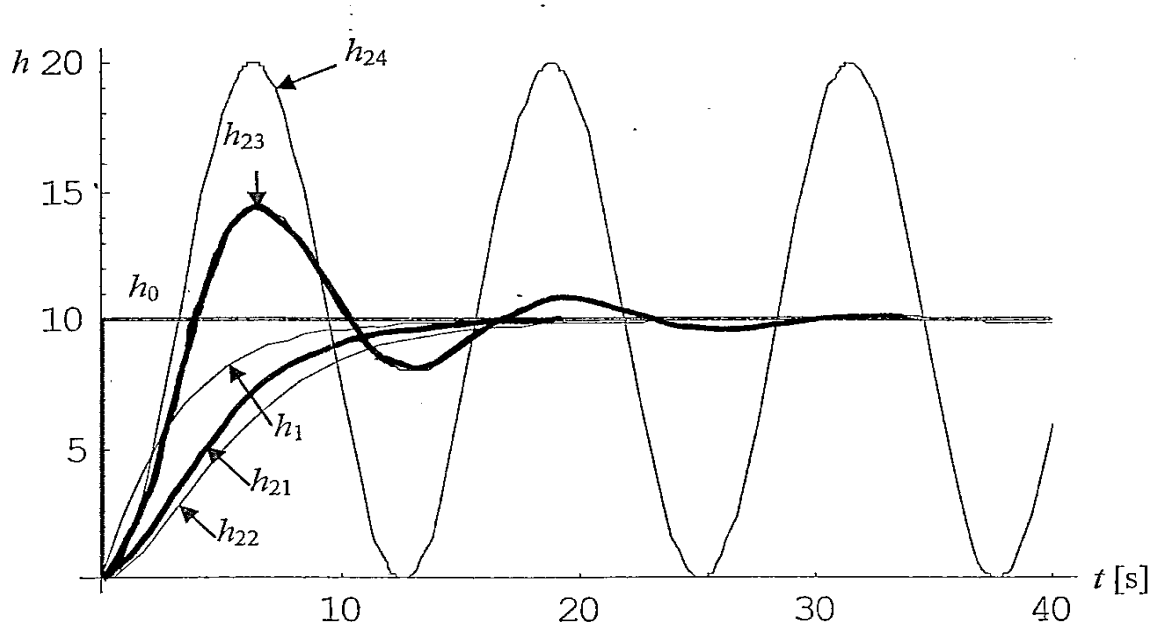
3 Results and Discussion

As mentioned above, results of previous research lead to the conclusion that (from a dynamic point of view) system of Czech commercial banks (or plant) can be considered as proportional (static) system element. Its dynamic behaviour, however, can be very different from the usual concept of stability.

Proportional (static) system element/plant – dynamics of behaviour

Behaviour of system elements (plant) can be described by using the step function response *h(t).* Its shape determines the parameters of the system elements, in this case parameters of the Czech commercial banks. Depending on these parameters, step function response *h(t)* may take the form as shown in Figure 4.

Figure 4 Variants of the Step Function Response *h(t)*



Legend:
h_0 ..... step response of an proportional element without inertia (an ideal proportional element)
h_1 ..... step response of an first-order proportional element with inertia (aperiodic first-order element)
h_{21} ..... step response of an second-order aperiodic element (criticaly damped)
h_{22} ..... step response of an second-order limit aperiodic element (over-damped)
h_{23} ..... step response of an second-order oscilating element (under-damped)
h_{24} ..... step response of an second-order conservative (lossless) element (on the threshold of instability, un-damped)
Source: Adapted from Balátě, J. (2004, pp. 57-58, Figure 3.21), Poley, R. (2014, p.18, Table 1.10)

Behaviour of system element (plant) is criticaly significant to the stability control of the system (in this case the CR banking system). It is defined by the nature of the system element.

The dynamic behaviour of the Czech commercial banks testet previous research (Kalouda, 2015). We can be considered proven that this system is able (considering unit step response *h(t)*) to respond by all above-mentioned ways.

Proportional (static) system element controller (as a technical system)

From the above, it is obvious that the nature of the system element (plant) is important for the selection of the controller as well. „The choice of the structure or type of controller is therefore largely determined by the nature of the system element (plant)." (Balátě, 2004, p. 221).

The basic characteristics (parameters) theoreticaly applicable controllers (as technical systems) are shown in Table 1.

Table 1 Theoretically Applicable Controllers (Overview)

controller	***e(t)***	**quality**	**stabilization**
P controller	stable	good	
I controller	temporary	good	
PI controller	0	better then	I controller
PD controller	0	better then	P controller
PID controller	0	the best	

Legend:
P controller – proportional controller
I controller – integral controller
PI controller – proportional plus integral controller
PD controller – proportional plus derivative controler
PID controller – proportional plus integral plus derivative controller
Source: Adapted from Balátě, J. (2004). *Automatické řízení*, Praha: BEN, pp. 155-156, Švarc, I., Matoušek, R., Šeda, M., Vítečková, M. (2011). *Automatické řízení, 2nd ed.* Brno: CERM, pp. 97-100

The last step is assigning the controller to the Czech commercial banks system. Theory of the technical cybernetics (automatic control) is in this case relatively unambiguous – only higher type controllers (PI, PD a PID) are suitable for higher order systems (it means second-order or higher) – see Table 2.

Table 2 The Order of the Controlled System (Plant) and Suitable Controller

plant /system element	**controller**				
	I	**P**	**PI**	**PD**	**PID**
proportional element without inertia (zero-order ideal proportional element)	/	/	/	/	/
aperiodic first-order element (proportional)	/	/	/	/	/
second-order aperiodic element (both proportional and integral)			/	/	/
second-order limit aperiodic element (both proportional and integral)			/	/	/
second-order oscilating element (both proportional and integral)			/	/	/
second-order conservative (lossless) element (on the threshold of instability)			/	/	/

Source: Adapted from Balátě, J. (2004). *Automatické řízení*, Praha: BEN, pp. 99,222, Švarc, I., Matoušek, R., Šeda, M., Vítečková, M. (2011). *Automatické řízení, 2nd ed.* Brno: CERM, pp. 56-57

Proportional (static) system element/plant – CNB as a controler

It schould be considered that controller is in this case a group of human individuals (Board of CNB). With all the advantages and disadvantages. The competence of the Board members are exceptional and, on the other side of hand, the risk of erroneus decisions is also exceptional.

It is obvious, that full analogy of technical and economic systems (with a strong human aspects - i.e. behavioral) is not possible. Nevertheless Allen (1971, p. 270) emphasizes in these terms unequivocal opinion: „There is necessary only the formal similarity to anticipate that the methods used in technics will be suitable for economic models too." In this context we assume, that this condition is in this case met (with sufficient accuracy off course).

This issue will be (among others) the subject of the further research activities.

4 Conclusions

Cybernetic modeling the behavior of the Czech banking system is a long term deal on the finance department of the ESF MU – more systematically we are dedicated to the topic during the last five years. In overwhelming majority, the results obtained are very interesting and regularly break the myths about the CNB´s management potential.

In this paper, we discuss the stability of the Czech banking system with regard to the capital cost management processes.

The focus of our interest is the choice of controller, which would guarantee the stability of the Czech banking system. Result of the research is as follows:

- system of Czech commercial banks acts as a proportional first/second-order system,
- this system faces potential instability due to inappropriate management intervention,
- the controller of this system should have the control potential of the entire range of controllers (namely type I, P, PI, PD and PID controllers), preferably in the form of a PID controller.

The subject of the further research will be:

- detailed description and analysis of the technical aspects of the matter (transmission coefficient k, damping ratio ξ, time delay T_D etc.),
- transformation of the technical cybernetics approaches to stability management into the approaches of the economic cybernetics in order the stability control of the Czech banking system (with a strong human aspects), and
- objectivization of the need for CNB interventions, which is a particularly sensitive issue, because off theoretical knowledge available on this subject (so far unique), are truly alarming! For the proportional controlled system it is true that: "… after deflection from the equilibrium state, they are able to theoretically always achieve a new equilibrium state without any intervention (connection) of the controller." (Balátě, 2004, p. 113).

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How the Changes in Exchange Rate Affect the Turkish Economic Growth under Inflation Targeting Regime?

Özcan Karahan

[1] Bandırma Onyedi Eylül University
Faculty of Economics and Political Sciences, Economics Department
Merkez Yerleşkesi, 10200, Bandırma-Balıkesir, Turkey
E-mail: okarahan@bandirma.edu.tr

Abstract: *In the literature, the conventional view argues that there is a positive relationship between exchange rate and economic growth since an increase in exchange rate stimulates the volume of net exports. However, Structuralist Economists show that there may be an inverse relationship between exchange rate and economic growth. Particularly in developing countries, the input structure of production depends on the imported capital and intermediate goods, so an increase in the exchange rate negatively affects the economic growth by making imported production inputs more expensive. Turkey, leaving exchange rates free to fluctuate, have adopted Inflation Targeting (IT) as a monetary regime since 2001 and thus exhibited a genuine experience to be analysed the role of exchange rate in economic growth. Accordingly, using quarterly data from 2002 to 2017 and employing Johansen cointegration and Granger causality tests, the nexus between exchange rate and economic growth has been investigated in this study. Empirical findings indicate that, as argued by Structuralist Economists, there is a negative causal relationship from exchange rates to economic growth. From the policy perspective, it can be concluded that monetary policy applications in Turkey should provide both price and exchange rate stability together under inflation targeting regime.*

Keywords: exchange rate, economic growth, Time-Series Model

JEL codes: F31, F43, C22

1 Introduction

The economic effects created by exchange rate changes have been the subject of constant debate in the literature. With the spread of the financial liberalization period, discussions about the effects of the exchange rate on the macroeconomic variables have increased even more. Recently, deep attention has been given to examination of the link between exchange rate and economic growth. Thus, the effect of exchange rate changes on economic growth is one of the important research issues in the literature today.

Conventional view argues a positive causality relationship from exchange rate to economic growth. According to this approach, an increase in exchange rate stimulates economic growth via enlarging the volume of net export. Rising exchange rate affects the relative prices of domestic and foreign goods and hence increases exports and decreases imports. In other words, depreciation of the local currency directs the demand for foreign commodities to local products. As a result, when the exchange rate raises, it will enhance economic growth by promoting net exports. Thus, devaluation can be used as an effective policy tool to encourage economic growth.

However, the Structuralist Economists suggest that devaluation policy may have a constrictive effect on the economies of developing countries in particular. The manufacturing process of developing countries is largely based on imported inputs such as machinery and intermediate goods. Thus, with the increases in the exchange rate, the costs of imported input and accordingly the cost of production increase significantly. As a result, increased production costs will slow production and in this case leads to a decrease in total supply and economic growth. Therefore, in developing countries there is a negative causality from exchange rate to economic growth.

To sum up, the transmission mechanism between exchange rate and economic growth can be examined in two respects. In other words, it is appropriate to determine the impact of exchange rate on economic growth through two channels. According to the conventional view, the exchange rate increase has a positive effect on the economic growth by increasing the net export volume. Thus, there is a positive causality relation from exchange rate to economic growth. On the contrary, the Structuralist Economists argue that the exchange rate increase, especially in developing countries, has a negative effect on economic growth since exchange rate increase reduces the imported production input which is intensively used in the production process. For this reason, they assert that there is an inverse relationship between exchange rate and economic growth.

The aim of this paper is to make a contribution to the debate in the literature indicated above. Accordingly, the relationship between exchange rate and economic growth in Turkey will be analysed using the Johansen cointegration and Granger causality tests for the quarterly data between 2002 and 2017. Following the economic crisis in 2001, within the framework of Inflation Targeting Regime, the exchange rate in Turkey was allowed to float. Thus, Turkey provides a genuine experience to be analysed the role of exchange rate in economic growth. The rest of paper is arranged as follows. Section 2 reviews the empirical literature focusing on the relationship between exchange rate and economic growth. Section 3 explains the data and methodology. Section 4 presents empirical results. Final section concludes and makes some policy implications.

2 Literature Review

There are two different hypotheses in the literature about how exchange rate affects economic growth. In other words, there are two different perspectives on the effect of exchange rate on economic growth. Conventional approach asserts that rising exchange rate positively affects economic growth while Structuralist view argues that rising exchange rate brings about a contraction in the economy.

According to Conventional view, an increase in exchange rate creates a positive impact on economic growth via enhancing the volume of net export. The main reason for the increase in economic growth with net exports here is the change in the relative prices of domestic and foreign goods after the increase in exchange rates. Namely, depreciation of local currency decreases the prices of domestic goods while makes the prices of goods abroad much more expensive. Thus, depreciation of exchange rate firstly increases the volume of net export and then growth rate of economy. That means devaluation can be used as a policy tool promoting economic growth. Accordingly, the positive impact of currency depreciation on economic growth has been widely documented in the literature. Indeed, mainstream studies have mostly produced the econometric results concerning with the positive correlation from exchange rate increase to net export and economic growth.

Domaç (1997), for the period 1960-1990, examined the relationship between exchange rate and economic growth in Turkey. Using regression analysis, he found that unexpected devaluations are a positive effect on output. Thus, he determined that the contractionary devaluation hypothesis is not valid in Turkey. Narayan and Narayan (2007) investigated the effects of devaluation for the Fiji economy between 1970-2000. They employed the co-integration method and found that the devaluation in the short and long term led to widening effect for the Fiji economy. They found that 10% devaluation increased the output by 2.3% or 3.3%. Rodrik (2008) examined the relationship among economic growth and real exchange rates using a data set from 188 countries between 1950 to 2004. Rodrik found a systematic positive relationship between growth and depreciation in the real exchange rate. However, the increase in the depreciation of the real exchange rate has only caused to economic growth only in some developing countries. According to him, this relationship does not apply to developed rich country economies.

Di Nino et al. (2011) analysed the connection between exchange rate and economic growth in Italy. They concluded that there is a positive relationship between undervaluation and economic growth for a dataset covering the period 1861–2011. In addition, the authors also showed that undervaluation supported growth by increasing exports, especially in

high-productivity sectors. Chen (2012) focused on the role of exchange rate in economic growth and the convergence of growth rates in Chinese provinces. Data set between 1992 and 2008 for 28 provinces were tested with dynamic panel data estimation. He found that real exchange rate increase has a positive effect on the economies of provinces. Aman et al. (2013) investigated the relationship between exchange rate and economic growth in Pakistan for the period 1976–2010 by employing two, three stage least square techniques. They showed that exchange rate has a positive impact on economic growth through the promoting export and import substitute industry. Habib et al. (2017) analysed the impact of movements in the real exchange rate on economic growth based on five-year average data for a panel of over 150 countries in the post Bretton Woods period. They determined that a real depreciation raises annual real GDP growth. Thus, the results revealed the broader economic effects of devaluation for developing countries.

As seen in the literature, many studies have found that the rising exchange rate ratio has a positive impact on the economy and thus supported the devaluation policy for economic growth. However, Structuralist economists have argued that the rising exchange rate has a restrictive effect on economic growth, especially in developing countries. Therefore, devaluation policy creates confining impact on the growth of developing economies (Bird and Rajan 2004:143-144). The negative impact of increases in exchange rates on economic growth arises from the restrictive effects on imported input. The production structure of developing countries is mainly dependent on the imported input. Therefore, the increases in the exchange rate create a negative impact on economic growth by decreasing the imports of raw materials, intermediate goods and investment goods. That's why the devaluation policy produces positive outcomes in some developed countries while it results in negative consequence on economic growth in developing countries (Hallwood and Macdonald, 2003:421).

Furthermore, it has been argued that import affects growth in developing countries by transferring of new knowledge or technology from abroad. Thus, import affects economic growth in developing countries by not only providing production input but also enhancing the domestic technological capability. Imported machinery and intermediate goods generates the channels for diffusion of new technology among countries. Therefore, it is clear that import have the impact on developing countries' growth by raising technological capacity of economy through transferring new knowledge. The important role of imports in technological diffusion has been extensively documented in the literature. (Lee 1995; Mazumdar 2001; Keller 2004).

In conclusion, rising exchange rate which causes imports to be restricted decreases economic growth by both reducing the availability of production input and technology transfer. Accordingly, many studies in the literature have shown that depreciation of the local currency caused to a contraction in the economies of developing countries. Bahmani-Oskooee et al. (2002) examined the transfer mechanism from exchange rate to economic growth in 5 Asian countries using the monthly data between 1976 and 1999. The empirical results of Johansen cointegration and Granger causality tests indicated that depreciation of local currencies have a negative impact on economic growth in Asian countries. Galindo and Montero (2005) investigated the causality relationship from exchange rate to economic growth by using panel data relating to 9 Latin American countries. Empirical results indicated that rising exchange rate in the Latin American countries which have high foreign debt ratio negatively affects economic growth. Yiheyis (2006) investigated the interaction among the exchange rate and economic growth in 20 African countries for the term 1981-1999. The results of unbalanced panel data analysis indicated that depreciation of local currencies creates a shrinking effect on economic growth.

Blecker and Razmi (2008) examined the impact of devaluation on economic growth in 17 developing countries for the period 1983-2004. Results of dynamic panel data analysis (Generalised Method of Moments) showed a negative relationship between exchange rate and economic growth. As a result, the authors emphasize that contractionary effect of devaluation for developing countries compared to industrialized countries. Vaz and Baer (2014) employed a panel model using unbalanced panel data covering 1995-2008 for a

sample of 39 countries. They showed that depreciation of currency in Latin American countries causes a nominal cost increase in production process and hence decreases economic growth rate rather than raises it. Çelik et al. (2017) investigated transfer mechanism from exchange rate to economic growth via panel data analysis using cross-sectional data between 1995 and 2014 for 12 transition economies in Eastern Europe and Middle Asia. The results of study showed that an increase in exchange rate result in economic downturn. However, they also indicated that real exchange rate movements do not turn out to be the major variable in explaining the economic growth.

3 Data and Methodology

The aim of the study is to examine the relationship between exchange rate and economic growth using quarterly data between 2002-Q1 and 2017-Q4. The variables of exchange rate (ER) and economic growth rate (EG) are sourced from Electronic Data Delivery System in Central Bank of the Republic of the Turkey. Empirical analysis begins by checking the stationary statute of data set by using Dickey and Fuller and Phillips-Perron Tests. Then, the long run relationship between inflation and interest rate is analysed by using Johansen (1988) Cointegration Test. Finally, we examine the causality relationship between inflation and interest rate by operating Granger (1988) Causality Test based on Error Correction Model.

The stationarity analyses of the variables were performed with the ADF (Augmented Dickey Fuller-ADF) and PP (Philips Perron) unit root tests. The constant model used in the unit root tests developed by Dickey and Fuller (1981) can be shown as equation 1. Test results determined by estimation of these model are evaluated in terms of critical values of MacKinnon and the null hypothesis ($H_0: \alpha = 0$) is tested against the alternative hypothesis ($H_1: \alpha \neq 0$). The null hypothesis indicates that the series is not stationary, while the alternative hypothesis suggests that the series is stationary.

$$\Delta Y_t = \beta_0 + \alpha Y_{t-1} + \sum_{i-1}^{m} \Delta Y_{t-i} + \varepsilon_t \quad (1)$$

The unit root test developed by Phillips-Perron (1988) is based on the model determined in Equation 2. In this equation T determines the number of observation while t indicates time. Test results determined by estimation of these model are evaluated in terms of critical values of MacKinnon. The null hypothesis ($H_0: \lambda = 0$) is tested against the alternative hypothesis ($H_1: \lambda < 0$). The null hypothesis states that the series contain unit root while the alternative hypothesis states that the series do not contain unit root.

$$\Delta Y_t = \delta_0 + \lambda Y_{t-1} + \delta_1 (t - T/2) + u_t \quad (2)$$

The cointegration test developed by Johansen and Juselius (1990) is suitable for examining the long-term relationship between variables after determining that the data are stable at the same level. This method makes an analysis of cointegration over the system of simultaneous equations generated by using variables that become stable at the same time when the difference is taken. In the framework of this methodology a VAR (Vector Autoregressive) Model with p degree in Equation 4 is operated.

$$Y_t = \mu + AY_{t-1} + \ldots\ldots + A_p Y_{t-p} + e_t \quad (3)$$

Equation 3 can be rearranged as in equation 4 by taking the first difference.

$$\Delta Y_t = \mu + \Pi Y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_{t-i} + e_t \quad (4)$$

In Equation 4, Π is the parameter indicating the long term relation. Thus, the cointegration hypothesis is analyzed through the equation which is Π = α β. So, α and β (pxr) represents a two-dimensional matrix. The matrix α shows the rate of improvement of the deviations from the long-run equilibrium of the variables while β denotes the cointegration vector showing the long-term effects of the variables in the equilibrium relations. The number of cointegration vectors is examined in the framework of Trace Statistics and Maximum-Eigen Statistics. Thus, both tests investigate long term associations by determining how many cointegrated vectors are among the variables.

Trace Statistics can be calculated from the formula indicated in Equation 5. Here, the null hypothesis ($H_0: r \leq m-1$) is tested against the alternative hypothesis ($H_1: r \geq m$).

$$\lambda_{\text{trace}}(\text{r}) = -\text{T} \sum_{\text{i=r+1}}^{\text{m}} \ln\,(1-\lambda_{\text{i}}) \tag{5}$$

Max-Eigen Statistics can be calculated from the formula indicated in Equation 6. Here, the null hypothesis ($H_0: r \leq m-1$) is tested against the alternative hypothesis ($H_1: r \geq m$).

$$\lambda_{\max}(\text{r}, \text{r}+1) = -\text{T} \ln(1-\lambda_{\text{r+1}}) \tag{6}$$

If the cointegration relation is found between the variables used in the analysis, then the VECM (Vector Error Correction Model) method should be used when the dynamic effects are examined in the next stage. Accordingly, the models to be used in the causality test developed by Granger (1988) are defined in Equation 7 and 8 below, including the error correction term.

$$\Delta \text{Y}_{\text{t}} = \beta_0 + \sum_{\text{i=1}}^{\text{m}} \alpha_{\text{i}} \Delta \text{Y}_{\text{t-i}} + \sum_{\text{k=1}}^{\text{m}} \beta_{\text{k}} \Delta \text{X}_{\text{t-k}} + \lambda_1 \text{ECT}_{\text{t-1}} + \text{u}_{\text{t}} \tag{7}$$

$$\Delta \text{X}_{\text{t}} = \text{u}_0 + \sum_{\text{i=1}}^{\text{m}} \text{u}_{\text{i}} \Delta \text{X}_{\text{t-i}} + \sum_{\text{k=1}}^{\text{m}} \delta_{\text{i}} \Delta \text{Y}_{\text{t-k}} + \lambda_2 \text{ECT}_{\text{t-1}} + \text{v}_{\text{t}} \tag{8}$$

In equations, the coefficients of the error correction term (ECT) λ_1 and λ_2 show the rotational speed of X and Y variables to equilibrium relation. Error correction coefficients are expected to be negative and statistically significant. In the framework of Granger causality test, whether the α and δ coefficients in the equations are meaningful is tested by the standard F-test. Accordingly, by equation (7) Y Granger causes X if the null of either $\sum_{\text{k=1}}^{\text{m}} \beta_{\text{k}} = 0$ or $\lambda_1 = 0$ is rejected. On the other hand, by equation (8), X Granger causes Y if λ_2 is significant and $\sum_{\text{k=1}}^{\text{m}} \delta_{\text{i}}$ are jointly significant.

4 Results and Discussion

Before running the econometric analysis of the model, we test whether time series used in the model are stationary or not. Accordingly, we check whether time series of economic growth rate (EG) and exchange rate (ER) are stationary by using Augmented Dickey Fuller (ADF) and Philips Peron (PP) tests. Table 1 presents the results of unit root tests. Findings show that all variables are not stationary at level. However, by first differentiation all series become stationary since the calculated test statistics exceed the critical values. In conclusion, both economic growth (EG) and exchange rate (ER) series are integrated of the same order at I (1).

Table 1. Results of Unit Root Tests

	ADF (Augmented Dickey Fuller)		PP (Philips Peron)	
Variables	Level	First Difference	Level	First Difference
EG	-3,5311	-6,5466*	-2,4321	-4,5675**
ER	-2,8346	-5,4184*	-1,8778	-3,1134**

Not: * and ** indicate the significance level at 1 % and 5 %, respectively.
Maximum lag length is specified by considering Akaike Information Criterion (1).
Source: Author

After determining that both the series of exchange rate (ER) and economic growth (EG) are integrated of the same order at I (1), we employ Johansen cointegration test in order to investigate the long run relationship between the variables. The results of Johansen Cointegration analysis are presented in Table 3. Results show that the computed value of the both Trace Statistic and Max-Eigen statistic are more than the critical value at 5% level of significance. Therefore, the null hypothesis that there is no co-integrating vector was rejected. Thus, the results of both cointegration test implies that there is long run relationship between exchange rate and economic growth in Turkey.

Table 3 Johansen Cointegration Tests Results

Null Hypothesis	Trace Statistics		Maximum Eigenvalue Statistics	
	Test Statistic	% 5 Critical Value	Test Statistic	% 5 Critical Value
$r = 0$	26.8643	19.7432	20. 6784	16.3467
$r \leq 1$	7.5431	8.7854	7.5431	8.7854

Source: Author

Given the long run relationship among the variables, Granger causality test based on the VECM (Vector Error Correction Model) has been employed in order to detect the direction of relation between the variables. The results of Granger causality test are presented in Table-4. According to results, we reject the null hypothesis that exchange rate (ER) does not Granger cause economic growth rate (EG). Thus, findings reveal that causality runs from exchange rate (ER) to economic growth (EG) while the reverse causation is not confirmed.

Table 4 Granger Causality Test

Null Hypothesis	F-Statistic	*p*-Value	Decision
ER does not Granger cause EG	3.1253*	0.0180	Reject
EG does not Granger cause ER	0.9811	0.4831	Not Reject

Not: * indicates the significance level at 5 %. Maximum lag length is specified by Akaike Information Criterion (1).

Source: Author

Finally, in order to show short-run dynamics between exchange rate and economic growth, the results of VECM estimation are presented in Table 5. The coefficient of error correction term is statistically significant and negative as we expected. Findings also indicated that exchange rate affects economic growth negatively as confirmed by the sign of the related coefficient (ΔER_{t-1}).

Table 5 Estimation Results of Vector Error Correction Model

Variables	Coefficient	*t Value*	Probability
Constant	0.134**	1.649	0,024
EC_{t-1}	-0.281*	-3,195	0,001
ΔER_{t-1}	-0.133**	-2.078	0.031
ΔEG_{t-1}	0.621*	3,841	0.000

Not: *, ** indicates the significance level at 1% and 5 %, respectively.
Diagnostic Tests: Adj. R^2 = 0.312; F test = 4.502 =.025); D.W = 2.034

Source: Author

Overall, empirical results indicated that there is a unidirectional negative causality from exchange rate to economic growth. These finding supports structuralist view asserting that depreciation of local currency have a contractionary impact on economic growth. It seems that depreciation of Turkish Lira restricts imports that create the appropriate conditions for economic growth by providing machinery, equipment and raw materials needed as the production inputs. In terms of policy implementation, empirical findings also give significant insights for the effectiveness of Inflation Targeting Policy adopted in Turkey since 2001. According to this, since the exchange rate is one of the significant determinants of economic growth in Turkey, special importance should be given to exchange rate management under Inflation Targeting Regime. In other words, Inflation Targeting Policy in Turkey should fulfil a difficult task by successfully providing both price and exchange rate stability in the same time.

5 Conclusions

In the literature, there are two basic approach related to transfer mechanism between exchange rate and economic growth. Conventional view argues that rising exchange rate stimulates economic growth via enlarging the volume of net export. Contrarily, Structuralist view claims that there is a negative relationship between exchange rate and economic growth in developing countries in particular. After an increase in exchange rate, in the developing countries that manufacture on the basis of external inputs, the cost of production increases and consequently the economic growth is adversely affected. In the line with the views indicated above, we examine the relationship between exchange rate and economic growth in Turkey using Johansen co-integration and Granger causality tests for the quarterly data from 2002 to 2017.

The findings of Johansen cointegration test show that exchange rate and income are significantly cointegrated in the long run. Estimation results of Granger causality test and Vector Error Correction Model indicated a negative causality relationship from exchange rates to economic growth. Together all of these findings provide an econometric confirmation for structuralist view arguing that the rise in the exchange rate causes a contraction in economic activity. From the policy perspective, instead of completely liberalizing the exchange rate in the framework of inflation targeting strategy adopted since 2011, policy makers in Turkey have to prevent the upside movements in the exchange rate by taking into consideration its negative effect on economic growth.

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The Effect of Bank Credit on the Current Account Balance in Turkey

Özcan Karahan[1], Metehan Yılgör[2], Hakan Öndes[3]

[1] Bandırma Onyedi Eylül University
Faculty of Economics and Political Sciences, Economics Department
Merkez Yerleşkesi, 10200, Bandırma-Balıkesir, Turkey
E-mail: okarahan@bandirma.edu.tr

[2] Bandırma Onyedi Eylül University
Faculty of Economics and Political Sciences, Econometrics Department
Merkez Yerleşkesi, 10200, Bandırma-Balıkesir, Turkey;
E-mail: myilgor@bandirma.edu.tr

[3] Bandırma Onyedi Eylül University
Faculty of Economics and Political Sciences, Econometrics Department
Merkez Yerleşkesi, 10200, Bandırma-Balıkesir, Turkey
E-mail: hondes@bandirma.edu.tr

Abstract: *Like another developing country, one of the most important problems in Turkish economy is the large current account imbalance which continues permanently. Past experiences in the Turkish economy indicated that persistent large current account imbalances make financial system more fragile and cause serious currency crises. Therefore, examining the determinants of current account deficit in Turkey becomes a significant research topic. Accordingly, this study aims to analyse the impact of bank credit expansion on current account balance in Turkey. Covering the quarterly data between 2004 and 2017 the relationship between bank credit and current account balance has been investigated in the long run and the short run by ARDL Model. Empirical results show that there is a causal relationship from credit growth to current account deficit. It seems that credit expansion has been one of the leading reasons behind the growing current account deficits in Turkey. Thus, the results indicate that policy-makers in Turkey should take into account the credit expansion while keeping the current account balance as the primary objective to provide financial system soundness and economic stability.*

Keywords: bank credit, current account deficit, ARDL model

JEL codes: E51, F32, C22

1 Introduction

Along with the liberalization process of the 1980s, real and financial economic relations among the countries have increased. In this process, the current account balance which demonstrates domestic residents' transactions with foreigners in the goods markets had been critical for the developing economies from various aspects. Even if developing countries have the opportunity to finance current account deficits by attracting foreign capital flows from international financial markets, national economies with high levels of current account deficits in the turbulent global market environment have become more vulnerable to external economic conditions. For this reason, high level of current account deficit has been accepted as an indicator that show the imbalance in the economy and country's risk increase.

Thus, the fight against the current account deficit can be seen as one of the main policy objectives for developing countries. In this context, studies aiming to determine the dynamics of current account deficits have begun to take an important place in the literature. Economists have identified many factors that cause the current account deficit in developing countries. However, in recent years, economists have focused on the credit expansion as the basic dynamic of current account deficit. Accordingly, expansion of bank credit leads current account balance via increasing total consumption. Thus, total credit volume in banking sector regarded as a driving force behind the growth of the current account deficit. Therefore, economic policies towards controlling the volume of bank credit have crucial importance for developing countries with high current account deficits.

Turkey is also among the countries facing with the problem of current account deficit. Indeed, the current account deficit for Turkish economy was a chronic macroeconomic problem which had generated financial instability and economic crisis in the past. Therefore, changes in the current account deficit and its determinants are on the top topics of agenda in Turkish economy today. Accordingly, this study examined the dynamics determining the current account balance focusing on the role of credit expansion in Turkey. More specifically, the aim of our study is to explore the impact of credit expansion in Turkey on current account balance during the period of 2004- 2017 by employing ARDL model. The paper proceeds as follows: Section 2 discusses the related literature briefly. Section 3 presents the data, econometric methodology and results. Final section concludes and makes some policy implications.

2 Literature

Looking at the literature, it seems that one of the most important macroeconomic problems in developing countries is current account deficit. It also seems that credit volume has been shown among the basic determinants of current account deficit by most of the economists. It can be theoretically asserted that an increase in bank credit would have an unbalancing effect on the current account deficit via stimulating import in developing countries. Accordingly, bank credits increase total domestic consumption, which results in increasing volume of imported consumption and investment goods.

Credit expansion or an increase in total domestic credit volume means that economic actors within the country have an additional income and purchasing power. This additional purchasing power is expected to increase both domestic demand and external demand since it is almost impossible to assess all of the consumer demand within the country. The increase in consumption demand for the foreign market directly increases the current account deficit. The increase in demand for the domestic market also leads to a current account deficit indirectly by increasing the imports of investment goods such as capital and intermediary goods in developing countries. As is known, the production structure in developing countries is overly dependent on the import of foreign intermediate and machinery equipment. That means firms in developing countries produce on the basis of imported inputs. For this reason, the increase in domestic demand due to the expansion of bank credits and the start of additional production of companies cause the increase of imported input production, which results in the increase of the current account deficit.

There are numerous empirical studies analysed whether there is a causal relationship between bank credit and current account deficits. It seems that total credit volume in banking sector is a driving force behind the growth of the current account deficit. Brissimis et al. (2012) studied the main macroeconomic factors that shaped current account development in Greece over the period from 1960 to 2007. They found that credit growth was pivotal in explaining the fall of the private saving rate and thus a factor deteriorating of the current account. Ekinci et al. (2015) analysed the determinants of the current account balance for the annual dataset covering the period from 1991 to 2011 in 49 countries including industrial and developing ones. They employed generalized method of moments (GMM) procedure in the framework of dynamic panel data analysis and reported a significant deterioration in the current account balance in case of an increase in the credit growth. The acceleration of loan growth has a deteriorating effect on current account balance especially in emerging countries. Buyukkarabacak and Krause (2009) investigated the impact of household and firm credit on current account deficit using data between 1990 and 2011 in 18 emerging economies. Employing panel data analysis, it was concluded that household credit is negatively but firm credit is positively correlated with the trade balance. In other words, consumer credit and producer credit have sharply different impacts on the trade balance.

Concerning with the case of Turkey, Göçer, İ. (2013) investigated the relationship between total domestic credit and current account deficit in Turkey. The results of cointegration test with multiple structural breaks using quarterly data over the period 1992—2013 determined that an increase in the domestic credit volume is a factor in increasing the

current account deficit. Demirhan (2014) analysed the effect of credit growth on current account deficit using quarterly data ranging from 1998 to 2015. Empirical results of ARDL model showed that credit growth have a significant impact on current account deficit in the short run and the long run. Thus, it was concluded that credit growth is taken into consideration as policy instruments improving current account balance in Turkey. Soydan (2016) empirically analyzed the relationship between current account balances and domestic credit dynamics in the case of Turkey. The results of ARDL bounds testing methodology showed the causality between domestic credit and external balance. Accordingly, he concluded that policymakers should designed a policy towards bring credit growth down in order to reduction in current account deficit. Karahan and Uslu (2016) investigated the relationship between credit by which commercial bank to private sector and current account deficit covering the period of 2005-2015. Employing ARDL model, it is asserted that credit volume is statistical significant and positively affects current account deficit in the short and long run. Therefore policymakers in Turkey should slow down credit volume in response to current account deficit in order to ensure financial stability.

Looking at the literature it seems that some studies decompose bank credit while examining the impact on external balance in Turkey. Telatar (2011), using the quarterly data between 2003 and 2010, examined the impact of different bank credit on current account deficit. He found that there is no significant causality relation to the current account from the total loans but there is a positive causality relation to the current account from the consumer loans. In other words, he showed that consumer credits, rather than total credits, contribute to current account deficit. Turgutlu (2014) also decomposed consumer loans into sub-categories as real estate loans, vehicle loans and other loans to investigate their individual effects on the current account balance of Turkey over the period 2000-2013. The results of ARDL model indicated that real estate loans and other loans negatively affected the current account balance. Alioğulları et al. (2015) investigated the relationship between consumer and commercial loan growths and current account deficit in Turkey. Regression analysis using quarterly data between 2003 and 2015 revealed that consumer loan growth negatively and statistically significantly affects current account balance while commercial loan growth has no statistically significant effect. Finally, Dücan (2016) investigated the impact of the increase in consumer credit on current account deficit using quarterly data covering the period between 2009 and 2015. Granger causality test and impulse response analysis and variance decomposition based on the VAR model were carried out. Empirical findings showed that the increase in consumer loans seems to be quite high share in the expansion of current account deficit.

Contrary to studies indicated above, some studies found no relationship between bank credit and externa balance in Turkey. For example, Gacaner and Saygılı (2014) used quarterly data for the period of 1998-2013 to identify the determinants of the current account deficit in Turkey. When the variables affecting the current account deficit are evaluated together, they determined that the effects of variables representing monetary aggregates like bank credit are weak. Thus, their results showed that the limitations on the loans are not enough to reduce current account deficit problem. Akçayır and Albeni (2016) examined the link between the volume of loans and the current account deficit in Turkey. Conducting Toda-Yamamoto test and ARDL Model for quarterly data set covering the period between 1992 and 2014, they found that the impact of bank credit on current account deficit is very weak. Therefore, they argued that it is impossible to think of the total domestic credit volume as the single most powerful cause of the current deficit in Turkey. Thus, it is not anticipated that policies towards restriction of bank credit expansion will be effective over the elements that increase current account deficit.

3 Data, Methodology and Empirical Results

The aim of this section is to empirically analyse the relationship between credit expansion and the current account deficit in Turkey. We use quarterly data covering the period 2004-Q1 and 2017-Q4. The amount of bank credit consists of all kinds of loan given to firms and household except credit cards. The current account deficit (CAD) and total bank credit (BC) variables used in the model is obtained as ration of current account deficit and bank credit

data to Gross Domestic Product (GDP). In addition, the logarithms of the series were taken and each data are shown as LBK and LCAD. All of the data set is compiled from the Electronic Data Distribution System (EDDS) in Central Bank of the Republic of Turkey (CBRT).

Empirical analysis begins by conducting the unit root tests such as ADF and PP in order check the stationary status of the variables. Later, the relationship between the series of bank credit and current account balance has been examined by using the autoregressive distributed lag (ARDL) model popularized by Pesaran, et al. (1996), Pesaran (1997) and Pesaran and Shin (1999). ARDL model does not impose a restrictive assumption that all the variables under study must be integrated of the same order. This model also allows us to get consistent and robust results both for the long-run and short-run relationship among the variables even if he sample size is small. In the framework of ARDL model we follow three-step procedure.

Firstly, cointegration relationship between the series of bank credit and current account balance has been examined by using Bond Test. In the framework of bounds test, calculated F-statistics is compared with the critical value tabulated by Pesaran (1997) and Pesaran et al. (2001). If F-statistics exceeds the upper critical value, the null hypothesis of a no long-run relationship can be rejected. If the test statistic falls below a lower critical value, the null hypothesis is not rejected. However, if the test statistic falls between these two bounds, the result is inconclusive. When the order of integration of all the variables is I (1), the decision is made based on the upper bound. If all the variables are I (0), then the decision is made based on the lower bound.

In the second step, if there is evidence of a cointegration among the variables, the long-run model indicated in Equation 1 is estimated. It is expected that coefficient of bank credit (λ) is positive and statistically significant.

$$\mathrm{LCAD_t} = \delta_1 + \sum_{i=1}^{n} \beta_i \, \mathrm{LCAD}_{t-1} + \sum_{i=1}^{n} \lambda_i \, \mathrm{LBC}_{t-1} + \varepsilon_t \qquad (1)$$

In the third step, based on the finding related to a long run relationship, error correction model (ECM), which indicates the speed of adjustment back to long-run equilibrium after a short-run disturbance is estimated. The standard ECM involves estimating the model indicated in Equation 2. It is expected that coefficient of error correction term (ECT) is negative and statistically significant

$$\Delta\mathrm{LCAD_t} = \Upsilon_1 + \emptyset_0 \mathrm{ECT}_{t-1} \sum_{i=1}^{n} \mathrm{u_i} \, \Delta \, LCAD_{t-i} + \sum_{i=1}^{n} \alpha_i \, \Delta \, \mathrm{LBC}_{t-i} + \varepsilon_t \qquad (2)$$

Unit Root Test

Firstly, to determine the order of integration for each variable we use the Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) tests. The first step of the empirical methodology is finding the order of integrations of the data. Accordingly, in order to indicate the stationary statute of data set related to bank credit (LBC) and current account deficit (LCAD) we perform Augmented Dickey Fuller (ADF) and Philips Peron (PP) unit root tests. The results of the Augmented Dickey-Fuller and Phillip Perron tests are presented in Table-1. Bank credit (LBC) is integrated to the order of one I (1), while the current account deficit (LCAD) is also integrated to the order of one I (1). Findings show that all variables are not stationary at level but both series become stationary after taking their first difference. Thus, unit root test results show that all time series in the model have same order I (1).

Table 1 Results of Unit Root Tests

	ADF (Augmented Dickey Fuller)		PP (Philips Peron)	
Variables	Level	First Difference	Level	First Difference
LBC	-1,274	-3,332**	-1,676	-2,679*
LCAD	-2,159	-5,488***	-2,028	-2,242*

Note: *, ** and *** denote statistical significance at the 10 %, 5 % and 1 % levels, respectively. Maximum lag length is specified by considering Akaike Information Criterion (2).
Source: Authors

Cointegration Tests

In this section we employ cointegration tests which are the standard tools in order to investigate the linear combination of time series variables. In the framework of ARDL model, bounds test is applied to indicate whether bank credit (LBC) and current account deficit (LCAD) have a long run relationship or not.

In the framework of bounds test for co-integration, we firstly determine lag order as 5 based on Akaike Information Criterion. Accordingly, bounds test is employed and the results are shown in Table-2. As can be seen from the Table calculated F-statistic (6.333) is higher than the upper bound critical value at a 5% level of significance (4.390) as reported by Pesaran et al. (2001). This implies that the null hypothesis of no cointegration is rejected at 5%. Therefore, there is a cointegrating relationship among the bank credit and current account deficit. In other words, the result of the bounds test indicates that there is a stable long-run relationship between the bank credit and current account balance.

Table 2 ARDL Bound Test Results

F statistics (k=1, n=55)	Critical Values					
	1%		5%		10%	
4,90	I (0)	I (I)	I (0)	I (I)	I (0)	I (I)
	3.143	3.670	3.790	4.190	5.377	6.047
Diagnostic Test	R^2	Adj. R^2	LM Test	BP	JB	Wald
	0.81	0.75	2.45 (0.10)	1.05 (0.42)	1.07 (0.58)	4.90

Note: k is the number of independent variables while N indicates the number of observations. Critical values are taken from Narayan (2005).
Source: Authors

Results of Long Run Estimation

After indicating the presence of cointegration among the variables, in this part of study we estimated the coefficients indicated the long run relationship between bank credit and current account deficit. The empirical results of the long-run model obtained by ARDL (6,5) based on Akaike Information Criterion are presented in Table-3. The impact of the bank credit on the current account deficit is positive and statistically significant. The results indicate that the bank credit is an important determinant of current account deficit. Every 1% increase in bank credit yields average 0.231% deterioration in the current account balance. Thus, the results confirm the theory asserting that a rise in bank credit increases the total consumption and will therefore increase imported consumption and investment goods and deteriorate the current account balance.

To ascertain the goodness of fit of the ARDL model, the results of diagnostic and stability tests also have been presented in Table 3. Test results of LM, Breusch-Pagan and Jarque-Bera indicate that there is no problem of the serial correlation, heteroscedasticity, normality, associated with the model.

Table 3 Estimated Long-Run Coefficients for ARDL (6,5)

Variables	Coefficients	Prob.
LCAD(-1)	1.955***	0.000
LCAD(-2)	-2.087***	0.000
LCAD(-3)	1.653***	0.000
LCAD(-4)	-1.179**	0.010
LCAD(-5)	0.686**	0.044
LCAD(-6)	-0.196	0.191
LBC	0.231**	0.038
LBC(-1)	-0.634**	0.039
LBC(-2)	1.085*	0.077
LBC(-3)	-1.213*	0.086
LBC(-4)	1.083*	0.099
LBC(-5)	-0.547**	0.030
C		
Long Term Coefficients		
C	0.258**	0.035
BC	0.231**	0.040
Diagnostic Test		
R^2	0.95	
Adj. R^2	0.94	
LM test	2.02 [0.16]	
Breusch-Pagan	0.95 [0.50]	
Jarque-Bera	1.70 [0.42]	

Note: *, ** and *** denote statistical significance at the 10 %, 5 % and 1 % levels, respectively.

Source: Authors

Results of Short Run Estimation

The results of the ECM obtained by ARDL (5,6) based on Akaike Information Criterion are presented in Table-4. Estimated coefficient of bank credit is positive and statistically significant. Every 1% increase in bank credit yields average 0.212% deterioration in the current account balance. It seems that the magnitude of positive impact of bank credit on the current account deficit is smaller than that of the long-run impact (0.231%). This finding indicates that the impact of change in bank credit on current account balance is stronger in the long run compared to short run.

Error correction term (ECT_{-1}) is one lagged value of the residuals from long-run ARDL model and the coefficient of it is the speed of adjustment towards long term equilibrium path. The coefficient of the lagged error term (ECT_{-1}) is negative and highly statistically significant as we expected. The significance of error correction term shows the causality in at least one direction. The coefficient of -0.579 indicates the rate of convergence to equilibrium, which implies that deviation from the long-term equilibrium is corrected by 57.90 % over each quarter. We apply a number of diagnostic tests to ascertain the goodness of fit of the error correction model. Findings of LM and Breusch-Pagan confirm that there is no serial correlation and heteroskedasticity, respectively. The model also passes the Jarque-Bera normality test which suggests that the errors are normally distributed.

Summing up the empirical results, it can be inferred that there is reasonable evidence depicting both positive long-run and short-run relationship between the bank credit and current account deficit in the case of Turkey. In other words, results of ARDL model indicate that the credit volume of Turkish Economy is statistical significant and positively affects current account deficit in the short and long run. The policy implication is that credit growth is taken into consideration as policy instruments improving current account balance and hence macroeconomic stability in Turkey. For example difficulties in the current account balance can be corrected through monetary policies restricting the volume of bank credit.

Table 4 Estimated Error Correction Model

Variables	Coefficients	Prob.
ΔLCAD(-1)	1.615***	0.000
ΔLCAD(-2)	-1.875***	0.000
ΔLCAD(-3)	1.453***	0.000
ΔLCAD(-4)	-1.294***	0.000
ΔLCAD(-5)	0.795***	0.004
ΔLCAD(-6)	-0.450***	0.002
ΔLBC	0.212**	0.038
ΔLBC(-1)	-0.332**	0.044
ΔLBC(-2)	0.652**	0.029
ΔLBC(-3)	0.504**	0.024
ΔLBC(-4)	0.414	0.107
ECT(-1)	-0.579*	0.084
C	-0.008	0.353
Diagnostic Test		
R^2	0.82	
Adj. R^2	0.76	
LM Test	1.44 [0.25]	
Breusch-Pagan	1.63 [0.12]	
Jarque-Bera	1.32 [0.51]	

Note: *, ** and *** denote statistical significance at the 10 %, 5 % and 1 % levels, respectively.

Source: Authors

4 Conclusions

Continuity high current account deficit has been one of the crucial economic problems in Turkey from past to now. Namely, an increase in current account deficit has been considered as significant factor raising country risk and leading to economic crisis. Therefore, it is crucial to indicate the dynamics of current account imbalance for Turkish economic agenda. Accordingly, this article is an attempt to examine the short and long-run relationship between the bank credit and current account balance in the case of Turkish economy. The autoregressive distributed lag (ARDL) model is applied to quarterly data for the period 2004 to 2017 in order to investigate whether a causal relationship exists between the bank credit and current account balance.

The result of the bounds test indicates that there is a stable long-run relationship between the bank credit and current account balance. The estimated coefficients in the short run and long run ARDL models show that the volume of bank credit is positively related to the current account deficit. Thus, the results provide an evidence that bank credit play a stronger role in determining the behaviour of the current account deficit in Turkey. This finding also shows that unbalancing impact of bank credit expansion on current account is crucial factor determining macro-economic risks in Turkey. Thus, management of the volume of bank credit is crucial for designing policies aimed at macroeconomic stability. That means the monetary policy framework of Central Bank of the Republic of Turkey (CBRT) should take into account the volume of bank credit while keeping the current account balance and macroeconomic stability together.

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Relations between IFRS Adoption and Financial and Non-financial Measures of Economic Entities, Empirical Results from the Selected Countries of Western Europe

Marcin Kędzior[1], Dorota Kędzior[2]

[1] Cracow University of Economics
Faculty of Finance and Law, Financial Accounting Department
ul. Rakowicka 27, 31-510 Cracow, Poland
E-mail: kedziorm@uek.krakow.pl

[2] Cracow University of Economics
Faculty of Finance and Law, Corporate Finance Department
ul. Rakowicka 27, 31-510 Cracow, Poland
E-mail: kedziord@uek.krakow.pl

Abstract: *The aim of the article was to analyze the relationship between the application of IFRS by economic entities and financial and non-financial measures of enterprises in the selected countries of Western Europe. 461 companies from Western European countries were analyzed. The article discusses the issues of preparing financial statements according to IFRS. The subject of the detailed analysis were correlations between the IFRS application and profitability, liquidity ratio, assets turnover, investment intensity, total debt ratio, company size, company growth, international activity, market share and industry concentration. The higher level of risk, lower liquidity, lower turnover of assets, higher capital intensity, higher company size, age of the business unit, broader international operations and higher market shares in companies applying IFRS in selected countries of Western Europe were verified empirically.*

Keywords: IFRS adoption, European Union, financial ratios, non-financial ratio, accounting harmonization

JEL codes: M41, M42, M21, L6, L2

1 Introduction

International Financial Reporting Standards have been globally recognized and accepted in accounting. They should be considered as the most mature form of harmonization of local accounting standards applied in particular countries, and they have been implemented in over 120 countries. The scope of their application varies significantly, however they are most commonly applied on stock exchanges. Within the area of the EU, all listed companies preparing consolidated financial statements are obliged to comply with their standards. In some countries, it is required to apply them in all entities, both listed and unlisted (Bulgaria), whilst in other countries they are allowed, yet not mandatory for the financial reports of unconsolidated listed companies (Great Britain), or finally in some other countries their application for the mentioned above companies is prohibited (Hungary, Sweden, Spain). Within the confines of the EU, voluntary use of standards in the countries of Western Europe has been increasing, even though the dynamics of that increase has somehow slowed down (Kędzior, 2015).

The application of IFRS is beneficial for many participants in the market. The standards enhance the quality of financial reporting; it is more precise, submitted on time, it better protects the interests of minority investors, largely eliminates disparities between local accounting standards, lowers the cost of financial information for the investors (Ball, 2006). Nonetheless, the application of IFRS proves to be costly for many entities as it requires advanced training sessions, and numerous enterprises encounter problems in the practical application of standards. In many cases, intensive investment in the area of IT is prerequisite (Kim et al., 2012). Numerous research papers have shown the conducive impact of IFRS on the cost of capital, risk (Daske, 2006; Daske et al., 2008), profitability, liquidity (Persakis and Iatridis, 2017; Grabiński and Kędzior, 2006), minimizing earnings management (André et al., 2012), and alike. This paper aims at analyzing the

dependencies between IFRS application by the economic entities and the chosen financial and non-financial company evaluation ratios in the selected countries of Western Europe. The analysis will focus on the relationships between IFRS application and profitability, liquidity ratio, assets turnover, investment intensity, total debt ratio, company size, company growth, company age, international activity, market share and industry concentration. The analysis of relationships between asset turnover, market share, industry concentration and IFRS should be considered as a novelty in the literature on that subject.

2 The application of IFRS versus financial and non-financial gauges applied by economic entities

In literature, various dependencies between the application of IFRS and the selected financial and non-financial factors were analyzed. Bessieux-Ollier and Walliser (2012) considered the size of the company, book value of fixed assets versus total assets, or sectorial affiliation. Bova and Pereira (2012) empirically verified indebtedness, company size, ROE, the percentage of shares held by foreign investors, the number of companies in the industry, book-to-market ratio, dividend yield. In turn, Gassen and Sellhorn (2006) analyzed the dependencies between IFRS and international exposure, company size, dispersion of ownership and recent IPOs. Renders and Gaermynck (2007) scrutinized microeconomic factors and country level factors. This paper will focus on profitability, liquidity ratio, assets turnover, investment intensity, total debt ratio, company size, company growth, company age, international activity, market share and industry concentration (compare: Gupta et al., 2017).

Apparently the companies that apply IFRS are characterized by higher profitability (Pichler et al., 2018). Business entities that use IFRS should be considered as entities with lower risk, a larger scope of accounting disclosures, hence also often a lower cost of capital (Daske, 2006; Daske et al., 2008; Jaruga et al., 2007; compare: Cuijpers and Buijink, 2005). In most cases, the application of IFRS translates into higher quality of financial reporting in comparison to the local standards. For that reason, the entities applying IFRS can expect a better access to external financing (Kędzior, 2012; similarly, Grabiński et al, 2013). On the other hand, it should be noted that earnings smoothing is made more difficult by the application of high quality reporting standards (IFRS). Consequently, it is likely that companies demonstrating high, or consistently high profitability level will decide to apply IFRS (André et al., 2012). In line with the theory of political costs, highly profitable business entities should account for their high profitability by additional disclosure and special transparency which is feasible with the application of IFRS.

Companies which show higher levels of risk will be more prone to apply IFRS. This is primarily attributable to the necessity of lowering the corporate risk through the application of high quality financial reporting. Higher quality of such reporting allows individual investors to compete with the institutional investors on capital markets, particularly the less informed investors. Financial reporting according to IFRS reduces the cost and risk of information for investors, hence they may require lower rate of return on stock (Ball, 2006). The application of IFRS facilitates risk assessment for the investors (Fijałkowska and Jaruga-Baranowska, 2007) and also conveys more information e.g. on the investment risk (Adamik-Citak, 2011).

Low liquidity companies will strive for voluntary application of IFRS. Excessively low liquidity ratios increase the risk for a company and they may even lead to bankruptcy (Maślanka, 2012; Maślanka, Mazur-Maślanka, 2017). The application of high quality accounting standards (IFRS) may become the way for lowering the risk. IFRS ensure better information about company's liquidity relative to local standards (Adamik-Citak, 2011). In view of Grabiński and Kędzior (2007) those companies that apply IFRS show lower liquidity level. They can afford it due to lower risk. However, in the opinion of the authors those differences are negligible. Large companies showing excess liquidity do not mostly require external capital, hence the application of global accounting standards is not for them of major importance.

Companies characterized by high operational efficiency will be less likely to apply IFRS. The higher asset turnover, the more efficient use of assets which may translate into higher profitability of an entity (Okwo et al., 2012). It seems that those companies which display higher operational efficiency are more likely to obtain external financing at a lower cost. By this token, they will not strive to implement IFRS at all cost. Companies characterized by high asset turnover are mostly smaller entities which do not possess the resources necessary for IFRS implementation (Chi and Padgett, 2006).

High capital intensity is to be found most often in those companies which practice local accounting standards rather than global solutions such as IFRS (compare: Renders and Gaeremynck, 2007). Capital intensity is to be understood as the share of fixed assets in the balance sheet total. The companies with a high share of fixed assets are considered to be relatively safe; their operation is predictable, and book value closer to the market value. In most cases, fixed assets do not stand for higher disclosure since their value is relatively stable and it does not involve "buying options on future" (Hope et al., 2006; Bessieux-Ollier and Walliser, 2012). In addition, oversight of long term fixed assets is not as important as a large share of current assets. Hence, the application of IFRS in these entities is less likely (Dumontier and Raffournier, 1998; André et al., 2012).

Indebted companies are more likely to disclose financial and non-financial information. Higher level of risk requires more disclosure to lessen the informative asymmetry between people who are outside and inside the company. In this way it is possible to lower the cost of additional oversight and agency costs to be borne by the owners. Higher cost of capital for the indebted companies may be lowered by voluntary disclosure of additional information (IFRS) (compare: Li, 2010). Economic entities encumbered with higher risk (high indebtness) are more willing to implement IFRS to mitigate the cost of capital. High quality accounting standards may be conducive for forming proper relations between the owners and creditors. Credit terms are more likely to be complied with and less prone to manipulation when high quality, rigorous accounting standards (IFRS) are being implemented. By the same token, monitoring the company from the perspective of creditors as well as the owners will be more efficient once high quality accounting standards are up and running.

Large companies are more prone to apply IFRS since the costs of their implementation are relatively lower for large entities (Bessieux-Ollier and Walliser, 2012). Large entities are obliged to disclose more financial information, hence their clear preference for IFRS. The cost of disclosing successive information is declining as that cost is spread over a bigger amount of sold products or services (Cuijpers and Buijink, 2005). Operating in line with the theory of political costs, large entities should disclose greater volume of financial information. Large entities are often financed with external capital and that is why they are concerned about securities exchanges reactions and they prefer the accounting standards that are common there (IFRS). By disclosing more information large entities do not worry about losing their competitive advantage. In conclusion, large entities, stable on the market, should apply high quality (credible), generally accepted accounting standards (compare: Gassen and Sellhorn, 2006).
Companies with a relatively high growth potential are more likely to apply IFRS. For obvious reasons, those companies will be more dependent on the external capital to finance their dynamic growth. One of the prerequisites for the acquisition of capital at lower cost will be decreasing information asymmetry with the increased disclosure guaranteed by IFRS. IFRS warrant high quality of financial reporting (Fitó et al., 2012). The external investors will become more interested in financing a company with a high growth potential once the risk of financial reporting is mitigated, and information asymmetry contained (André et al., 2012).

Again, the dependencies between the age of a company and application of IFRS are not quite clear. Younger companies are, as a rule, more flexible, and they are characterized by greater development potential or the management more open to changes. Greater development potential translates into a greater demand for the external capital (Bassemir, 2012). It is necessary to show that the conducted activity and the financial performance

are credible, hence the application of IFRS seems more likely. Nonetheless, the process of their application is complex, costly and time consuming, and it calls for qualified manpower and expertise. Quite often, advanced training courses allowing proper implementation of IFRS are a must, and they are necessary for older companies. Such companies are, as a rule, larger entities, well established on the market, and simply required to apply high quality financial reporting (Şenyiğit, 2014). It seems natural that the above attitude will prevail and older companies will more eager to apply IFRS.

The companies engaged in the international activity will be more likely to apply IFRS since they are more accepted on capital markets. Quite frequently, the companies involved internationally are required to produce financial reports for the local markets. Their cost can be lowered with a uniform application of consistent, standardized accounting standards (IFRS). By the same token, the cost of auditing financial reports may be also mitigated. What is more, IFRS reports provide wider information on changing currency exchange rates which are crucial for international companies (Adamik-Citak, 2011). International operations mean that international investors can also invest in enterprises. It is also more common to hire Board or Supervisory Board members from abroad. Due to their little knowledge about local accounting standards they will prefer globally recognized, high quality accounting standards represented by IFRS (Francis et al., 2008; Bova and Pereira, 2012).

The companies which have a large share in the market are called industry leaders in many categories. This phenomenon concerns the competitive advantage related to operating, financial and investment activities. The largest companies on the market are concerned about their image in the eyes of many stakeholders, so they will be especially interested in the application of widely recognized and reputable accounting standards (IFRS). The companies which have a large share in the market are characterized by high innovation and susceptibility to change in many areas (e.g. replacing local standards with IFRS) (Goddard et al., 2005). As large economic entities they will be more likely to use IFRS. It should also be noted that financial statements based on IFRS provide important information on market risk, which is important for these entities (Adamik-Citak, 2011).

The concentration of shares in the industry usually means a very intense competitive struggle between economic entities (Bennenbroek and Harris, 1995). Often, 4-5 of the largest enterprises in the industry control a large part of the market. It means large barriers to entry and exit from the market (Kotha and Nair, 1995). Competition between individual entities is not limited only to operational activities, but also financial ones, including competition for external sources of financing, in particular for share capital. The use of IFRS is a way to gaining equity capital and authenticating your business and financial reporting. Acquiring share capital at a lower cost may facilitate competitive struggle, especially in industries with large capital expenditures.

For purposes of empirical analysis the following hypotheses have been developed:

H_1 – ROE is higher in companies using IFRS
H_2 – level of risk is lower for economic entities using IFRS
H_3 - liquidity ratio is higher in companies that adopted IFRS
H_4 - assets turnover is lower for corporations using IFRS
H_5 – investment intensity is lower in companies that implemented IFRS
H_6 - total debt ratio is higher in companies using IFRS
H_7 – bigger companies implement IFRS
H_8 - company growth is higher in companies using IFRS
H_9 – older companies use IFRS
H_{10} - international activity is greater in economic entities that introduced IFRS
H_{12} - industry concentration is higher in companies using IFRS

The definitions of particular variables included in the analysis are listed below:

- IFRS (1;0); when a company applies IFRS, the variable takes ”1”, if it applies local standards (local GAAP) then the variable takes ”0”,
- ROE = 100%*net result/equity capital,

- liquidity = current liabilities/current assets,
- capital intensity = fixed assets/total assets,
- asset turnover = operating activity revenue/value of assets,
- total debt ratio = value of short and long-term liabilities/ total liabilities,
- risk = EBIT standard deviation for the last 4 years,
- company size = ln (revenue from operating activity)[3],
- company age = the number of years in business,
- growth potential = annual increase of revenue from operating activity in %,
- international activity = the number of branches abroad,
- concentration of shares in the industry = the value of revenue from operating activity of the four largest branches in the industry/ total revenue of operating activity of all entities in the industry,
- market share = revenue from operating activity of a specified entity/total revenue from operating activity of all entities in the industry.

3 Results and Discussion

The analysis included 461 listed companies from Germany, Great Britain, Finland, Italy and France, and the empirical data were collected for 2012- 2016. In the test sample, p of Shapiro-Wilk test was below 0.05, hence the analysis was conducted with the application of Mann-Whitney test (Table 1 and 2). P values below 0.05 indicate those variables which are significantly related with the accounting practice.

Table 1 The Dependencies Between IFRS Application by Economic Entities and Financial Measures

Variable	Accounting practice	Average	SD	Median	Q1	Q3	p
ROE	Local GAAP	-6.73	62.37	**5.39**	-2.75	13.16	p=0.222
	IFRS	-3.21	63.27	**6.55**	-5.86	14.8	
Risk	Local GAAP	39529	239726	**1568**	487.63	5336	p<0.001
	IFRS	7186	313698	**4976**	1584.29	19032	
Liquidity ratio	Local GAAP	0.87	4.88	**0.49**	0.27	0.75	p<0.001
	IFRS	0.77	1.96	**0.59**	0.38	0.81	
Assets turnover	Local GAAP	1.19	0.88	**1.10**	0.80	1.47	p<0.001
	IFRS	1.02	0.63	**0.93**	0.64	1.23	
Investment	Local GAAP	0.40	0.22	**0.39**	0.23	0.54	p<0.001
	IFRS	0.47	0.19	**0.47**	0.33	0.61	
Total debt ratio	Local GAAP	0.78	3.25	**0.53**	0.37	0.66	p=0.656
	IFRS	0.59	2.41	**0.52**	0.37	0.67	

Source: Author's own elaboration

In the analysis of IFRS application and the selected financial measures, it should be noted that liquidity ratio values are significantly higher for those companies which apply local accounting standards. Hence, the assumption is confirmed that companies with lesser liquidity and higher risk will seek to reduce it through the use of IFRS. It was noted that capital intensity was significantly higher among those companies which applied IFRS, hence the increased demand for long term capital requires the application of IFRS. The dependency of IFRS on profitability and indebtness turned out to be insignificant. In addition, it was noted that companies encumbered with higher risk are more likely to apply IFRS (IFRS reduce information cost for the investors). In turn, asset turnover ratio is

[3] Company size can be also defined as, value of assets or number of employees.

significantly higher for those companies which apply local accounting standards. High operating efficiency lowers the risk of a company and the cost of its capital.

Table 2 presents the dependencies between the selected non-financial factors and IFRS application. In terms of statistics, the age of companies applying IFRS is significantly higher. This might be attributable to the fact that older companies have the resources allowing application of IFRS. In turn, companies applying IFRS are substantially bigger which possibly stems from the fact that such companies require more capital from the external sources and need to remain accountable to the social and economic environment. Companies applying IFRS have greater share in the market. Such entities, as business leaders, are obliged to sustain the image of their company and the quality of financial reporting. For this reason, they are more likely to apply IFRS. International operations are conducted to a wider extent in entities applying IFRS, which are, for understandable reasons, more accepted or even required for entities operating internationally (globally). The relationship between IFRS and the concentration of market shares and growth opportunities proved to be statistically insignificant.

Table 2 The Dependencies Between IFRS Application by Economic Entities and Selected Non-financial Measures

Variable	Accounting practice	Average	SD	Median	Q1	Q3	p
Company size	Local GAAP	10.70	2.40	**10.54**	9.24	12.01	p<0.001
	IFRS	11.74	2.38	**11.59**	10.30	13.02	
Company growth	Local GAAP	14.35	73.92	**5.24**	-8.44	18.44	p=0.341
	IFRS	18.52	349.53	**4.96**	-8.34	16.37	
Company age	Local GAAP	45.85	70.79	**23.00**	11.00	54.00	p<0.001
	IFRS	44.25	41.68	**30.00**	14.00	58.00	
International activity	Local GAAP	1.70	1.47	**1.39**	0.69	2.56	p<0.001
	IFRS	2.69	1.51	**2.56**	1.61	3.66	
Market share	Local GAAP	3.66	10.76	**0.19**	0.04	2.18	p<0.001
	IFRS	6.29	12.97	**0.92**	0.16	4.69	
Industry concentration	Local GAAP	84.05	11.01	**86.6**	78.11	92.73	p=0.478
	IFRS	84.19	9.92	**84.8**	78.22	91.38	

Source: Author's own elaboration

4 Conclusions

IFRS should be considered the most mature attempt to harmonize local accounting standards. The introduction of IFRS has undoubtedly become the biggest revolution in accounting history in over 120 countries. They affect many spheres of activity, such as, among others, the cost of capital, risk, profitability, liquidity, the quality of financial reporting, the phenomenon of profit management, etc. This paper focused on the dependencies between IFRS application and the selected financial and non-financial measures of economic entities' performance such as profitability, liquidity ratio, assets turnover, investment intensity, total debt ratio, company size, company growth, company age, international activity, market share and industry concentration.

This paper has shown that the production sector of listed companies, operating in the selected countries of Western Europe and applying IFRS, demonstrate higher risk, lower liquidity, lower assets turnover, higher capital intensity, and they are relatively older and larger entities more actively engaged in the international activity. In addition, they control larger market share than those entities which do not apply IFRS. Therefore, the relationship between IFRS and liquidity assets turnover, company ages, company, international activity and market share should be verified positively. Thus, dependencies with non-financial

variables are more predictable than with financial variables. The dependencies between IFRS and risk and investment capacity have been verified negatively. A higher level of risk was observed in companies using IFRS. Thus, in the surveyed company population, reducing the total risk of a company by preparing the high quality of the financial statements is not significant. Public manufacturing companies listed on the stock exchange are not characterized by a large level of risk, hence the introduction of IFRS does not significantly reduce the risk. In companies using IFRS, the capital intensity is higher. An important factor for these companies may be valuation of fixed assets according to fair value recommended by IFRS.

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Comparison of Gulka's Model and Model IN05 on Sample of Slovak Industrial Companies

Natália Klempaiová[1], Mária Bohdalová[2]

[1] Comenius University in Bratislava
Faculty of Management, Department of Information Systems
Odbojárov 10, Bratislava, 820 05, Slovakia
E-mail: natalia.klempaiova@fm.uniba.sk

[2] Comenius University in Bratislava
Faculty of Management, Department of Information Systems
Odbojárov 10, Bratislava, 820 05, Slovakia
E-mail: maria.bohdalova@fm.uniba.sk

Abstract: *In this paper, we analyse two modern bankruptcy models on samples of selected Slovak industrial enterprises. IN05 is a well-known model in Slovakia that gives a high percentage of reliability in predicting the financial health of Slovak companies. The Gulka's model was created in 2016 and its popularity is rising. The aim of this paper is to compare IN05 and Gulka's models and determine which of them is more suitable for Slovak enterprises. Analyses were based on real data from the latest available financial statements of industrial enterprises for five industries typical of Slovakia: Automotive, Electricity, Agriculture and Forestry, Construction, Mechanical Engineering. We have selected private domestic companies with limited liability. In the case of companies in bankruptcy or restructuring, we used the latest available financial statements before the date of bankruptcy or, respectively, management of restructuring. Using contingency tables, we compared the number of correct predictions for both models - the Gulka's model, created by the logistic regression method (LOGIT model) and the IN05 index created by the Multidimensional Discrimination Analysis (MDA method). We predicted the correct forecast when the company was actually in bankruptcy and the model rated it or if the company was not bankrupt and the model ranked it as prosperous. Both models are very useful in the conditions of the Slovak Republic. For Slovak industrial enterprises, the Gulka´s model is more reliable. In general, the model's highest ability to leverage is in the country where the model was created or for the industry for which it was created.*

Keywords: Index IN05, Gulka's model, corporate financial health forecast, credit and bankruptcy models

JEL codes: C35, M10, G32

1 Introduction

Predictive ability of any bankruptcy model depends on time, location, industry for which it was developed, and also on the used method. Our research focuses on modern bankruptcy models that can estimate the financial situation of Slovak companies as accurately is possible. In this paper, we focused on Slovak or Czech models because the economic situation is similar in both countries (Diheneščíková and Hičák, 2011).

There are several Slovak bankruptcy models. For example, Chrastinová´s CH-index (Chrastinová, 1998) or Gurčík's model (Gurčík, 2002) are aimed for agriculture. Binkert (Binkert, 1999) developed bankruptcy model for joint stock companies, Hurtošová (Hurtošová, 2008) created model for personal and legal entities accounting for double-entry accounting and Gulka's model (Gulka, 2016) was developed for Slovak trading companies. Only Gulka´s model could easily differentiate prosperous and unprosperous businesses. In the study by (Ďurica and Zvaríková, 2017), models created for V4 countries were compared, either through Multidimensional Discrimination Analysis (MDA) or logistic regression (LOGIT models).

Based on the above, we decided to look more closely at the perspective for future Gulka´s model and to compare it with the frequently used the Czech index IN05 (Neumaierová and Neumaier, 2005), which also proved to be successful in Slovakia (Bohdalová and Klempaiová, 2017). Our aim is to compare and analyse the predictive power of the IN05 model and Gulka´s model on samples of selected Slovak industrial enterprises and to determine which of them is more suitable for Slovak companies.

The Gulka´s model was obtained using a logistic regression method. The math entry is as follows (Gulka, 2016):

$$p = \frac{e^{0,0216-0,6131*X1-0,0068*X2-0,0293*X3-0,0011*X4+0,0240*X5+0,0317*X6-1,0663*X7}}{1+e^{0,0216-0,6131*X1-0,0068*X2-0,0293*X3-0,0011*X4+0,0240*X5+0,0317*X6-1,0663*X7}} \quad (1)$$

where

X1 – Quick Ratio – (Financial accounts / (Short-term liabilities + Short-term financial borrowings + Current bank loans))

X2 – Working Capital Turnover = ((Revenue from sold goods + Manufacture) / Working capital; while WC is Current assets – Short-term liabilities – Short-term financial borrowings – Current bank loans)

X3 –Financial Accounts Ratio (in %) – (Financial accounts / Total Assets)

X4 – Self-financing Ratio (in %) – (Equity / Total Assets)

X5 – Credit load (in %) – ((Fixed Bank loans + Short-term financial accommodations) / Total Assets)

X6 – Share of liabilities to state institutions (in %) – ((Payables from social insurance + Tax liabilities and grants) / Total Assets)

X7 – Return on Assets from the perspective of EBITDA – (EBITDA / Total Assets; while EBITDA = Profit from economic activity + Depreciation + Residual cost of the sold long-term assets and material – Revenue from the sale of long-term assets and material)

p –probability the company will go bankrupt during the next 12 months

if $1 \geq p \geq 0,50$, an enterprise is heading to bankruptcy

and if $0,50 > p \geq 0$, the enterprise is not heading to bankruptcy

Index IN05 was created by modifying Altman's methodology for the conditions of Czech businesses using a multidimensional discriminatory analysis:

$$IN05 = 0,13 * \frac{A}{CZ} + 0,04 * \frac{EBIT}{Ú} + 3,97 * \frac{EBIT}{A} + 0,21 * \frac{VÝN}{A} + 0,09 * \frac{OA}{KZ + KBÚ} \quad (2)$$

where

A – Assets respectively Liabilities
CZ – Foreign Sources
EBIT – Earnings before Interest and Taxes – (Profit before tax + Interest expense)
Ú – Interest Expense
VÝN – Total Returns
OA – Current Assets
KZ – Short-term Liabilities
KBÚ – Short-term Bank Loans and Borrowings

If *IN05* > 1.6, an enterprise creates worthiness with probability 67%.

The area enclosed by $0.9 \leq IN05 \leq 1.6$ is an area of unmatched results (grey zone).

If *IN05* < 0.9, an enterprise is at risk of bankruptcy with probability 86%.

If interest rates in the EBIT / Ú indicator approach zero, a problem arises. The Neumaiers recommend limiting the value of this indicator to 9 (Neumaierová and Neumaier, 2005).

2 Methodology and Data

To analyze Gulka´s model and IN05 index, we have selected five sectors that make up a significant part of GDP in Slovakia and are typical for Slovakia. These are privately owned domestic limited liability companies in the automotive, electrical, agricultural and forestry sectors, construction and machinery.

We have drawn the data from the databases of Finstat, L.t.d.(2018). After filtering the five sectors according to Finstat´s classification, legal form and type of ownership, a database with 31 431 enterprises was created. Of these, 380 companies were bankrupt with a known bankruptcy date or authorization for restructuring.

We removed empty rows in the indicators needed to calculate *p* in Gulka´s model. We also removed rows with businesses missing the IN05 value, as the database contained already calculated index values of IN05 and its indication. The database was also cleared from companies where assets were not attributable to liabilities and/or were found to be negative in assets, stocks, financial accounts, bank loans, sales, etc. Unlike Gulka, however, we ignored extreme variability in the values of financial indicators. After these adjustments, the number of businesses decreased to 661, of which 15 were in real failure.

We manually searched and added data from the last published financial statements before the date declared as bankruptcy or restructuring authorization for businesses in bankruptcy. We mostly used data from one to two calendar years before the date with public known bankruptcy. Subsequently, companies with missing indicator values required to calculate the value *p* in Gulka´s model or with some of the above accounting anomalies were removed again. Final database sample consisted of 649 businesses, out of which 10 were in real decline.

Subsequently, calculations and the new cut-off thresholds for the IN05 index include only two areas in Gulka´s model, in contrast to IN05 model, to determine the prosperity of the business. We calculated the average from the upper (1.6) and the lower (0.9) limits for IN05 model (1.25) to compute new cut-off thresholds similarly as Gulka used for the Altman model (Gulka, 2016). For modified IN05 model, there was a cut-off threshold equal to 1.25. If the calculated value was higher than 1.25, the company was prosperous, and businesses with a value of less than or equal to 1.25 were non-prosperous. For Gulka´s model, there was a cut-off threshold of 0.50.

We have calculated individual ratios (X1 – X7) for all companies according to equation (1) and then we have calculated the probability *p*. There were situations when the denominator was zero when we calculated the probability *p*. Therefore, we had to discard four more companies from the database for which it was impossible to calculate their *p* values. The final database contained 645 businesses, 10 of them were actually bankrupt. After checking duplicity of data, we could proceed with the analysis of both models.

This database was used to find out how many businesses the model labelled as "prosperous" in a group of truly prosperous businesses or non-prosperous in a group of companies in real decline. Models can be compared based on the number of correct answers individually in each group. Given an uneven number of prosperous and unsustainable businesses in the database, we will not be able to determine whether the model is more successful in predicting bankruptcy or predicting business prosperity (whether the model has a tendency to include an enterprise rather to prosperous or non-prosperous companies).

If we would like to determine the success or failure of the models based on a simple sum of the total correctly evaluated companies or the total error rate (census of type I and type

II errors), we would have to use a sample with the same number of prosperous and non-prosperous businesses. Otherwise, we could get a distorted conclusion. If the first model was compared to the other model, it would have a higher tendency to classify businesses as thriving, it would show a higher success rate than the second model in an uneven database with more realistically prosperous businesses. In reality, however, the second model could be more successful. Based on this fact, we used a database in which the number of businesses in real decline (10) and the number of real prosperous businesses (10) was the same. For each bankruptcy or restructuring of companies, we assigned a truly prosperous company with the same SK-NACE business class rating and approximately the same size category, with the main criteria being the number of employees, after which other size criteria were compared.

The analysis was performed using MS Office Excel software.

3 Results and Discussion

We began analysis with the case when businesses were real prosperous (their count was 635) or bankrupt (their count was 10). Table 1 shows the number of prosperous businesses and businesses in bankruptcy or restructuring in total and in individual sectors. There are no companies in the automotive and mechanical engineering sector among companies in decline.

Table 1 Initial State

Bankruptcy and Restructuring	**Number of enterprises**	**% of Total**	**% of Superior row**
Yes	**10**	**1.55**	**1.55**
Electricity	1	0.16	10.00
Agriculture and Forestry	3	0.47	30.00
Construction	6	0.93	60.00
No	**635**	**98.45**	**98.45**
Automotive	3	0.47	0.47
Electricity	19	2.95	2.99
Agriculture and Forestry	172	26.67	27.09
Construction	407	63.10	64.09
Mechanical Engineering	34	5.27	5.35
Total	**645**	**100.00**	**100.00**

Source: Own results processed based on data from www.finstat.sk

We found out which model predicted more business prosperity in a group of truly prosperous businesses and bankruptcy in a group of truly non-prosperous businesses. The results for IN05 model with the modified cut-off boundary and Gulka´s model are summarized in Table 2.

In the group of truly prosperous businesses (635), IN05 model with a modified cut-off threshold identified 397 (62.52% of 635) companies in bankruptcy or restructuring and 238 (37.48% of 635) companies as prosperous. Gulka´s model identified 322 companies as non-prosperous and 313 as prosperous in this group. In this comparison, it had 75 correct predictions more than IN05 model. In the group of companies that were bankrupt (10), both models agreed. They predicted bankruptcy to 9 businesses and 1 was identified as prosperous, and it was for the same company.

Table 2 Comparison of Prediction - IN05 Model with Cut-off Line 1.25 and Gulka´s Model

	IN05 model with modified cut-off line (1.25)			**Gulka´s model (cut-off line 0.50)**		
Bankruptcy and Restructuring	Number of enterprises	% of Total	% of Superior row	Number of enterprises	% of Total	% of Superior row
Yes	**10**	**1.55**	**1.55**	**10**	**1.55**	**1.55**
Bankruptcy	9	1.40	90.00	9	1.40	90.00
Prosperity	1	0.16	10.00	1	0.16	10.00
No	**635**	**98.45**	**98.45**	**635**	**98.45**	**98.45**
Bankruptcy	397	61.55	62.52	322	49.92	50.71
Prosperity	238	36.90	37.48	313	48.53	49.29
Total	**645**	**100.00**	**100.00**	**645**	**100.00**	**100.00**

Source: Own results processed based on data from www.finstat.sk

From the 397 enterprises that IN05 model with a modified cut-off threshold identified as bankrupted in a group of real prosperous companies, Gulka´s model marked 254 as non-prosperous and 143 as prosperous. From the 238 enterprises that the revised IN05 model estimated as prosperous companies, both models agreed on 170 businesses. The others (68) were classified by Gulka´s model to be non-prosperous companies (Table 3).

Table 3 IN05 Model with Modified Cut-off line versus Gulka´s Model

Bankruptcy and Restructuring	**Number of enterprises**	**% of Total**	**% of Superior row**
Yes	**10**	**1.55**	**1.55**
Bankruptcy	**9**	**1.40**	**90.00**
Bankruptcy	9	1.40	100.00
Prosperity	**1**	**0.16**	**10.00**
Prosperity	1	0.16	100.00
No	**635**	**98.45**	**98.45**
Bankruptcy	**397**	**61.55**	**62.52**
Bankruptcy	254	39.38	63.98
Prosperity	143	22.17	36.02
Prosperity	**238**	**36.90**	**37.48**
Bankruptcy	68	10.54	28.57
Prosperity	170	26.36	71.43
Total	**645**	**100.00**	**100.00**

Source: Own results processed based on data from www.finstat.sk

It means that from the 322 companies that Gulka´s model estimated as a non-prosperous in a group of truly prosperous companies, IN05 model with a changed cut-off threshold marked 68 companies as prosperous and 254 as non-prosperous. From the 313 enterprises that Gulka´s model identified as prosperous, 143 as non-prosperous and 170 prosperous companies were determined by modified model IN05 (Table 4).

We also looked at whether the business was indeed prosperous or non-prosperous if the model marked it so. The analysis has been done on a sample of 20 companies filtered from the original database with 645 companies. 10 companies were bankrupt and 10 were not bankrupt. The sample consisted mostly of the construction industry. It did not include Automotive and Mechanical Engineering industries because there are no bankrupt companies in the original database with 645 enterprises.

Table 4 Gulka´s Model versus IN05 Model with Modified Cut-off Line

Bankruptcy and Restructuring	Number of enterprises	% of Total	% of Superior row
Yes	**10**	**1.55%**	**1.55%**
Bankruptcy	**9**	**1.40%**	**90.00%**
Bankruptcy	9	1.40%	100.00%
Prosperity	**1**	**0.16%**	**10.00%**
Prosperity	1	0.16%	100.00%
No	**635**	**98.45%**	**98.45%**
Bankruptcy	**322**	**49.92%**	**50.71%**
Bankruptcy	254	39.38%	78.88%
Prosperity	68	10.54%	21.12%
Prosperity	**313**	**48.53%**	**49.29%**
Bankruptcy	143	22.17%	45.69%
Prosperity	170	26.36%	54.31%
Total	**645**	**100.00%**	**100.00%**

Source: Own results processed based on data from www.finstat.sk

IN05 model with an amended cut-off marked 16 out of 20 enterprises to be bankrupt, of which there were 9 companies in bankruptcy or restructuring and 7 were not. 4 businesses were declared prosperous, of which 1 was actually bankrupt and 3 were actually prosperous. As can be seen in Table 5, the same is valid for Gulka´s model.

Table 5 Comparison of Prediction for 20 Companies

	IN05 model with modified cut-off line (1.25)			**Gulka´s model (cut-off line 0.50)**		
	Number of enterprises	% of Total	% of Superior row	Number of enterprises	% of Total	% of Superior row
Bankruptcy	**16**	**80.00**	**80.00**	**16**	**80.00**	**80.00**
Yes	9	45.00	56.25	9	45.00	56.25
No	7	35.00	43.75	7	35.00	43.75
Prosperity	**4**	**20.00**	**20.00**	**4**	**20.00**	**20.00**
Yes	1	5.00	25.00	1	5.00	25.00
No	3	15.00	75.00	3	15.00	75.00
Total	**20**	**100.00**	**100.00**	**20**	**100.00**	**100.00**

Source: Own results processed based on data from www.finstat.sk

However, the predictions of the two models differ slightly. From the 16 companies that were predicted by IN05 model with the modified cut-off threshold as bankrupt, there were only 15 marked as non-prosperous by Gulka´s model. 1 business was identified as prosperous, and it also corresponded to the reality. Modified IN05 model classified this business as non-prosperous. From the 4 companies that IN05 model with the changed cut-off boundary classified as prosperous, 1 was classified as non-prosperous by Gulka´s model. However, this business was prosperous. From 3 other companies classified by Gulka´s model to be prosperous, 2 were prosperous and 1 bankrupt. The company that was bankrupt and was among those four companies was evaluated as prosperous by both models (Table 6).

Based on the results of the analyses, we can evaluate Gulka´s model as slightly more successful in comparison to IN05 model with the changed cut-off-border. In the group of

truly prosperous businesses, more businesses were rated as prosperous, in the group of companies in real decline, the situation was balanced in both models. When investigating whether the business was actually bankrupt or prospering, both Gulka's model and IN05 model with cut-off boundary resulted in 7 false negatives (error of type II). Both models resulted in 1 false positive (error of type I). In this investigation, the status of both models was balanced.

Table 6 IN05 Model with Modified Cut-off Line versus Gulka´s Model – 20 Companies

	Number of enterprises	% of Total	% of Superior row
Bankruptcy IN05	**16**	**80.00**	**80.00**
Bankruptcy Gulka	**15**	**75.00**	**93.75**
Yes	9	45.00	60.00
No	6	30.00	40.00
Prosperity Gulka	**1**	**5.00**	**6.25**
No	1	5.00	100.00
Prosperity IN05	**4**	**20.00**	**20.00**
Bankruptcy Gulka	**1**	**5.00**	**25.00**
No	1	5.00	100.00
Prosperity Gulka	**3**	**15.00**	**75.00**
Yes	1	5.00	33.33
No	2	10.00	66.67
Total	**20**	**100.00**	**100.00**

Source: Own results processed based on data from www.finstat.sk

4 Conclusions

In our analysis, Gulka´s model came out slightly more successful than the IN05 model, but it is questionable to declare it as more successful than the IN05 model. In practice, nobody uses IN05 model with a modified cut-off boundary because it was only used to make the comparison of both models feasible. The advantage of Gulka´s model is that it was created by a method of logistic regression (generally considered to be more accurate than methods of multidimensional discriminatory analysis), it is newer than IN05 index and it is created based on Slovak businesses data (IN05 index is a Czech model) including industrial companies (IN05 index was based on Czech industrial enterprises). These factors could cause that Gulka´s model is more successful than IN05 index in the conditions of the Slovak Republic and therefore more suitable for Slovak companies.

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The Efficiency of Health Systems in OECD Countries with Novel DEA Methodology

Kristína Kočišová[1], Jakub Sopko[2]

[1] Technical University
Faculty of Economics, Department of Banking and Investments
Němcovej 32, 040 01 Košice, Slovak Republic
E-mail: kristina.kocisova@tuke.sk

[2] Technical University
Faculty of Economics, Department of Banking and Investments
Němcovej 32, 040 01 Košice, Slovak Republic
E-mail: jakub.sopko@tuke.sk

Abstract: *The main purpose of this paper is to determine the relative scores of the efficiency of health systems in the OECD countries. The data used in the analysis of this paper has been obtained from the official OECD database and we have been analyzing the data between 2005 and 2015. We use the health indicators to point out the performance of healthcare systems of individual OECD countries. The efficiency results are obtained by Data Envelopment Analysis (DEA). DEA is an analysis of the efficiency of production units, which give us the efficiency score of the specified individual units. DEA is also used for the examination of the efficiency in the services sector. In this way, we can point to the level of efficiency of the health systems of the individual OECD countries. Traditional DEA methods are limited in some cases with regard to the nature of the selected variables. Emrouznejad and Amin (2009) point to the limitations of DEA models using the indicators expressed as ratio variables. In our paper, we will use the novel method for assessing efficiency – Dynamic Network Data Envelopment Analysis (DNDEA), applied by Ozcan and Khushalani (2016).*

Keywords: public health, Data Envelopment Analysis, DNDEA, OECD, efficiency

JEL codes I15, H51, C61

1 Introduction

The process of shaping individual sectors of the national economy can be monitored on the basis of the characteristic changes that have been deepening in the given period. The national economy represents the basic cycle of economic processes, which includes four basic economic sectors: the primary, secondary, tertiary and quaternary. A major change in the development of the national economy has led to deindustrialization – the shift of labor force from the industrial sector. The beginning of this process has gradually become the fastest growing and currently one of the most important sectors of the national economy, the service sector. Important fields of the tertiary sector include health and education. These areas of service sector can be quantified by a number of methods. The results being known as determinants of health and education. The educational level of the country and the adequate health status of the population affect the development of the regions. In most countries, we still see poor regions and regions with poor healthcare infrastructure. Often these problems are associated with inefficient financing in the country. At the present we are often confronted with the increasing trend of investment and innovation in the service sector. The service sector is known as a faster developing sector compared to other. Health and education are areas in which the country in recent years invested considerable percentage of funds. Therefore, we can further consider the analysis of the efficiency of inputs and outputs of health and education policy. Among the best-known and most widely used methods of measuring efficiency in the service sector are Data Envelopment Analysis models (DEA). In our work we try to estimate the efficiency of health systems based on data obtained from the OECD (*Organisation for Economic Co-operation and Development)* database using the DEA analysis.

The paper is organized as follow: In the section 2 a preview of the relevant literature is provided. In the section 3, the methodology and data are described and the section 4 presents the key findings and results.

2 Literature preview

Several authors address issues of efficiency in the healthcare sector. The OECD and the World Health Organization (WHO) offer several publications and reports (2017, 2018) that tell us about health care situation. The literature overview on efficiency in the health sector is also shown in Table 1.

Tandon et al. (2001) in their work point out that with the increase of health expenditure per capita, overall results of the country have increased. They analyze 191 countries and the relative efficiency score of the health expenditure. Countries with a high incidence of AIDS and HIV had a low level of efficiency. As the worst countries were: Malawi, Botswana, Namibia, Zambia and Zimbabwe, while the best performing countries were: Italy, France, San Marino, Malta, Oman. Sinimole (2012) analyzes the efficiency in 180 WHO countries. The results show that 45 out of 180 countries were efficient. Using the DEA model, it estimates the relative efficiency of WHO countries, pointing to five types of indicator groups: health status, health system, risk, health service coverage, demographic socio-economic situation and statistics and the author uses data, which belong under the groups of health status and health service coverage.

Table 4 DEA Models Specification Used in the Reviewed Studies

Paper **Data & Methods**	
Inputs & Outputs	**Results**
Retzlaff-Roberts et. al. (2004) **27 OECD countries; DEA models**	
Inpatient Beds, MRI, Physicians, Health expenditure, Tobacco use, Gini coefficient **Outputs:** **Infant mortality, Life expectancy**	Australia, UK, Sweden, Turkey, Spain, Norway, Mexico, Australia, Canada, Japan, France, Ireland, Greece, Korea are efficient. Therefore, they have found that the country can be technically efficient or inefficient at any level of health outcomes.
Spinks and Hollingsworth (2009) **28 OECD countries, DEA & Malmquist index, 1995 and 2000**	
Expected years of schooling under current conditions excluding education for children under five, Unemployment rates as percentage of total workforce, GDP per capita, Health expenditure per capita **Outputs:** **Life expectancy**	Efficient countries: In 1995 – Spain, Japan, Korea, Greece, Mexico, Turkey. In 2000 – Spain, Japan, Switzerland, Korea, Iceland, Turkey, Mexico, Greece.
Hadad et al. (2013) **31 OECD countries, DEA models and multivariate linear regression**	
Physicians density, Inpatient bed density, Health expenditure, GDP, Fruit and vegetable expenditure. **Outputs:** **Life expectancy, Infant mortality; Control variables: Fat intake, Health expenditure, Unemployment, Gini index, Environmental health score, Organizational arrangements, Use of disease management programs, Gatekeeping, Performance related payment incentives**	9 countries (Australia, Canada, Israel, Italy, Luxembourg, Spain, Sweden, Switzerland, and the United Kingdom) as efficient.
Jeremic et al. (2012) **27 European countries, Distance based analysis**	
Nurses, Physicians, Dentists, Public and total health expenditure, Beds **Outputs:** **Life expectancy, Healthy life expectancy; Adults, under 5, infants, mothers mortality rate**	Cyprus and Ireland have a most efficient health system. New model for evaluating the efficiency score is presented.
Sinimole (2012) **180 WHO countries, DEA models**	
Nurses, Physicians, Health expenditure **Outputs:**	45 out of 180 countries are relatively efficient in providing health services. 12 out of 48 efficient

Adult, infant, neonatal and under 5 mortality rate, immunization coverage	countries are EU countries. Most countries are countries with low input variables (e.g. density of doctors, expenditure on health) but these countries produce high output values.
Tajnikar and Došenovič Bonča (2007)	
16 EU countries, DEA models and group comparison	
Physicians, Beds, Discharges, Consultations, Health expenditure **Outputs:** **Life expectancy (male, female), Mortality rate, Discharges, Physicians consultations**	Health care provision is more efficient in countries where the private ownership of providers is predominant and where health care systems follow the social insurance model.
Samut and Cafri (2015)	
29 OECD countries between 2000 - 2010, DEA models, Malmquist Productivity, Panel Tobit Model	
Beds, Physicians, Nurses, MRI, CT **Outputs:** **Discharge rates from all hospitals, Infant survival rate.** **Independent variables: GDP, Health expenditure (public and private), educational expenditure, Public hospital, Private hospital, Life expectancy**	6 countries were fully efficient in 2010. Fully efficient during period 2000-2010 were Mexico, Turkey and the UK. Japan, Iceland, France and Belgium have under average efficiency scores for all the years.
Ozcan and Khushalani (2016)	
34 OECD countries between 2000 and 2012, Dynamic Network DEA	
Alcohol and tobacco consumption, Obese population, Public and private health expenditure, CT, Physicians, Hospital beds **Outputs:** **Life expectancy at birth (male and female), Discharges, Consults. Carry over variables: Mortality (maternal and infant), Health status. Medical care division: Immunization, Cancer, Screening-breast and cervical cancer.**	14 out of 34 countries underwent reform between period. Average overall Malmquist score for these countries was 0.98. Austria, Canada, US, Mexico, Turkey and Norway improved efficiency scores of the overall health system over time.
Behr and Theune (2017)	
34 OECD countries, DEA models	
Beds, Physicians, Nurses, Cataract surgery, Coronary artery bypass graft, Transplantation of kidney, Health expenditure, GDP, Gini coefficient, Alcohol and tobacco consumption, Obesity. **Outputs:** **Infant mortality, 30-day mortality after admission to hospital for ischemic stroke and for acute myocardial infarction per 100 patients; Life expectancy at birth**	Germany was inefficient at producing surgeries. Denmark – the country with the highest sum of weighted inputs. Japan was the most inefficient country in analysis of lifestyle and mortality. Norway, Switzerland, Luxembourg and USA – extremely low efficiency scores in the analysis of life expectancy and health expenditure.

Source: prepared by authors

Samut and Cafri (2016) use the Malmquist index and the regression analysis extended by the Tobit model in addition to the DEA analysis. The authors try to estimate the efficiency and the changes in the efficiency of key determinants of health systems on the sample of 29 OECD countries between 2000 and 2010. 6 countries were fully effective in 2010. Fully efficient during the period 2000-2010 were Mexico, Turkey and the UK. Japan, Iceland, France and Belgium have under-average efficiency scores for all years.

3 Methodology and Data

One of the most well-known methods for estimating efficiency in the healthcare sector is Data Envelopment Analysis. Efficiency is in this case in the form of ratio of health output to health input. The goal is to minimize the input side given the certain volume of outputs or to maximize the output given a certain volume of inputs. Data Envelopment Analysis is a non-parametric method that estimates the efficiency of production units. Koopmans (1951), Debreau and Arrow (1954) and Farell (1957) have provided a basic concept for DEA development with their articles. Debreau and Arrow (1954) and Farell (1957) have introduced the score of technical efficiency rate. In the next period, DEA was the subject of several authors. The further development of this method was provided by Charnes et al. (1978) who introduced the CCR (Charnes, Cooper, Rhodes) model based on the constant returns to scale and Banker et al. (1984) developed the BCC (Bankers, Charnes, Cooper) model based on the variable returns to the scale (VRS). The Network DEA

represents a new approach to the assessment of the efficiency, which is needed on the one hand to understand the past success of the organization and on the other hand for planning to the future. The network DEA helps identify the specific factors which point to the inefficiency of the decision making units (DMUs) as a whole (Kao, 2017).

Dynamic Network Data Envelopment Analysis (DNDEA) specification

Standard DEA models are often referred as a "black box" models, because they do not take into account the internal factors and structure of DMUs. Tone and Tsutsui (2009) in their analysis present new types of Dynamic Network DEA models, taking into account the internal or linking structure of DMUs. Färe and Grosskopf (1997, 2000) present their network of DEA models with various types of structure. The DNDEA model can evaluate the overall efficiency, dynamic change in the periodic efficiency and dynamic change in the divisional efficiency. In the health sector, the advantage of DNDEA is that it assesses efficiency separately in public health and also medical care provision. DMUs have carry-over variables that take into account a positive or negative factor in the previous period (Ozcan and Khushalani, 2016). Kawaguchi et al. (2014) use DNDEA with estimating the efficiency of Japanese hospitals.

Consider n DMUs (j=1,…,n), which consist of K divisions (k=1,…,K) over T time periods (t=1,…,T). The number of inputs and outputs to division k represent m_k and r_k, respectively. The set of links L_{kh} point from division k to division h by (k,h) and the observed data are as follows (Kawaguchi et al. 2014):

$x_{ijk}^{t} \in R_{+}(i=1,\mathrm{K}\,,m_k;\ j=1,\mathrm{K}\,,n;k=1,\mathrm{K}\,,K;t=1,\mathrm{K}\,,T)$ represents input resource I to DMU_j for division k in the period t;

$y_{rjk}^{t} \in R_{+}(r=1,\mathrm{K}\,,r_k;\ j=1,\mathrm{K}\,,n;k=1,\mathrm{K}\,,K;t=1,\mathrm{K}\,,T)$ represents output product r from DMU_j for division k in period t. We treat the outputs, which are undesirable, as inputs to division k.

$z_{j(kh)_t}^{t} \in R_{+}(j=1,\mathrm{K}\,,n;l=1,\mathrm{K}\,,L_{kh};t=1,\mathrm{K}\,,T)$ define the linking intermediate products of DMU_j from k to h in period t

$z_{jk_t}^{(t,t+1)} \in R_{+}(j=1,\mathrm{K}\,,n;l=1,\mathrm{K}\,,L_k;k=1,\mathrm{K}\,,K;t=1,\mathrm{K}\,,T-1)$ represents carry-over of DMU_j. $DMU_o\left(o=1,\mathrm{K}\,,n\right)\in P$ can be expressed as follows:

$$\begin{aligned}
&\mathbf{x}_{ok}^{t}=\mathrm{X}_k^{t}\lambda_k^{t}+\mathbf{s}_{ko}^{t-}\ \ \left(\forall k,\forall t\right)\\
&\mathbf{y}_{ok}^{t}=\mathrm{Y}_k^{t}\lambda_k^{t}+\mathbf{s}_{ko}^{t+}\ \ \left(\forall k,\forall t\right)\\
&\mathbf{e}\,\lambda_k^{t}=1\ \ \ \left(\forall k,\forall t\right)\\
&\lambda_k^{t}\geq 0,\mathbf{s}_{ko}^{t-}\geq 0,\mathbf{s}_{ko}^{t+}\geq 0,\ \left(\forall k,\forall t\right)
\end{aligned} \tag{1}$$

where

$\mathrm{X}_k^{t}=\left(\mathbf{x}_{1k}^{t},\mathrm{K}\,,\mathbf{x}_{nk}^{t}\right)\in R^{mk\times n}\ and\ \mathrm{Y}_k^{t}=\left(\mathbf{y}_{1k}^{t},\mathrm{K}\,,\mathbf{y}_{nk}^{t}\right)\in R^{r_k\times n}$ represent input and output matrices and $\mathbf{s}_{ko}^{t-}\ and\ \mathbf{s}_{ko}^{t+}$ represent input and output slacks, respectively.

In the "as input" link value case, the linking activities are treated as input to division and excesses are accounted for in the input inefficiency:

$$\mathbf{z}_{o(kh)in}^{t}=Z_{(kh)in}^{t}\lambda_k^{t}+\mathbf{s}_{o(kh)in}^{t}\ \ \ \left((kh)in=1,\mathrm{K}\,,linkin_k\right) \tag{2}$$

and in the "as output" link value case, the linking activities are treated as output from the preceding division and shortages are accounted for in the output inefficiency:

$$\mathbf{z}_{o(kh)out}^{t}=Z_{(kh)out}^{t}\lambda_k^{t}-\mathbf{s}_{o(kh)out}^{t}\ \ \ \left((kh)out=1,\mathrm{K}\,,linkout_k\right) \tag{3}$$

where $\mathbf{s}^t_{o(kh)in} \in R^{L_{(kh)in}}$ represents slacks and is non-negative, $linkin_k$ represents the number of "as input" links and $\mathbf{s}^t_{o(kh)out} \in R^{L_{(kh)out}}$ represents slacks and is non-negative and $linkout_k$ is the number of "as output" links from *k* division.

Carry over categories can be expressed as follows:

$$
\begin{aligned}
&z^{(t,t+1)}_{ok_l good} = \sum_{j=1}^{n} z^{(t,t+1)}_{jk_l good}\lambda^t_{jk} - s^{(t,t+1)}_{ok_l good} \quad \left(k_l = 1,\mathrm{K}\,, ngood_k; \forall k; \forall t\right)\\
&z^{(t,t+1)}_{ok_l bad} = \sum_{j=1}^{n} z^{(t,t+1)}_{jk_l bad}\lambda^t_{jk} + s^{(t,t+1)}_{ok_l bad} \quad \left(k_l = 1,\mathrm{K}\,, nbad_k; \forall k; \forall t\right)\\
&z^{(t,t+1)}_{ok_l\, free} = \sum_{j=1}^{n} z^{(t,t+1)}_{jk_l\, free}\lambda^t_{jk} + s^{(t,t+1)}_{ok_l\, free} \quad \left(k_l = 1,\mathrm{K}\,, nfree_k; \forall k; \forall t\right)\\
&z^{(t,t+1)}_{ok_l\, fix} = \sum_{j=1}^{n} z^{(t,t+1)}_{jk_l\, fix}\lambda^t_{jk} \quad \left(k_l = 1,\mathrm{K}\,, nfix_k; \forall k; \forall t\right)\\
&s^{(t,t+1)}_{ok_l good} \geq 0\,,\ s^{(t,t+1)}_{ok_l bad} \geq 0 \ and\ s^{(t,t+1)}_{ok_l\, free} : free \quad \left(\forall k; \forall t\right)
\end{aligned}
\tag{4}
$$

The objective function for the overall-efficiency can be expressed by the following program:

$$
\Theta = \min \frac{\sum_{t=1}^{T} W^t \left[\sum_{k=1}^{K} w^k \left[1 - \frac{1}{m_k + linkin_k + nbad_k}\left(\sum_{i=1}^{m_k}\frac{s^{t-}_{iok}}{x^t_{iok}} + \sum_{(kh)_i=1}^{linkin_k}\frac{s^t_{o(kh)_i in}}{z^t_{o(kh)_i in}} + \sum_{k_l=1}^{nbad_k}\frac{s^{(t,t+1)}_{oklbad}}{z^{(t,t+1)}_{oklbad}}\right)\right]\right]}{\sum_{t=1}^{T} W^t \left[\sum_{k=1}^{K} w^k \left[1 + \frac{1}{m_k + linkout_k + ngood_k}\left(\sum_{r=1}^{r_k}\frac{s^{t+}_{rok}}{y^t_{rok}} + \sum_{(kh)_i=1}^{linkout_k}\frac{s^t_{o(kh)_i out}}{z^t_{o(kh)_i out}} + \sum_{k_l=1}^{ngood_k}\frac{s^{(t,t+1)}_{ok\lg ood}}{z^{(t,t+1)}_{ok\lg ood}}\right)\right]\right]}
\tag{5}
$$

where, W^t *(t=1,…,T)* represents the weight to period *t* and w^k represents the weight to division *k.* To keep the structure of the paper, we will not report and present further calculations for period efficiency, divisional efficiency and period-divisional efficiency. In our analysis we used for evaluating the efficiency score the mathematical program DEA Solver Pro 13.

4 Results and Discussion

In our analysis we used Dynamic Network Data Envelopment Analysis model with Constant Returns to scale for 35 OECD countries between period 2005-2015. We consider health systems of OECD countries as a DMU. In our paper, the health system consists of two parts: public health system and medical care. In our model we used equal weights for both divisions (0,5 for public health and 0,5 for medical care). Characteristics of inputs and outputs and the definition of all variables, which belong to the divisions are presented in the Table 2. The inputs and outputs have been used in several studies, including basic health determinants as well as medical care characteristics (Ozcan and Khushalani, 2016).

Table 5 Definitions of Variables

Variable	Definition
PUBLICH HEALTH DIVISION	
Inputs	
1 Alcohol consumption	Annual consumption of pure alcohol in liters, per capita, 15+
2 Tobacco consumption	Tobacco consumption, % of population 15+ who are daily smokers
3 Health expenditure	Current expenditure on health, per capita, US$ (current prices, current PPPs)
Outputs	
4 Life expectancy	Life expectancy, Total population at birth, Years
CARRY OVER	
Bad	
5 Infant mortality	Number of deaths of children aged under 1 year of age, per 1000 live births
Good	
6 Health status	Percentage of the population, aged 15 years old and who report their health to be "good/very good"

LINKS TO MEDICAL CARE	
7 Immunization	Diphtheria, Tetanus, Pertussis; % of children immunized
8 Screening-breast cancer	Breast cancer screening, survey data; % of females aged 50-69 screened
9 Screening-cervical cancer	Cervical cancer screening, survey data; % of females aged 20-69 screened
MEDICAL CARE DIVISION	
Inputs	
10 Medical Technology	Computed Tomography scanners, total, Per million population
11 Employment	Nurses + physicians per 1000 population
12 Beds	Beds per 1000 population
Outputs	
13 Discharges	Discharges per 100 000 population
14 Consults	Number of consultation per capita
BAD CARRY OVER	
15 Cancer	The number of new cancer cases per 100 000 population

Source: prepared by authors

Efficiency scores for selected OECD countries are presented in the Table 3. The table consists of four important columns: overall efficiency score, public health, medical care and Malmquist score, in given period 2005-2015. The overall Malmquist score above 1 point out to the improvement in the efficiency between period in OECD countries.

Table 6 Efficiency Scores for Selected OECD Countries

Country	**Overall score**		**Public Health**		**Medical Care**		**Malmquist**	
DMU	**2005**	**2015**	**2005**	**2015**	**2005**	**2015**	**Overall**	**Rank**
Australia	0,7706	0,8576	0,8104	0,9721	0,7245	0,7406	1,1916	8
Austria	1	1	1	1	1	1	0,9246	29
Belgium	0,6538	0,6399	0,7788	0,715	0,5659	0,5809	0,9113	31
Canada	1	1	1	1	1	1	1,1959	6
Chile	1	1	1	1	1	1	1,0045	22
Czech Republic	1	1	1	1	1	1	0,9247	28
Denmark	0,6975	1	0,7478	1	0,6552	1	1,6831	2
Estonia	1	0,8273	1	1	1	0,6866	0,744	35
Finland	1	1	1	1	1	1	0,9778	25
France	0,743	0,6585	0,7722	0,7045	0,7182	0,6195	0,8565	33
Germany	0,7178	0,7773	0,7348	0,7468	0,698	0,814	1,1039	10
Greece	1	1	1	1	1	1	1,2054	5
Hungary	1	1	1	1	1	1	0,9712	26
Iceland	1	1	1	1	1	1	0,978	24
Ireland	0,5137	1	0,7249	1	0,4119	1	1,9942	1
Israel	1	1	1	1	1	1	1,0268	20
Italy	1	1	1	1	1	1	1,047	16
Japan	1	1	1	1	1	1	0,9185	30
Korea	1	1	1	1	1	1	0,902	32
Latvia	1	1	1	1	1	1	1,0187	21
Luxembourg	0,6368	0,7627	0,685	0,7269	0,5976	0,7978	1,1263	9
Mexico	1	1	1	1	1	1	1,0887	12
Netherlands	1	0,7083	1	0,7674	1	0,6602	0,8152	34
New Zealand	1	1	1	1	1	1	1,1933	7
Norway	0,7932	0,8232	1	1	0,6416	0,6719	1,042	17
Poland	0,8119	1	1	1	0,6776	1	1,0903	11
Portugal	1	1	1	1	1	1	0,9563	27
Slovak Republic	1	1	1	1	1	1	1,0331	19
Slovenia	1	1	1	1	1	1	0,9872	23
Spain	1	0,9449	1	0,8897	1	1	1,0807	13
Sweden	1	1	1	1	1	1	1,3612	3
Switzerland	0,4826	0,4922	0,6616	0,6179	0,3698	0,406	1,0406	18
Turkey	1	1	1	1	1	1	1,2665	4
United Kingdom	1	0,9408	1	0,8832	1	1	1,0769	14

United States	1	1	1	1	1	1	1,0544	15
Average	0,9092	0,9266	0,9404	0,9435	0,8874	0,9136	1,0798	-

Source: prepared by authors

The average Malmquist score for the medical care division for the selected countries is 1,1535 and for the public health division is 1,0315. The best score in the improvement of the efficiency showed Ireland, Denmark, Sweden and Turkey over time. Based on the Malmquist score, it is important to mention, that the improvement of the overall efficiency score was driven by better score in efficiency of the medical care as to public health system in Ireland, Denmark, Sweden. The improving of medical care should to be the challenge for Turkey. The same results we can see in other countries. The better improvement we can see in medical care division over time (19 countries vs 16 countries).

Table 7 Projections of Inputs for Selected Countries

Inputs	**Average % difference between actual and projected values**
PUBLIC HEALTH	
Alcohol consumption	-6,6714
Tobacco consumption	-3,1449
Health expenditure	-3,6071
MEDICAL CARE	
Medical technology	-9,1394
Beds	-7,7206
Employment	-1,4031

Source: prepared by authors

In the Table 4 we present the projections based on DNDEA model for inputs of our sample. This table shows how should to be reduced the inputs to public health system and medical care system based on the projected values. These projections represent average % difference between actual and projected values for achieving the efficiency. From the table can be seen that the inputs to the medical care should to be reduced more than the inputs to the public health system.

5 Conclusions

In this paper we used DNDEA model for assessing the efficiency of health system by the constant returns to scale for selected OECD countries between period 2005-2015. The aim of the paper was to compare the health systems results based on DNDEA model. The DNDEA model consisted of a selection of inputs and outputs for two divisions: the public health system division and the medical care system division. The results of our analysis could be useful for better understanding of current health situation of health policy makers in selected countries. Within the divisions we estimated the efficiency based on 15 variables. The results of our analysis point to improvements in health care in OECD countries. The presented results of efficiency also have some limitations. In the case of missing data in a given year, we included the data that was closest to the given year, which, of course, leads to a bias in the results. Inputs and outputs in health system are very complex. In the literature, there are a number of the other determinants and variables of health system or medical care system, which can be used in DNDEA or other DEA models. The results of either DNDEA models or traditional DEA models are mainly affected by the choice of input and output variables. By including other variables in our model, we can achieve different results.

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Household Deposits' Availability for Credit Institutions during Tensions on Funding Markets – A Case of the Euro Area Countries

Katarzyna Kochaniak

Cracow University of Economics
Department of Finance
27 Rakowicka Street, 31-510 Cracow, Poland
E-mail: katarzyna.kochaniak@uek.krakow.pl

Abstract: *The EU regulations indicate household deposits as stable funding for credit institutions under stress and in the long run. However, the recent financial crisis revealed runs in the euro area, including ones that threatened financial stability. They encouraged to analyse the changes in the levels of deposits placed by households with credit institutions in individual member countries in the period of distress in funding markets. The study aims to analyse the fluctuations in the levels of household deposits and, in particular, to recognise regularities and irregularities in this respect. It applies regression models with time series data on household deposit totals for individual countries in the euro area. The results display considerable cross-country differences in the formation of deposit levels in the period analysed. For several member states, the trend could be recognised only in specified sub-periods. Only for some of the countries, the linear trend described a general long-term direction of changes in household deposit totals, confirming its stability in the entire period. In most member states, seasonal fluctuations in deposit totals occurred, but they related to various months. The study allowed identification of unexpected deposit outflows as well, which resulted, among other reasons, from financial problems of credit institutions. On the other hand, the adjustments in deposit guarantee schemes fostered households' confidence in these entities and led to the unexpected increases of the deposits in selected countries.*

Keywords: banks' liquidity, household deposits, banks' debt funding

JEL codes: G21, G32

1 Introduction

The financial crisis has revealed previously underestimated weaknesses of funding models of credit institutions in the EU. They resulted from the growing reliance on wholesale funds, including short-term, and diminishing the importance of retail deposits (Song and Thakor, 2007; Borio, 2009; Brunnermeier, 2009; Fender and McGuire, 2010; Merc et al., 2012; van Rixter and Gasperini, 2013; UKNF, 2017). The period of distress in funding markets led to the revision of the opinion on wholesale funds, drawing attention to their sensitivity to the prevailing conditions. This new, critical view has been strengthened by the EU post-crisis liquidity standards which emphasise the stable nature of retail deposits, both under stress and in the long run (ESRB, 2012; EBA, 2013; European Parliament and Council, 2013; EC, 2015). However, the experience of the last financial crisis provides examples of increased vulnerability of household deposits as well. They were recognised in Belgium, Cyprus, Greece, Spain, Ireland, and Portugal (ECB, 2009; Banco de Espana, 2012; Merck et al., 2012; Central Bank of Cyprus, 2013; Constancio, 2013; Whelan, 2013; National Bank of Greece, 2015).

The literature pays little attention to the formation of household deposit totals and its significance for the liquidity of credit institutions in countries of the single regulatory background. This study aims to fill the existing gap and recognise regularities and irregularities in this respect. Moreover, it refers the empirical results to the EU post-crisis regulatory stance about deposit stability. The paper answers the following research questions:

- Were the aggregated levels of household deposits characterised by a general (long-term) direction of changes in individual countries in the period analysed?

- Could the seasonal changes in household deposit totals be recognised in the euro area member states despite the ongoing destabilisation?
- Were there any unexpected deposit fluctuations during the period analysed?

The paper is organised as follows. Section 2 describes the research method and data applied in the study; Section 3 presents the results of the study; Section 4 contains conclusions.

2 Methodology and Data

The formation in time of household deposit totals (D_t) is an economic process that comprises the general trend (T_t), the economic cycle (C_t), seasonal variation (S_t), and irregular component (ε_t). It can be described as follows:

$$D_t = T_t + C_t + S_t + \varepsilon_t. \tag{1}$$

Due to the length of the period analysed, the study allows determining the trend, seasonal fluctuations, and autoregressive component. The trend defines a general, long-term direction of changes in deposit totals, the seasonality is confirmed by at least one significant parameter of the seasonal variable, and the autoregressive process occurs when the current value of the examined feature results from its value in previous periods. These issues are relevant to assess the formation of household deposit totals in the euro area countries. The study applies the following model (Kufel, 2013):

$$D_t = \sum_{j=0}^{r} a_j t^j + \sum_{i=1}^{m-1} d_i M_{it} + \sum_{s=1}^{p} \rho_s e_{t-s} + e'_t, \tag{2}$$

where D_t is the value of household deposits in the sector of credit institutions of a given country (in EUR million) in the t-th unit of time. The unit of time refers to the subsequent months of the analysed period while the value of deposits reflects their value at the end of the month. The first part of the equation relates to jth-degree polynomial whose argument is the time index (t) to isolate the appropriate trend. The second segment captures seasonal fluctuations in deposit values using dummy variables (M_i) identifying the months from January to November (December is the basis for comparison). The third part refers to autoregressive residues from the model (3); a, d, ρ - structural parameters of the model.

$$D_t = \sum_{j=0}^{r} a_j t^j + \sum_{i=1}^{m-1} d_i M_{it} + e_t \tag{3}$$

The OLS is applied to estimate of the structural parameters of the models. However, GLS is used in the case of heteroscedasticity (Kufel, 2013), according to heteroscedasticity consistent covariance matrix (HCCM). The goodness-of-fit of the models to empirical data is tested by the Akaike criterion (AIC), the Schwartz-Bayes information criterion (SBC), and the coefficient of determination (R^2) (Gorecki, 2010). The variance inflation factor (VIF) is used to check the collinearity of independent variables, and the White's test to verify the homoscedasticity of the variance (Kufel, 2013). The t-Student test is applied to assess the significance of structural parameters of the models, while the Doornik-Hansen test is to assess the normality of the distribution of residues (Kufel, 2013).

The study uses monthly data on household deposit totals placed with credit institution sectors of the euro area. They are derived from the ECB's and national central banks' database, "Our statistics", for the period of distress in funding markets. In most cases, this time span lasts from August 2007 to December 2014. However, in the case of Cyprus, Greece, Portugal, and Italy, it is extended until December 2016 due to the continuing funding problems of domestic credit institutions. The limited data for Estonia and Latvia led to the adoption of shortened periods for them (from January 2008 to December 2014 and from September 2010 to December 2014, respectively).

3 Results and Discussion

The analysis of the formation of household deposit totals in individual euro area countries was carried out using the model (2). In the case of Cyprus, Ireland, and Luxembourg, its specification was only possible in sub-periods, which referred to August 2007 - December 2012, January 2009 - December 2014, and May 2008 - December 2014, respectively. Due to the severe economic and financial problems of Greece, the analysis conducted for this country was limited to the estimation of a trend for specified sub-periods. In its case, the reliance on international aid programs and the persisting political problems triggered immediate reactions by depositors, who were withdrawing the deposits from domestic banks. The above limitations of the study prove significant cross-country differences in the formation of deposit totals in the euro area.

The first critical issue in this study was the choice of the polynomial degree of the time variable. The linear trend was adopted in the models for most countries (i.e., Belgium, Cyprus, Estonia, Finland, France, Germany, Ireland, Italy, Latvia, the Netherlands, and Spain). Intercept and parameter estimate of the time variable informed about the differences in the availability of household deposits for credit institutions among the countries regarding their initial levels and average monthly changes in the period analysed. However, an upward trend was recognised in all of them except for Ireland, where for the sub-period December 2009 to December 2014, the trend was negative. Concerning the remaining countries - Austria, Lithuania, Luxemburg, Portugal, Slovakia, and Slovenia - second-degree polynomial for the time variable was adopted. The German sector certainly stood out with the intercept reaching almost EUR 1,500,000,000,000 and the coefficient of time variable exceeding EUR 5,600,000,000. Also, the French sector distinguished itself with the intercept equal to over EUR 950,000,000,000 and the trend coefficient of almost EUR 3,400,000,000. Subsequently, the attention should be drawn to Italian sector (over EUR 750,000,000,000 and EUR 2,400,000,000 respectively) and the Spanish sector (almost EUR 650,000,000,000 and EUR 1,500,000,000 respectively). On the other hand, there were relatively small countries with significantly lower deposit levels like Estonia with the intercept of slightly over EUR 3,000,000,000 and trend coefficient equal to EUR 27,000,000, Latvia with values of almost EUR 4,000,000,000 and EUR 22,000,000 respectively, or Malta with the values of almost EUR 6,000,000,000 and almost EUR 30,000,000 respectively. On the basis of the levels of the intercept it can be stated that with the beginning of the crisis, the availability of this funding was generally adequate to the size of domestic sectors of credit institutions.

The parameter estimates confirmed the occurrence of seasonal changes in the deposit levels in all countries analysed, except for Greece (Table 1). Regarding the dummies identifying individual months, at least three of them were statistically significant in each model. The least susceptible to seasonal fluctuations were the deposits placed in Austria, France, Ireland, and Luxembourg. It should be emphasised that, in Austria, the most significant monthly outflows of deposits accounted for only 1.4% of the average value of the deposits in the analysed period. While comparing the seasonality of deposit totals in each month, it can be stated that in January they were close to those in December (the basis for comparison). In January, a seasonality was recognised only in Belgium, Lithuania, Malta, the Netherlands, Slovakia and Slovenia. However, for the Slovenian sector, this amplitude was the highest during the entire year. Most models (except for Austria, France, and Luxembourg) confirmed the seasonal fluctuations of the deposits in July. Regarding Estonia and Portugal, they led to utmost changes in their availability for credit institutions. Moreover, in June, household deposit totals were subject to significant adjustments. The positive ones were observed in Belgium, Cyprus, Estonia, Finland, the Netherlands, and Spain. This phenomenon resulted from bonus payments to employees before the summer vacation season, among other factors (DeNederlandscheBank, 2016). It is worth noting that September was a month of substantial negative seasonal changes in the deposit levels. The limited availability of this funding occurred then in, e.g. Austria, Germany, Italy, Latvia, Lithuania, and Portugal. The same could be concluded regarding November, when the deposits outflowed from the sectors of credit institutions in, e.g. Belgium, Cyprus, Estonia, Finland, France, Ireland, Italy, Lithuania, Slovakia, and Spain. In October, large deposit

withdrawals were observable in, e.g. Finland, France, Germany, Italy, Portugal, Slovakia, and Spain. For selected countries, the statistical significance of the parameter estimates of the dummies representing seasonal changes in deposit totals from January to November allowed estimating the ones that occurred in December each year. They led to conclusions about deposit outflows at the end of each year from credit institutions located in Belgium, Cyprus, Estonia, Finland, Luxembourg, the Netherlands, and Slovenia. They were caused, among other factors, by increasing expenditures of households during the Christmas and New Year period, as well as estimations of their capital gains taxes based on deposit levels at the end of the year (in the case of the Netherlands). In turn, the deposit accumulation in December was recognised in Germany, Italy, Latvia, Lithuania, Malta, Portugal, and Slovakia..

In selected countries of the euro area, solely positive or negative seasonal changes in deposit levels could be observed (Table 1). The only negative estimates were recognised in the models for Austria, Germany, Ireland, Italy, Lithuania, Latvia, and Malta. Thus, they informed about the largest availability of household deposits for credit institutions in December each year. The opposite could be concluded regarding Luxembourg, the Netherlands, and Slovenia. In the Netherlands and Slovenia, the elevated amounts of the deposits were recorded in most months. The results in Table 1 also draw attention to Belgian, Cypriot, Estonian, Finnish and Slovakian households who in general displayed an increased propensity to accumulate the deposits in the first half of a year and to withdraw them in the second.

In selected credit institution sectors, certain irregularities regarding deposit formation could be identified. They related to sudden inflows or outflows of the deposits in monthly periods. Due to their occurrence, the dummies relating to specific months entered the models and allowed estimating the dimension of these phenomena. Such adjustments were carried out for Belgium, Cyprus, Estonia, the Netherlands, Lithuania, Latvia, Germany, Slovakia, Slovenia, and Italy. In Lithuania, October 2008 and December 2011 emerged as months characterised by deposit outflows equal to EUR 414,500,000 and EUR 581,700,000, and December 2014 as a month with an increased value of the deposits by EUR 419,600,000. It should be emphasised that both negative changes resulted from a loss of confidence of depositors (households) in credit institutions caused by the bankruptcy of Snoras (one of the largest banks in Lithuania) and liquidity problems of the sector, including its limited access to market funding (IMF, 2009). On the other hand, a substantial increase in the deposits in December 2014 should primarily be linked to the accession of Lithuania to the euro area. In Slovakia, December of 2008 turned out to be the month of massive unexpected inflows of the deposits as well as October and November of 2008. The abandonment of the limit within the deposit guarantee scheme could explain the unusually high level of the deposits in the last quarter of 2008. In Belgium, irregular units of time with negative effects on deposit totals became apparent in December 2011 and May 2014 due to the problems of Dexia, including a rescue package provided for this bank by the governments of Belgium, France, and Luxembourg. In Cyprus, the last month of 2016 turned out to be distinctive due to a vast increase in the aggregated level of deposits resulting from the boosted confidence of depositors in credit institutions and elevated interest rates in this country (IMF, 2017). In the Netherlands, December 2014 represented a month of reduced deposit totals due to households looking for alternative investment opportunities of a higher rate of return (DeNederlandscheBank, 2016). In Latvia, November 2011 and December 2013 significantly differed from the remaining months. Regarding the first one, the decreased level of deposits resulted from households' reaction to the insolvency of JSC Latvijas Krājbanka and commencement of deposit repayments from the national deposit guarantee scheme. In December 2013, the value of households' deposits, in turn, was higher and could be explained by the adoption of the single currency by this country. It is worth noting that it was the most substantial increase in deposits since the beginning of the financial crisis. In Germany, irregularities in deposit totals were recognised in October 2008. The remarkably higher level of deposits resulted from the increased limit in the deposit guarantee scheme. In Italy, unexpected significant deposit inflows happened in October, November, and December 2008. The last quarter of

2008 can, therefore, be seen as conducive to the accumulation of deposits by Italian households, which resulted from the elevated guarantee limit. In Estonia, irregular positive changes in deposit totals were recognised in December 2010 due to a new deposit guarantee limit and Estonia's entry into the euro area. However, January 2013 was identified as a month of a statistically significant decrease in deposit totals caused by low interest rates, which discouraged households from holding them.

Table 1 Seasonal Fluctuations in the Total Value of Household Deposits in Plus and Minus in Individual Months in the Sectors of Credit Institutions

	Months										
Country	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
AT	×	(−)	×	×	×	×	×	(−)!	(−) !!	×	(−)
BE	(+)	(+)	(+)	(+)	(+) !!	(+) !	(+)	×	×	×	(−) !!
CY	×	(+)	×	(+)	(+) !	(+) !!	(+)	×	×	×	(−)!!
DE	×	×	(−)	×	×	(−)	(−)	(−)	(−) !!	(−) !	×
EE	×	(+)	×	(+)	(+)	(+) !	(+) !!	(+)	×	×	(−) !!
ES	×	×	×	×	×	(+) !!	(+) !	×	(−)	(−) !!	(−) !
FI	×	×	×	(+) !	(+)	(+) !!	(+)	(+)	×	(−) !	(−) !!
FR	×	×	×	(+) !!	×	×	×	×	(−)	(−) !	(−) !!
IE	×	×	(−)	×	×	×	(−) !	×	×	×	(−) !!
IT	×	(−)	(−)	×	×	×	(−)	(−)	(−) !	(−) !!	(−)
LT	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−)	(−) !!	(−)	(−) !
LU	×	(+) !!	(+)	(+)	(+) !	×	×	×	×	×	×
LV	×	×	(−)	(−)	(−)	(−)	(−)	(−) !!	(−) !	(−)	×
MT	(−)	(−)	(−) !	(−)	(−) !!	(−)	(−)	(−)	(−)	(−)	×
NL	(+)	(+)	(+)	(+)	(+)	(+) !!	(+) !	(+)	(+)	(+)	×
PT	×	×	(−)	(−)	(−)	×	(+) !!	×	(−) !	(−) !!	×
SI	(+) !!	(+) !	(+)	×	(+)	(+)	(+)	(+)	×	×	×
SK	(+) !	(+) !!	(+)	(+)	×	×	(−)	(−)	(−)	(−) !	(−) !!

Notes: (+) - positive parameter estimate, (-) - negative parameter estimate, (!!) - the highest amplitude of seasonal fluctuations among all positive/negative monthly amplitudes,
(!) – second the highest amplitude of seasonal fluctuations among all positive/negative monthly amplitudes.
Source: own study based on results from the model (2).

The last part of the model (2) refers to the autoregressive component. It allowed concluding about the statistical significance of developments in deposit totals from past months for the current level of deposits in the countries analysed (Table 2). The links between the levels of the deposits in the current month and previous month were recognised as the sole one in the models for Austria, Belgium, Cyprus, Spain, Lithuania, Luxembourg, Malta and Slovakia. Regarding the remaining countries, the influences of more distant months were observable as well. They could result from the flows of household saving deposits.

Table 2 Statistically Significant Delays of Residues from Models (2) of the Formation of Household Deposit Totals in Credit Institution Sectors of the Euro Area

	Delay in months											
Country	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
AT	(+)	×	×	×	×	×	×	×	×	×	×	×
BE	(+)	×	×	×	×	×	×	×	×	×	×	×
CY	(+)	×	×	×	×	×	×	×	×	×	×	×
DE	(+)	×	(+)	(−)	×	×	×	×	×	×	(+)	(−)
EE	(+)	×	×	×	×	×	×	×	×	×	×	×
ES	(+)	×	×	×	×	×	×	×	×	×	×	×
FI	(+)	×	×	(−)	×	×	×	×	(+)	(−)	×	×
FR	(+)	×	(+)	(−)	×	×	×	×	×	×	×	×

IE	(+)	×	×	×	×	×	(−)	×	×	×	×	×
IT	(+)	×	×	×	×	×	×	×	×	×	(+)	×
LT	(+)	×	×	×	×	×	×	×	×	×	×	×
LU	(+)	×	×	×	×	×	×	×	×	×	×	×
LV	(+)	×	(+)	×	×	×	×	×	×	×	×	×
MT	(+)	×	×	×	×	×	×	×	×	×	×	×
NL	(+)	×	×	×	×	×	×	×	(+)	(−)	×	×
PT	(+)	×	×	(−)	×	×	×	×	×	×	×	×
SI	(+)	×	×	×	×	×	×	×	×	(−)	(+)	(−)
SK	(+)	×	×	×	×	×	×	×	×	×	×	×

Notes: (+) - positive parameter estimate, (-) - negative parameter estimate.
Source: own study based on results from the model (2).

4 Conclusions

The results of modelling the process of household deposit allocation in the euro area countries allowed to refer them to the EU single regulations, which emphasise the stable nature of retail deposits under stress and in the long run. They served to formulate the following conclusions:

- The process of deposit allocation in credit institution sectors of the euro area was not uniform in the period of tensions in funding markets. The differences in the availability of household deposits in the long term, as well as in its monthly fluctuations, drew attention to the limited adequacy of the single regulatory stance regarding the euro area countries.
- In the models for most countries, the time variable was linear. Only in their cases can we, therefore, conclude the constancy of the general direction of the value of the deposits in the period analysed. Increasing deposit totals in the sectors of credit institutions of these countries confirmed their long-term availability and, thus, their stability as funding for credit institutions, despite the evolving destabilisation.
- In the remaining sectors, the direction of changes in household deposit totals was described with a second-degree polynomial. Thus, regarding the entire period analysed, it was possible to distinguish two sub-periods characterised by the opposite direction of changes in the availability of the deposits for credit institutions. In one of them, a gradual decrease in deposit totals was observed, emphasising the need for credit institutions to rely more on funding from other sources, which were difficult to obtain on a dysfunctional financial market. Thus, the changes observed in deposit totals were not in line with the regulatory stance on the availability of deposits in the long run. Regarding the second subperiod, the deposit inflows were conducive to their availability for credit institutions. These results led to conclusions that the general direction of changes in deposit totals might be responsible for the modifications of the models of funding of credit institutions throughout the study period.
- In most sectors of credit institutions in the euro area, the levels of household deposits were subject to seasonal fluctuations. It should be noted that the recognised fluctuations occurred on a monthly basis and had a repetitive nature despite the instability. The changes in deposit totals were therefore predictable and regular throughout the analysed period regardless of the phase of the financial crisis. The positive mid-year and end-year fluctuations were revealed in selected countries. It should be emphasised that in some sectors, the amplitude of fluctuations in the level of deposits was negative and occurred, among others, in December. The knowledge on the seasonality of changes in deposit values—in particular, those related to outflows—is essential for liquidity management in credit institutions.
- In the models for selected countries, irregular time units were identified in which excessive flows of household deposits resulted from extraordinary, unpredictable events. The sudden increase in deposits was caused by, among other phenomena, increased trust in governments and public institutions, both domestically and within the euro area. They occurred in selected sectors after the announcement of changes in deposit guarantee schemes, referring to the increase or abandonment of the limits, as

well as after the accession of selected countries to the euro area. However, attention should be paid, in particular, to these irregular time units that identified sudden outflows of deposits. They occurred, among other situations, under the lack of depositors' confidence in credit institutions. All the runs identified in this study related to large credit institutions and were visible at the country level. In their case, the limited stability of household deposits under stress should be therefore concluded.

- In all credit institution sectors, the availability of household deposits in a given month was positively affected by their increasing value in the previous month. This conclusion seems essential for the management of short-term liquidity of credit institutions, according to the LCR standard.

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Motives of Households for Saving in Poland

Anna Magdalena Korzeniowska

Maria Curie-Skłodowska University in Lublin
Faculty of Economics, Department of Banking
Pl. Marii Curie-Skłodowskiej 5, 20-031 Lublin, Poland
E-mail: anna.korzeniowska@umcs.lublin.pl

Abstract: *According to J. M. Keynes' theory of saving in the economy and households' behaviour followed by M. Browning and A. Lusardi (1996), the main motives for people to save are the precautionary motive, the life-cycle motive, the intertemporal substitution motive, the improvement motive, the independence motive, the enterprise motive, the bequest motive, the avarice motive and the down payment motive. This article examines which motives prevail in the decisions of Polish households in terms of saving. A sample of 223 working respondents was taken under consideration. Each of them represents a household from Lubelskie Voivodeship (Poland). The research proves that the precautionary motive has the highest ranking in respondents' opinions followed by the independence motive. The down payment motive was ranked lowest, closely followed by the enterprise motive. Additionally, analysis of correlation between motives was carried out. In most cases, there is a statistically significant correlation between saving motives. However, although the respondents rated saving motives highly, their impact on respondents' saving behaviour is lower than can be assumed.*

Keywords: saving motives, saving behaviour, personal saving

JEL codes: D14, E21

1 Introduction

Saving is a process of putting away some resources to preserve them for future use. The process can be run either consciously or unconsciously. The latter occurs, e.g. when at the end of a certain period, some unplanned surplus is available. The saving process is the subject of intense consideration in different trends of economics. Many researchers and scientists are interested enough in saving and its motives to include it as part of their economic theories. Among them were J. M. Keynes, who focused on current income, F. Modigliani, the author of the life-cycle hypothesis of saving and M. Friedman, who worked on the permanent income hypothesis. J. Duesenberry and a large group of other researchers state that the saving behaviour of households is determined mostly by psychological and sociological determinants. Duesenberry emphasizes that saving behaviour of an individual is influenced by that person's peers. Others focus on personal traits such as aversion to risk, habits and attitudes as factors of saving. They often take into consideration socio-economical qualities of savers, e.g. gender, age, location, income, etc. These points of view were presented in the works of G. Katona, who also suggested that past experience in saving influences the likelihood of doing it in the future (Devaney, Anong, Whirl, 2007).

The aim of this article is to analyse which motives determined by Keynes, in terms of saving, prevail in the decisions of Polish households.

2 Saving motives in theories of economy

In his work published in 1981, Alf Lindqvist pointed out that socioeconomic variables and those variables specifically that are important in economic theories may not be related to bank saving. During the regression analysis, the variables assumed to be important predictors of saving showed no predictive value (Lindqvist, 1981). This research inspired other scientists to search for and analyse the determinants and motives of saving.

On the basis of Maslow’s hierarchy of needs, some researchers studied motives that influence saving behaviour simultaneously (Xiao, Noring, 1994). In 1998, Boeree ranked

saving motives by their importance, from lowest to highest: physiological (basic), safety, security, love/societal, esteem/luxuries and self-actualization (Devaney et al., 2007). Generally, when the lower level needs are met, an individual one tends to move up to higher ones in the hierarchy. The perception of importance and significance of saving motives depends mostly on age and wealth of individuals (Yao, et. al., 2011)

Following J. M. Keynes' theory of saving in economy and households' behaviour with regard to this, M. Browning and A. Lusardi (1996) produced a list of eight household saving motives with one addition: the precautionary motive, the life-cycle motive, the intertemporal substitution motive, the improvement motive, the independence motive, the enterprise motive, the bequest motive, the avarice motive and the down payment motive. However, research scientists had already observed the need to analyse these motives while considering heterogeneity of members of populations and changes that can occur in the motives of the same person over the long run (Browning, Lusardi, 1996).

The importance attributed to saving motives can determine or at least influence the household saving rate. Additionally, the relative contribution of the saving motive to household saving changes with age. What is more, the importance that households attach to different saving motives is correlated with observed saving behaviour (Schunk, 2009). But scientist also determined that there is vast heterogeneity between households from different regions, cultures and age groups when it comes to the hierarchy of saving motives and the strength of their influence on saving (Canova et al., 2003).

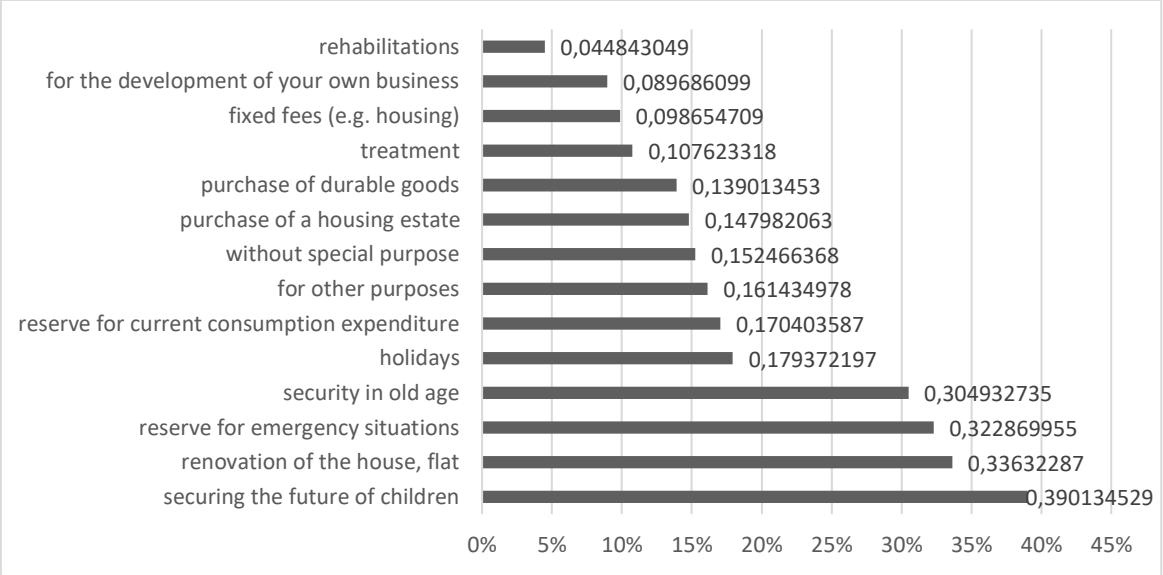
3 Goals and motives of saving in Poland

In research carried out at the beginning of 2018, a sample of 223 working respondents was considered. Each represented a household from Lubelskie Voivodeship (Poland). The respondents differed in gender, age, location and the level of education. They also declared the size of their household measured by the number of members, and they were asked to assess their financial situation. In all, 57% of respondents were women, and more than 55% of respondents were 26 to 35 and 36 to 45 years old. The same percentage, 30%, was recorded for those respondents living in rural areas and in cities with more than 200,000 citizens. Those having one to three other members in their households, respectively, were within a group of 26% to 28% respondents. As for their economic situations, approximately 50% assessed it as average. Almost 80% hold permanent employment, while 12% run their own businesses or were self-employed. In all, 35% graduated from high school, 24.5% hold bachelor's or engineering degrees and 34.5% were university graduates.

The respondents were asked to choose all their goals of saving from the provided list (Fig. 1). The largest group (39.01%) identified their saving goal as preserving money for their children. The Pearson coefficient between this goal and bequest motive is r=0.346 (p-value=0.000; with significance threshold 0.01). The next three goals indicated by more than 30% of the respondents were renovation of housing estate, reserve for random situations and providing security in old age. The second one is correlated with the precautionary motive with r=0.165 (p-value=0.033, sign.=0.05), and the last one is correlated with the life-cycle motive with r=0.166 (p=0.023, sign.=0.05).

Both the improvement and the independence motives are statistically significantly correlated with purchasing own housing, with r=0.218 (p=0.003, sign. 0.01) and r=0.159 (p=0.036, sign. 0.05), respectively. Although only 8.97% of the respondents declared they were saving for opening or developing their own business, that goal is strongly correlated with the enterprise motive with r=0.270 (p=0.000, sign.=0.01).

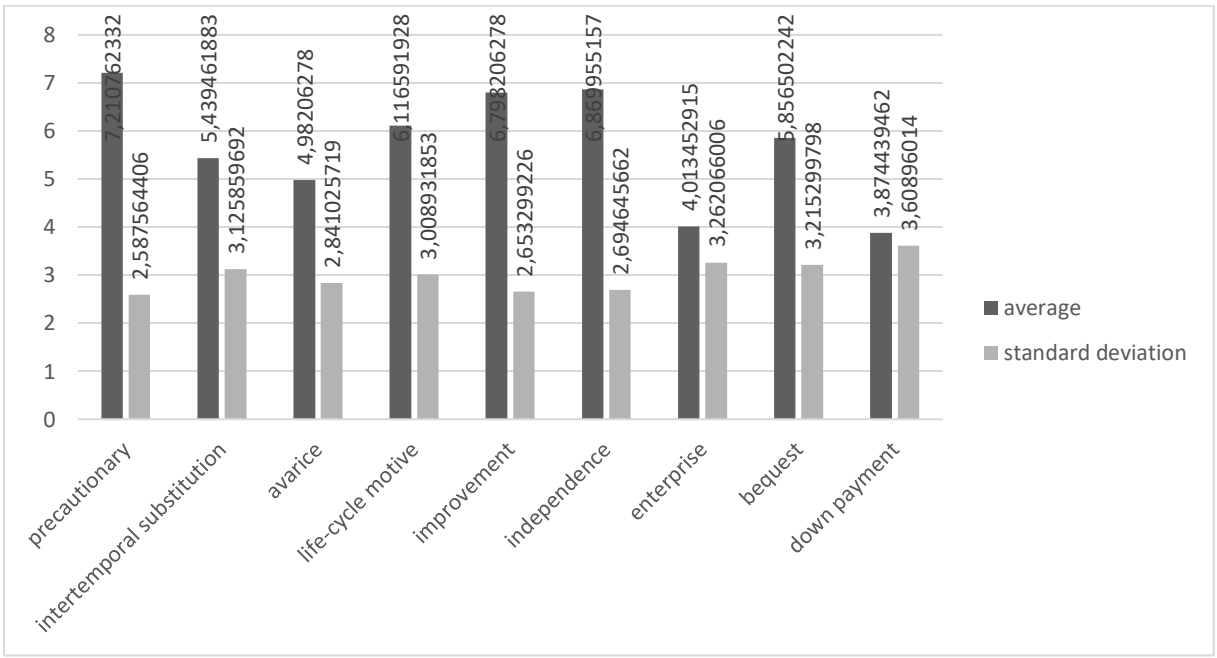
Figure 1. Goals of Saving (Multiple Choice)



Source: own calculations on the basis of questionnaire

The research proves that the precautionary motive has the highest ranking in the respondents' opinions, with the average mark 7.21 in the ascending scale from 0 to 10, followed by the independent and improvement motives with marks of 6.87 and 6.80, respectively (Fig. 2). The lowest ranking refers to the down payment motive with an average assessment of only 3.87, closely followed by the enterprise motive with an average mark of 4.01. The standard deviation of the mark for both these latter motives is the highest, which indicates large differences in respondents' opinions about these motives' importance.

Figure 2. Importance of Saving Motives (0—not important, 10—extremely important)



Source: own calculations on the basis of questionnaire

The relatively high value of averages indicates the importance of these saving motives for Polish households. However, the low correlation between saving motives and actual goals

of saving may imply that either households do not follow their motives or other important factors influence the choice of saving goals.

Furthermore, analysis of correlation between saving motives was carried out. In most cases, there is a statistically significant correlation between saving motives (Table 1). The highest correlation (r=0.654) occurred between the life-cycle motive and the bequest motive, followed by the correlation between the improvement and independence motives (r=0.537) and the independent and precautionary motives (r=0.501). However, no significant correlation was found between the down payment motive and the precautionary, improvement or independence motives. There is also a lack of correlation between the enterprise and precautionary motives and between the bequest and avarice motives.

Table 1. Pearson's Coefficient Between Saving and Saving Motives

	precautionary motive	**intertemporal substitution motive**	**avarice motive**	**life-cycle motive**	**improvement motive**	**independence motive**	**enterprise motive**	**bequest motive**	**down payment motive**
precautionary motive	1	.300**	.219**	.471**	.501**	.366**	.147	.291**	.123
intertemporal substitution motive	.300**	1	.384**	.454**	.345**	.234**	.397**	.373**	.237**
avarice motive	.219**	.384**	1	.245**	.182*	.259**	.159*	.137	.197**
life-cycle motive	.471**	.454**	.245**	1	.424**	.309**	.332**	.654**	.236**
improvement motive	.501**	.345**	.182*	.424**	1	.537**	.307**	.223**	.147
independence motive	.366**	.234**	.259**	.309**	.537**	1	.220**	.174*	.152
enterprise motive	.147	.397**	.159*	.332**	.307**	.220**	1	.306**	.203**
bequest motive	.291**	.373**	.137	.654**	.223**	.174*	.306**	1	.256**
down payment motive	.123	.237**	.197**	.236**	.147	.152	.203**	.256**	1

* - refers to p=0.05
** - refers to p=0.01

Source: own calculations on the basis of the questionnaire

4 Relationship between saving and its motives

To compare saving behaviour of the respondents with their saving motives, cross tables and the correspondence analysis with symmetrical normalisation were calculated. Correspondence analysis allows presenting results in graphic form as a chart of dispersion in which the points present particular categories of variables. The results proved to be statistically significant only for three motives: precautionary, improvement and life-cycle. In the case of both the precautionary and improvement motives, the first two dimensions of the correspondence analysis cover more than 70% of the results. While the importance of motives was assessed on an ascending scale from 0 to 10, the list of answers to the question about saving behaviour was:

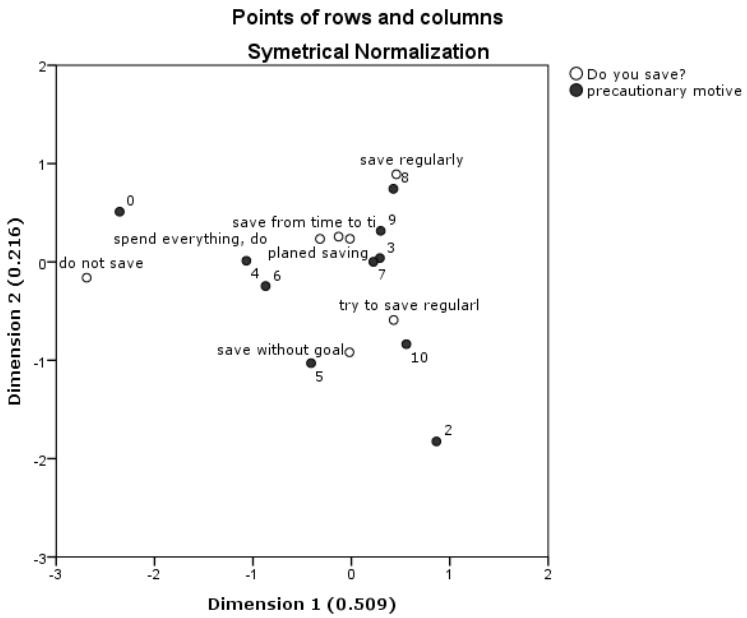
- I do not save,
- I spend everything on current needs, do not put off anything, do not invest (spend everything),
- I usually devote everything to current needs, but from time to time, I manage to save something (save from time to time),

- in addition to current expenses, I try to save some funds on regular basis (try to save regularly),
- I save a certain amount of money in addition to current expenses each month (save regularly),
- I allocate funds for consumption and savings in advance, but I have no specific purpose to save and plan to use financial instruments (save without a goal), and
- in advance, I allocate funds for consumption and savings, which I invest in planned financial instruments (planned saving).

The analysis shows that Polish households do not save with a proper plan. The largest group consisting of 34.08% of the respondents are those who try to save regularly. Another group of 25.11% of the respondents saves only from time to time after having satisfied their basic needs. Certain amounts of money are regularly put away by 17.49%. The respondents allocating set amounts of income to saving in advance are in the minority. In all, 6.73% save intentionally but without a goal or a saving plan, and 5.38% have some saving strategy. More than 11% of the respondents do not save at all.

The analysis reveals various patterns in households' behaviour. In the case of the precautionary motive, both the 0 and the 2 marks stand out, which indicates evidently that this motive is extremely important and is placed close to those who make an effort to save regularly (Fig. 3). Some who save regularly set amounts of money, but they do not have fixed goals, so they tend to follow this attitude, while the rest of them seem to have assessed the importance of the precautionary motive as an average "5" within the ranking. The respondents who allocate their funds in advance and have plans to utilise specific financial instruments to increase their wealth and those who manage to save some amounts from time to time (which in G. Katona's classification would be contractual saving and residual saving, respectively) (Fisher, Anong, 2012), the precautionary motive has varied importance. Some give it a rather low mark of "3", while others attributed to it higher ratings of "7" and "9". The largest group of regular savers is very close to mark "8". Interestingly enough, the declaration about not saving in the case of the precautionary motive is close to "0", while the improvement motive is closer to ratings "3" and "4" (Fig. 4).

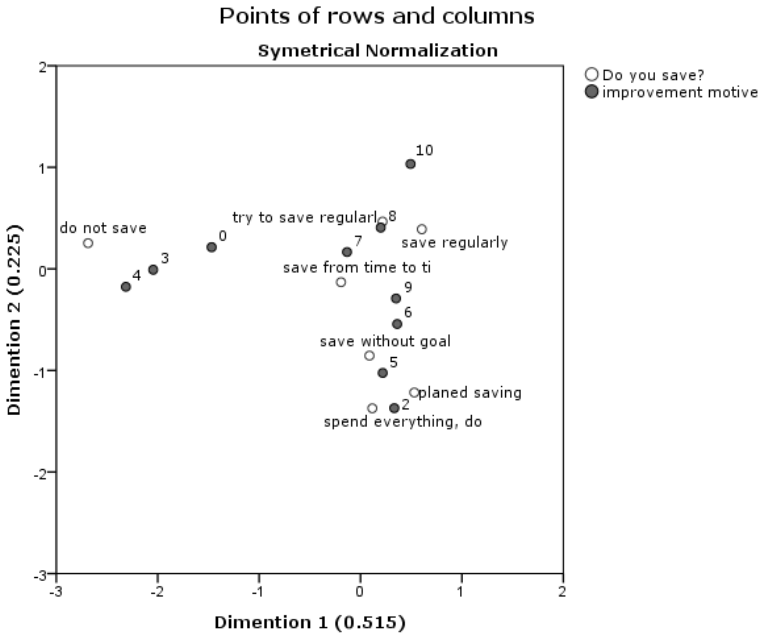
Figure 3. Correspondence Analysis of the Saving Behaviour vs the Precautionary Motive



chi^2=80.497, p-value=0.04 (60 degrees of freedom)
Source: own calculations with the usage of IBM SPSS on the basis of the questionnaire

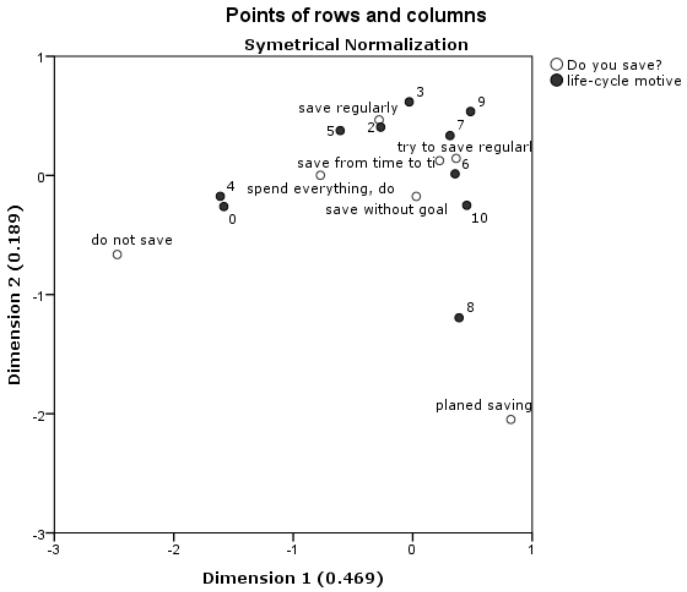
In Fig. 4, which represents the correspondence between the saving behaviour and the improvement motive, we can observe a very distinctive pattern. The more regular the saving, the more important the improvement motive is, with the exclusion of planned saving. The improvement motive includes saving for different real assets and services such as real estate satisfying the housing requirements of the household, a car, up-to-date furnishings and household equipment, and an education in the form of extra courses or studies. The implied need to save with the intention to spend money on specific planned goals forces savers to allocate their money regularly or at least semi-regularly. The analysis proves a real correspondence of saving behaviour with the improvement motive.

Figure 4. Correspondence Analysis of Saving Behaviour vs Improvement Motive



chi2=87.245, p-value=0.012 (60 degrees of freedom)
Source: own calculations with the usage of IBM SPSS on the basis of questionnaire

Figure 5. Correspondence Analysis of Saving Behaviour vs Life-cycle Motive



chi^2=87.783, p-value=0.011 (60 degrees of freedom)
Source: own calculations with the usage of IBM SPSS on the basis of questionnaire

The first two dimensions in the correspondence analysis of saving behaviour vs the life-cycle motive cover roughly 65.8% of the results (Fig. 5). This motive of saving is not important for people who do not save. It is also one of the less important saving motives for these who allocate and invest their saving with a plan. Out of all correspondence analysis between saving behaviour and the importance of the life-saving motive, the answers are the most concentrated in one place on the figure. This suggests that although life-cycle motive is not the most important for respondents, it is considered significant regardless of their saving behaviour. The results may also suggest that Polish households do not know how or do not have proper instruments to save in the long term because the life-cycle motive requires low risk stable instruments such as insurance policies, pension plans, and long-term deposits.

5 Conclusions

These findings indicate that Polish households understand the importance of saving to provide financial security for themselves and their descendants. They are aware of the implications of saving inspired by the improvement motive. They also know how to gain financial independence through that activity. The relatively low standard deviation of their assessment of saving motives' importance suggests the high compatibility of the respondents' opinions in that mater.

Although the analysed saving motives are considered essential in the respondents' assessment, their opinions do not translate into saving goals and other aspects of saving behaviour. Out of the list of 14 saving goals, only four were identified by more than 30% of the respondents, seven others were viewed by from 10% to 20% of the households representatives and the last four were chosen by less than 10%. These figures clearly suggest that the knowledge and opinions of the importance of saving are not supported by real activity. This statement is strengthened by the data representing behaviour of the respondents in terms of saving, which clearly reflect that Polish households save mostly occasionally and without employing any strategy such as using adequate financial instruments.

The results indicate a rather disturbing picture of Polish households' saving behaviour. Despite the fact that the Polish financial market is highly developed, to the level that recently analysts stopped considering Poland an emerging market, Polish households do not take full advantage of that fact. Many households store their saving in liquid instruments or in cash even if their goal of saving is long term. The lack of translating saving motives into actual saving behaviour can be influenced by many, not just economic, factors because households are under social and cultural constraints. Nevertheless, both financial and educational institutions should intensify their efforts in educating individuals to adjust their offers of financial instruments to the needs of households.

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The Relationship between Saving and Debt in Polish Households

Anna Magdalena Korzeniowska[1], Wojciech Misterek[2]

[1] Maria Curie-Skłodowska University in Lublin
Faculty of Economics, Department of Banking
Pl.Marii Curie-Skłodowskiej 5, 20-031 Lublin, Poland
E-mail: anna.korzeniowska@umcs.lublin.pl

[2] Maria Curie-Skłodowska University in Lublin
Faculty of Economics, Department of Banking
Pl.Marii Curie-Skłodowskiej 5, 20-031 Lublin, Poland
E-mail: wojciech.misterek@umcs.lublin.pl

Abstract: *It can be assumed that having saving and credit is mutually incompatible, because the logics requires paying down of any debt if one has financial surpluses. This is because the cost of servicing debt is much higher than the benefits of interest on saving. As the observation of real household behaviour proves the opposite, the aim of this paper is to analyse the relationship between saving and debt of households, which is illustrated by the case of citizens of Lubelskie Voivodeship (Poland). The research conducted on a group of 223 working representatives of households shows that more than 50% of persons with bank loans also have saving that exceeds in its amount a 3-month income of a respondent. It is worth noting, however, that among persons assessing their financial situation as good or very good, the percentage of such persons is higher than in the case of people assessing their financial situation as bad or rather bad. In the latter group, many more people are holding only credit products. The research has also shown that people with saving are more likely to use car loans and credit cards, while people who do not save are more likely to use cash credits and cash loans. In both groups, the percentage of people with mortgages is comparable.*

Keywords: personal finance, credit instruments, saving level

JEL codes: D14, G21

1 Introduction

Consumption spending is the most important component in the expenditure method of calculating the gross domestic product. Therefore, the number of research topics connected with consumption is not surprising. Scientists research the level of consumption expenditure as part of national demand, the structure of the consumption on a micro level and sources of financing consumption. The standard theory claims that the level of consumption depends on a disposable income because the basic decision of the household is how to divide the income into consumption and savings when the latter is understood as postponing consumption. From this perspective, households' debt is treated as accelerating consumption in time that in consequence will be paid off during coming periods by using saving. The intertemporal aspect of saving is fundamental for understanding households' financial behaviour (Börsch-Supan and Essig, 2003).

The commonly shared approach in the analysis of the household's wealth (which is co-integrated with income and consumption ((Dreger and Reimers, 2011)) on a micro level is to focus on net wealth, whereby the household's liabilities are deducted from its assets (Kukk, 2014). But while drawing proper conclusions, there is a problem with heterogeneity of household assets across countries because there are noticeable differences in real estate ownership, which is an important part of real assets. Another problem is that the same net wealth can be calculated from various combinations of assets and liabilities. That is why in another approach, researchers compare only financial assets with liabilities. It is claimed that households use credit to smooth their income, but the process is affected by credit constraints. There is also a relationship between credit constraints and selection of financial assets (Wang, 2016).

Scientists are also interested in households with income that is lower than their expenditures. The question arises how households deal with these expenses. Usually the sources of financing over-expenditure are wealth/past saving, formal credits and loans, informal loans in the form of assistance from family and/or friends and unpaid bills (Le Blanc, Porpiglia, Teppa, Zhu, and Ziegelmeyer, 2015).This prompts to further analysis on the financial situation of vulnerable households (Ampudia, van Vlokhoven, and Żochowski, 2016).

There is little to none simultaneous research on both saving and debt of households. Usually debt is used only as a background for saving opportunities of individuals or it is treated as a constraint to save, especially if we take into consideration the debt-to-income ratio of households, which in the European Union is much higher than 100% (Rocher and Stierle, 2015).

It can be assumed that having saving and credit mutually exclude each other, because the logics require paying down of any debt only if financial surpluses are generated. This is because the cost of servicing debt is much higher than the benefits of interest on saving. However, the observation of real household behaviour proves the opposite. This is particularly the case with the precautionary and the life-cycle motives of saving. For example, according to the Polish Central Bank, the value of financial assets of households at the end of the 1st quarter of 2017 was 1 953,7 bln PLN, while at the same time, the value of financial debt was 701 bln PLN (Kolasa, 2017). Therefore, this paper analyses the relationship between saving and debt of households in Lubelskie Voivodeship (Poland).

2 Description of the methodology and the research sample

This paper researches financial aspects of households' functioning in Lubelskie Voivodeship. The research was run by the scientists from the Faculty of Economics of Maria Curie-Skłodowska University in Lublin under the patronage of the research staff of the Department of Banking. The research was carried out with the use of the direct questionnaire survey methodology. The questionnaire was completed by 223 professionally active persons representing households. Among the respondents, the majority had employment contracts or some other similar form of employment, and they account for 79.37% of the research sample. A significant proportion of the respondents run their own businesses (12.11%) or farms. The remaining respondents (1.35%) most often combined a few forms of employment. Although the questions referred to the financial standing of the whole household, the structure of the respondents affected the answers only to a small extent. The research group was dominated by women (56.95%) and persons aged 36-45 (30.49%).There were slightly fewer persons aged 26-35 (26.46%) and 46-55 (21.52%).The least numerous were respondents up to the age of 25 (13.01%) and those 56 and older (8.52%). The research was carried out in Lubelskie Voivodeship, which is the sample included 30% of households in towns with more than 200 000 inhabitants and villages, 20% in towns up to 20 000 inhabitants as well as between 20 000 and 200 000 inhabitants. The research covered households of various sizes. A similar proportion, i.e. at the level of 27%, was recorded for two- , three- , and four-person households. Slightly over 12% of the research group were households consisting of a minimum of five persons, and only 6.3% were single person households.

To sum up, the structure of the research sample fully reflects the structure of the inhabitants of the examined region both in terms of demographic and social factors.

3 Comparative analysis of holding saving and credit

With the right assumption, saving and credit are mutually exclusive because the logics require repaying debt when some financial surpluses are generated. It results from the fact that the cost of debt service is much higher than benefits from interest rates for savings.

However, the research shows that over 30% of persons with bank credits hold saving that exceeds a three-month income of a respondent. If the research was to take into account also those persons with saving lower than a three-month income, it would appear that a group of respondents with both credits and saving increases to more than 50%. Therefore, it seems appropriate to verify the characteristics of this group of persons and the nature of the debt they hold.

Analysis of the data in Table 1 shows that a financial standing is essential for holding debt or saving instruments. It is clear that the higher assessment of a household's financial standing, the higher the number is of individuals holding saving or credit together with saving. Within the group, which is of key importance for the research, i.e. those persons who hold both credit and saving, 40% assess their financial standing of their households at a good or very good level, and only 6% said their situation is bad or very bad. This structure is very similar to the structure of persons holding only saving. For comparison, among persons with credits only, only 20% of persons assess the financial situation of their households at a good or very good level, and nearly 30% of those declared it is bad or rather bad.

Table 1 Structure of Respondents by Their Individual Assessment of a Household's Financial Standing

Financial standing	Only credit	Only saving	Credit and saving	Neither credit nor saving
Bad	6.7% (1.6%)	1.2% (0.0%)	0.0% (0.0%)	0.0% (3.0%)
Rather bad	20.0% (9.4%)	3.7% (1.7%)	6.0% (5.9%)	10.0% (9.1%)
Average	53.3% (56.3%)	43.2% (41.4%)	53.0% (50.0%)	70.0% (54.5%)
Good	20.0% (29.7%)	40.7% (43.1%)	34.2% (35.3%)	20.0% (30.3%)
Very good	0.0% (3.1%)	11.1% (13.8%)	6.8% (8.8%)	0.0% (3.0%)

* the data in parenthesis are given for the assumption that saving must account for minimum three-month incomes of a household

Source: Own study based on questionnaire surveys

Giving the assumption that saving should account for minimum three-month incomes of a household (the data in parentheses in Table 1), the reliances indicated are also confirmed. Yet, the discrepancies between the answers from persons only with credits and possessors of credits and saving or only savings are slightly smaller.

The data presented in Table 2 identify a similar reliance between a saving instrument and/or credit and income per capita in the household. It becomes evident that the respondents holding both credit and saving and those with saving only are wealthier than the respondents who have only credit. In the first two groups, the proportion of persons with incomes higher than 2400 PLN per person is between 21.7-28.6%, and those earning the least (less than 1 600PLN per person) account for 40%, while among the persons with credit only, the proportions are -12.7% and 54.5%, respectively.

Therefore, while the financial standing of a household has an effect on saving, it has no effect on debt. The data in Fig. 1 shows that the level of saving does not affect holding or not holding credit. It is clear that for all the groups of respondents with different levels of saving, the proportion of persons declaring bank debt is similar, and its level is 46.9%-

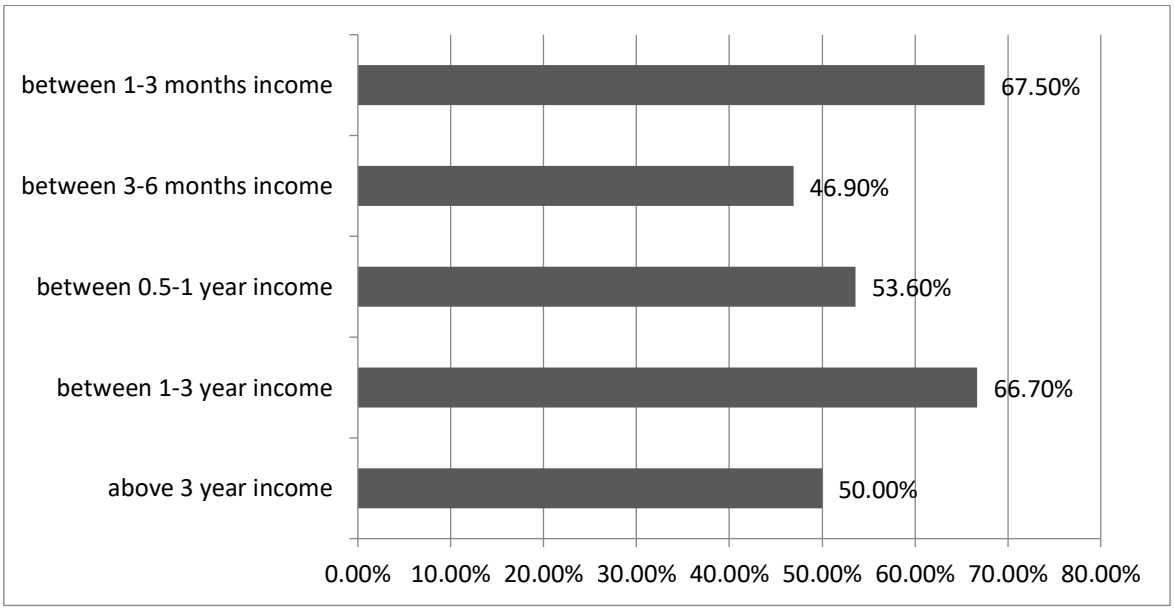
67.5%. What is also essential is the fact that it is difficult to identify any trend here, whether it is an uptrend or downtrend.

Table 2 Structure of Respondents with Credit or Saving by Income per Capita in a Household (for the analysis, it was assumed that saving must account for minimum three-month incomes of a household)

Income per capita in a household (in PLN)	Only credit	Only saving	Credit and saving	Neither credit nor saving
0-799	10.9%	2.0%	6.7%	8.0%
800-1599	43.6%	38.8%	33.3%	52.0%
1600-2399	32.7%	30.6%	38.3%	36.0%
2400-3199	10.9%	18.4%	10.0%	0.0%
> 3199	1.8%	10.2%	11.7%	4.0%

* the data in parenthesis are given for the assumption that saving must account for minimum three-month incomes of a household
Source: Own study based on questionnaire surveys

Figure 1 Percentage of Persons Holding Credits with Different Levels of Household Saving



Source: Own study based on questionnaire surveys

Hence, if the income (wealth) of a household is a determinant of saving but not credit, it is worth verifying what affects decisions to use credit. It is then fairly justified to compare types of credit typical for the groups of respondents with different levels of saving. It should allow diagnosing why persons holding saving hold credit at the same time. As the data from Table 3 show, the amount of saving influences a particular type of credit. These dependencies, however, may vary because for some types of credit, an increase in saving causes this very type of credit to be more common, while for others, an increase in saving results in a decrease of the percentage of persons holding this type of credit.

The first group, for instance, has credit cards that are used by only several per cent of households with no saving or with saving equivalent to an annual income at maximum; more than 25% of households hold saving in excess of their annual income. This is clearly determined by a type of credit. People mostly use credit cards for convenience to temporarily improve their creditworthiness and to transfer debt service burden to another period. Consequently, economic rationality, which says that the cost of credit is higher than the interest rates on saving, is of minor importance. What is more, the cost of debt service in this case is low. That is why so many persons despite having some funds in their bank accounts decide to use a credit card to increase their comfort while clearing transactions.

Similarly, it applies to car credits. In this case, only a few households with no or a low level saving use this form of debt. Yet, among individuals with saving higher than their annual income, the frequency of this type of debt is higher and ranges from several to several dozen per cent. Also in this case, the purpose of the credit affects the situation. Car credit is often used by persons only because they would like to split the burden of purchase of a given means of transport over time, not because they are not able to set aside sufficient resources for a one-off transaction. Additionally, not less important is the influence of car manufacturers themselves, which encourage buy new vehicles by offering very cheap credits. Thus, wealthy persons, despite having saving, decide to purchase a new car by instalments and take advantage of car credit. This type of debt is less popular with less wealthy persons and therefore holding less saving may mostly result from the fact that such persons decide to buy second-hand cars for which car manufacturer offer no cheap credits.

Table 3 Percentage of Households with Different Levels of Saving and Holding Particular Types of Credit

Level of saving in monthly income of a household / Credit type	No saving	Between 1-3 months income	Between 3-6 months income	Between 6-12 months income	Between 12-36 months income
Mortgage	24.0%	27.5%	18.8%	32.1%	27.8%
Credit card	16.0%	17.5%	6.3%	14.3%	27.8%
Credit line, e.g. in savings and transaction account	8.0%	3.8%	6.3%	0.0%	0.0%
Car credit	0.0%	8.8%	3.1%	7.1%	11.1%
Credit/Cash loan	20.0%	15.0%	15.6%	3.6%	11.1%
Consumer credit	4.0%	10.0%	6.3%	3.6%	11.1%
Student credit	4.0%	1.3%	3.1%	0.0%	0.0%
Consolidation loan	0.0%	1.3%	0.0%	0.0%	5.6%

Source: Own study based on questionnaire surveys

A reverse situation is the case of cash credit/loan. This form of funding is more commonly used by households with low saving, i.e. less wealthy ones, because it is a form of debt

used mainly to replenish current cash flow shortages when there is no other way to provide funds. Although these credits are very expensive, there are persons who decide to choose them because they have no other alternative and also because interest rates on their saving are lower than the cost of the debt.

Student credit is relatively commonly used by households with low saving. However, age is a decisive factor in this case. Young persons who use this form of credit to finance their education are obliged to repay it in the first years of their employment. Consequently, such debt is still serviced even though some surpluses in saving are systematically generated.

It is worth noting that in the case of some credits, the frequency of their use is comparable for persons both with high and low saving. This is the case for mortgages, which are used to split very high payments into a few or a few dozen years. Rare is the case when saving allows paying such a high debt off in one payment. As a result, this form of debt is chosen both by wealthy persons with high saving and those with lower income and saving. It would seem reasonable to repay this debt from saving, but persons with higher income and saving do not do this because they want more comfort of functioning and safety (so-called precautionary saving). The same applies to a credit line in the current account, except that it is affected not by the amount of debt but by its form. This credit is used while using a bank account, which is why so many persons take this opportunity, no matter how high their incomes and saving are.

4 Conclusions

It is natural to assume that holding saving and credit is mutually excluded because logically, one is expected to repay debt when financial surpluses are generated. As the research shows, it does not always hold true because more than 30% of persons with bank credit are able to hold saving that exceeds their three-months income, and another 20% hold some lower saving despite holding debt. This mainly results from the fact that financial standing of a household is a determinant of saving but not credit. Consequently, the higher the income generated by a household, the higher its saving is. It does not mean, however, that such a household has lower debt. This is influenced by the purpose for which credit is taken because many types of credit are offered for our convenience. Although we bear the costs of its service, we try to take advantage of it because it makes our functioning in the market much easier. We often decide to take credit despite holding saving because of an attractive commercial offer, e.g. car credit. Still, some other reasons are for mortgages, which allows a high one-off payment to be split over time. Although we are sometimes able to generate surpluses, we decide to put aside some saving rather than make an early payment of credit. These are psychological factors that decide that our priority is to hold free financial resources for safety, not to reasonably repay debt.

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The Selected Aspects of Foreign Trade in Central European Countries

Jaroslav Kovárník[1], Eva Hamplová[2]

[1] University of Hradec Králové
Faculty of Informatics and Management, Department of Economics
Rokitanského 62, 500 03 Hradec Králové, Czech Republic
E-mail: jaroslav.kovarnik@uhk.cz

[2] University of Hradec Králové
Faculty of Informatics and Management, Department of Economics
Rokitanského 62, 500 03 Hradec Králové, Czech Republic
E-mail: eva.hamplova@uhk.cz

Abstract: *This article deals with the selected aspects of foreign trade development in the countries from central Europe, namely the Czech Republic, Poland, Slovakia, Hungary, where these countries belong into Visegrad Four, and Germany, because countries of V4 have usually strong connections with Germany. The article continues with analysis from other articles presented on other conferences, and it analyses development since 2000, and it focuses on selected aspects of foreign trade development, because foreign trade is crucial part for sustainable development for almost all countries around the world (it is part of GDP formula in open economy). The article analyses development of foreign trade with goods and with services, where have been discovered relatively surprising results (the weakest economy in terms of services has been Germany), but consequently the article analyses relations between export development, foreign trade development, and GDP development. In theoretical point of view, export is considered to be independent on domestic product, and economically weak countries are usually considered to be more dependent on export (in terms of GDP development). This fact has been proved during analysis, where especially V4 countries are strongly dependent on export. However, the final impact of net balance of foreign trade on GDP is relatively weak in all V4 countries, which is relatively surprising fact again. Detail description of results is in this article.*

Keywords: Central Europe, Czech Republic, export, foreign trade, import

JEL codes: F43, O11

1 Introduction

Foreign trade is very important for every state all around the world because it is, among others, part of macroeconomic Gross Domestic Product (GDP) formula. In other words, it can either improve the GDP level (in case that export is higher than import) or worsen it (in the opposite case). This basic theory has been explained in many books and articles, for example in Andrews, Bernake, & Croushore (2011), or Samuelson & Nordhaus (2010).

Nevertheless, foreign trade is important for every country because of other reasons as well. In almost all countries worldwide, foreign trade helps to solve the proportionality problem, where only few countries have all necessary resources in quantities required for economic development. Foreign trade also has demonstrative effect, where the export program is kind of indicator of the level of economic development, and it also helps create an image of developed country. Foreign trade has also other benefits, such as support of peaceful cooperation among partners, reducing of the risk of conflict, growth of education, and others.

From above mentioned text is clear that foreign trade is very important for every country. The importance of foreign trade has been evaluated in other articles by other authors, for example Baier, Bergrstrand & Feng (2014), Cieslik, Bieganska & Sroda-Murawska (2016), Do, Levchenko & Raddatz (2016), Fracasso & Marzetti (2015), Giordano & Zollino (2016), Gladkov (2016), or Vannoorenberghe (2014). Authors themselves already analysed the

topic of foreign trade several times, for example in Kovárník & Hamplová (2016), or Kovárník & Hamplová (2017).

The Czech Republic is a member state of Visegrad Four, and all other member states (namely Poland, Slovakia, and Hungary) are very important business partners for the Czech Republic. Situation in Visegrad Four countries has been also analysed by other authors, for example by Zdražil & Kraftová (2012). However, the most important business partner for the Czech Republic is Germany, where this economy has a very important position as a business partner for all V4 countries.

The aim of this article is to analyse the selected aspects of foreign trade in above mentioned countries, namely in the Czech Republic, Poland, Hungary, Slovakia, and Germany. Firstly, this article analyses the development of GDP in selected countries, because of the importance of foreign trade for this indicator. The development of foreign trade in terms of goods and in terms of services in these countries is next topic for analysis. Consequently, the relation between export and GDP and between foreign trade and GDP are analysed as well. The aim is to verify the hypothesis whether the development of both GDP and foreign trade of these countries is similar or not, and also to verify whether especially small and relatively weak economies are more open and more dependent on foreign trade.

2 Methodology and Data

Covered period of time is 2000 – 2017, where data were obtained in general available database Eurostat and calculated by authors (Eurostat a, 2018, Eurostat b, 2018).

Methods of comparison and comparative analysis have been used. Moreover, for the verification of above mentioned hypothesis about openness of economy can be used several different calculations. One of the most frequently used calculations measures the relation between export and GDP, where more open economies usually have high ratio. Another possible calculation uses turnover of foreign trade (summary of both export and import) on GDP.

On the other hand, the importance of foreign trade for GDP creation can be evaluated by the size of net balance on GDP, because in the theoretical point of view, only net exports are part of GDP formula in open economy.

3 Results and Discussion

The Analysis of GDP Development

Based on the fact that the Czech Republic has currently around 10.5 billion of inhabitants, Hungary around 9.8 billion, Slovakia around 5.4 billion, Poland more almost 38 billion, and Germany more than 82 billion, it is quite obvious that the level of GDP in billions of euro is the highest in Germany, second highest in Poland, next in the Czech Republic, in Hungary, and Slovakia is on last position.

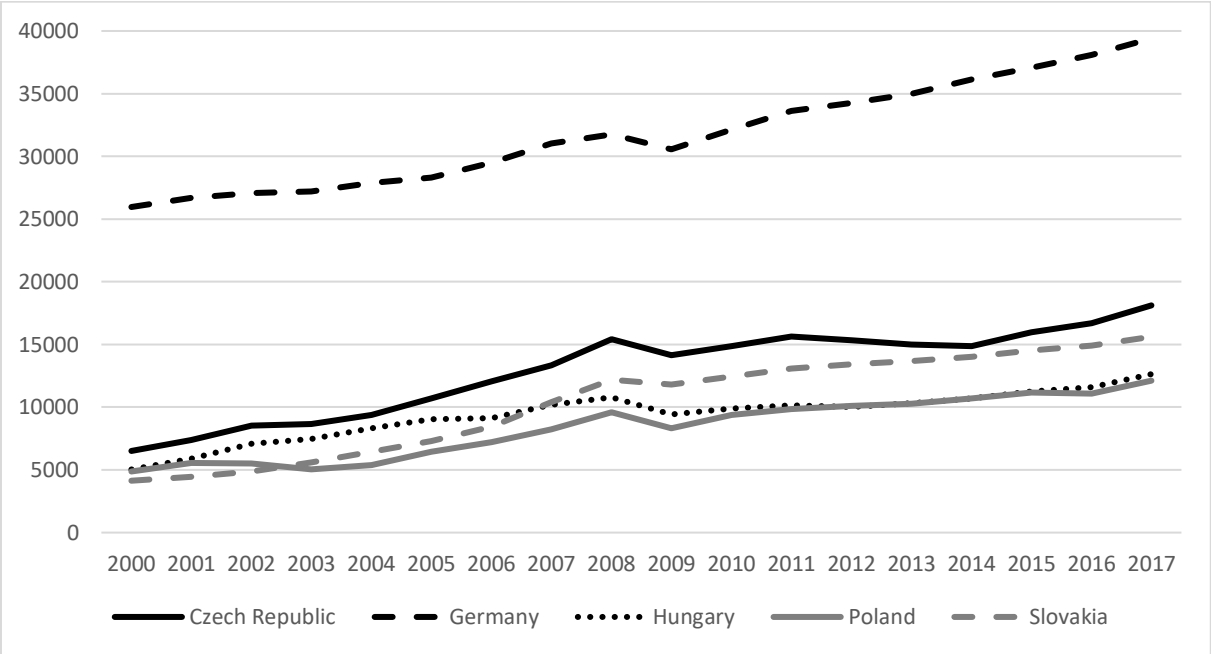
However, it is better to use the level of GDP per capita for comparison. According to this, Germany still has the highest level, but the Czech Republic is on the second position, Slovakia is the third, Hungary on the fourth place, and Poland is the last. With respect to this information is good to add one interesting fact. Even if the development in the number of inhabitants in each country have not been steady, this number grew in the all analysed countries except Hungary (comparison of the number of inhabitants in the years 2000 and 2017).

Deep analysis of GDP development shows that in all analysed countries was significant decrease in this indicator in the year 2009 (both in absolute value and in per capita) as a result of global economic crisis. However, the after crisis development is different. Germany has been growing since 2009 and it managed exceed pre-crisis year already in 2010. The Czech Republic was growing between 2009 – 2011, it was decreasing between 2011 – 2014, and it has been growing again since 2014. Moreover, it managed to exceed pre-crisis year in 2011, but the level of GDP per capita in this country decreased under the

pre-crisis year during the decrease, and it exceed the pre-crisis level again in 2015. Poland was on the last position in 2008, it had been growing since 2009 to 2015, it dropped a little in 2016, and it has grown again in 2017. It exceeded pre-crisis year in 2011, and in the year 2012 (but only in this year) it exceeded Hungary. Hungary has been growing since 2009 with one exception in 2012. It was on the fourth position before crisis and it is on the fourth position again in 2017. Slovakia has been growing, as well as Germany, since 2009, and it also managed to exceed pre-crisis year within one year.

Following Fig. 1 shows the development of GDP per capita in analysed countries.

Figure 1 GDP Development (Euro per Capita)



Source: own calculations based on Eurostat a (2018), Eurostat b (2018)

Foreign Trade Development – Trade with Goods

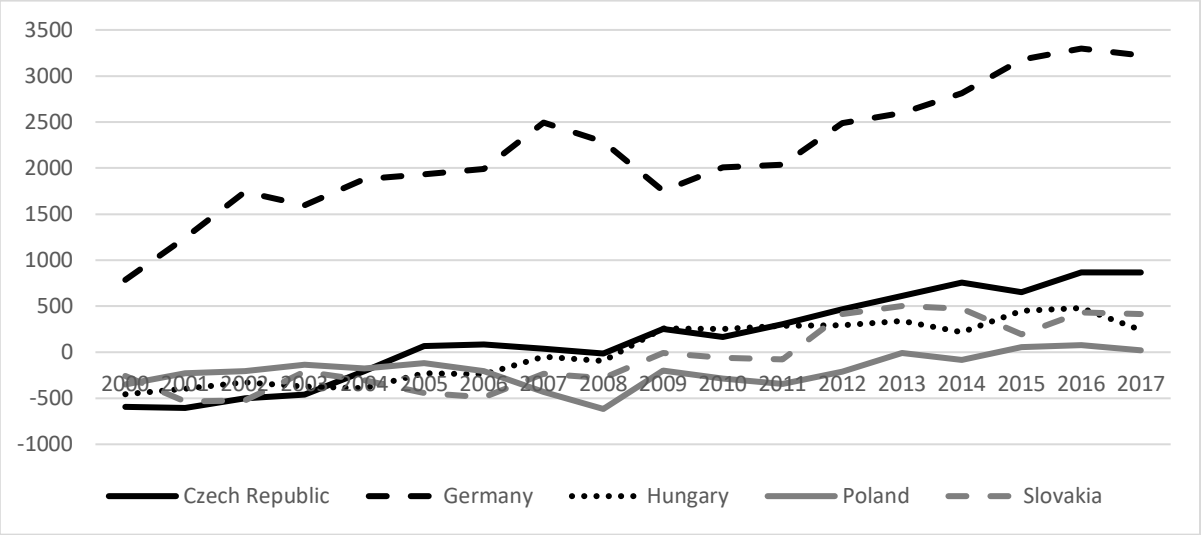
The analysis of foreign trade development shows relatively different results than the GDP development analysis. The development of net balance in terms of goods recalculated per capita is described in following Fig. 2. Recalculation per capita is necessary, because absolute values of net balance in Germany are significantly higher than in other countries and mutual comparison of all five countries in absolute values is difficult. After the recalculation, Germany is still on the first position, but the differences are lower.

First interesting fact is that in the first analysed year (2000) all countries except of Germany had negative trade balance, which means they had higher imports than exports. Even if current trade balance is positive in all analysed countries, the development has been quite irregular. Germany had surplus more than 64,000 billion in 2000, and it had surplus around 268,000 billion in 2017. The second highest surplus in 2017 had the Czech Republic, where this surplus is little bit more than 9,000 billion.

As was already mentioned, Germany has been in surplus and it has had the strongest position from all analysed countries. However, the mutual comparison of V4 countries shows interesting results. The Czech Republic had the worst position in 2000 (the highest deficit per capita, while in absolute amount had Poland worse result), but it has been growing (with few exceptions), and currently the Czech Republic has the second highest surplus (after Germany). Exactly opposite development has been in Slovakia. This country had the best result from V4 countries in 2000 (both in absolute amount and per capita), but it has the second worst result in 2017 in absolute amount and the third highest values in terms of net balance per capita (after Germany and the Czech Republic). Really interesting fact is that in 2009, during the economic crisis, was net balance decreasing in

Germany, while it was increasing in all other analysed countries. Moreover, the net balance grew in Germany in 2010, while it decreased in all analysed countries. The development of foreign trade with goods per capita is described in the following Fig. 2.

Figure 2 Foreign Trade with Goods (Euro per Capita)

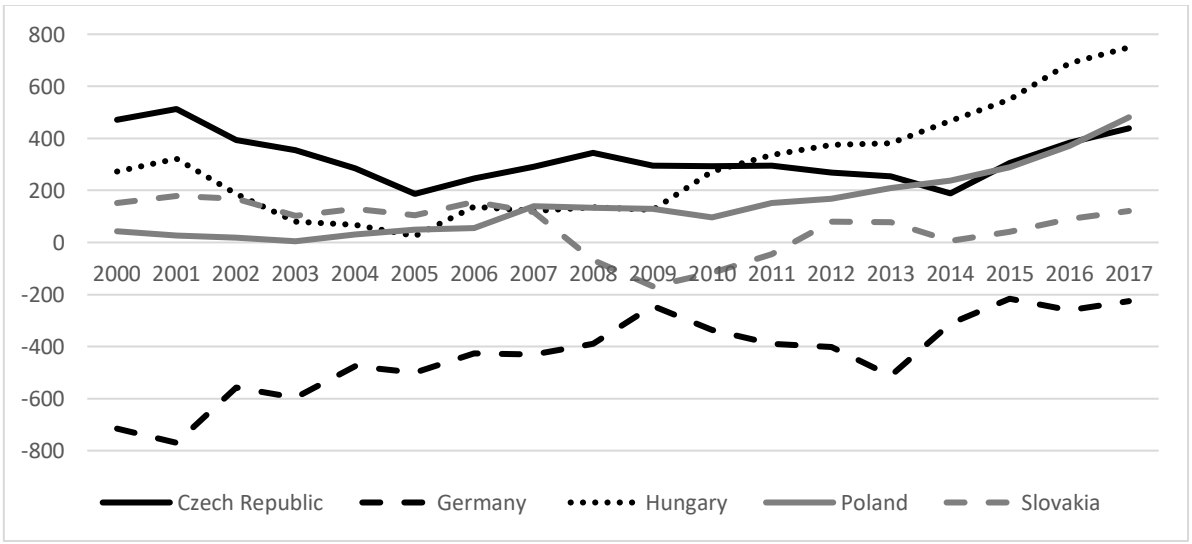


Source: own calculations based on Eurostat a (2018), Eurostat b (2018)

Foreign Trade Development – Trade with Services

The analysis of foreign trade with services shows completely different results. Surprisingly, the only country which has been in deficit for all analysed period is Germany. All other V4 countries has been in surplus, with only few exceptions in case of Slovakia. However, the development is quite irregular in all countries, with several increases and decreases. Nevertheless, the deficit in Germany in 2017 is lower than in 200, but on the other hand, surpluses in the Czech Republic and in Slovakia decreased, while surpluses in Poland and in Hungary increased. The development (again recalculated per capita) is described in Fig. 3.

Figure 3 Foreign Trade with Services (Euro per Capita)



Source: own calculations based on Eurostat a (2018), Eurostat b (2018)

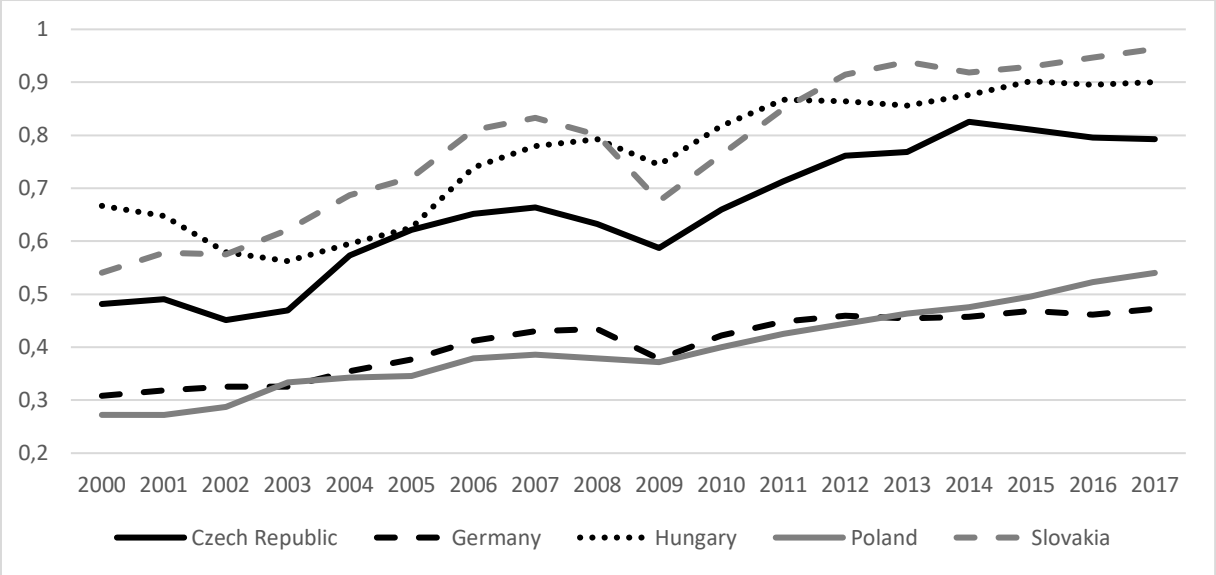
The Relation between Export and GDP Development

As was mentioned before, one of the aims of this article is to verify the openness of analysed countries, where one of the possible tools (indicators) for this evaluation is the

ratio between export and GDP. Open economies usually have high value of this ratio, where more closed economies have lower values. Openness is typical for small and developing economies, where more closed are usually large and developed economies.

The share of export on GDP (in percent) is described in following Fig. 4.

Figure 4 Export on GDP Ratio (%)



Source: own calculations based on Eurostat a (2018), Eurostat b (2018)

It is quite obvious that hypothesis about openness is verified. Despite the fact that Germany is not only the largest, but also the most powerful economy (in this article), its export on GDP ratio has been below 50% during the whole analysed period. This share is low also in Poland (in 2000, Poland had lower value than Germany, but in 2017, Poland had a little bit more than 50%), where this economy cannot be considered as powerful one (GDP per capita is the lowest, see Fig. 1), but it is large country (it has second highest number of inhabitants, and second highest value of GDP in absolute amounts).

All other analysed countries have had higher values. In 2000, the Czech Republic had this ratio under 50%, but it is around 80% nowadays. Hungary had this ratio more than 66% in 2000, but its development has not been steadily, and nowadays is Hungary on the second position with the export on GDP ratio around 90%. Slovakia had this ratio around 54% in 2000, but it has been growing relatively fast (compared to other countries), and this ratio is more than 96% in 2017.

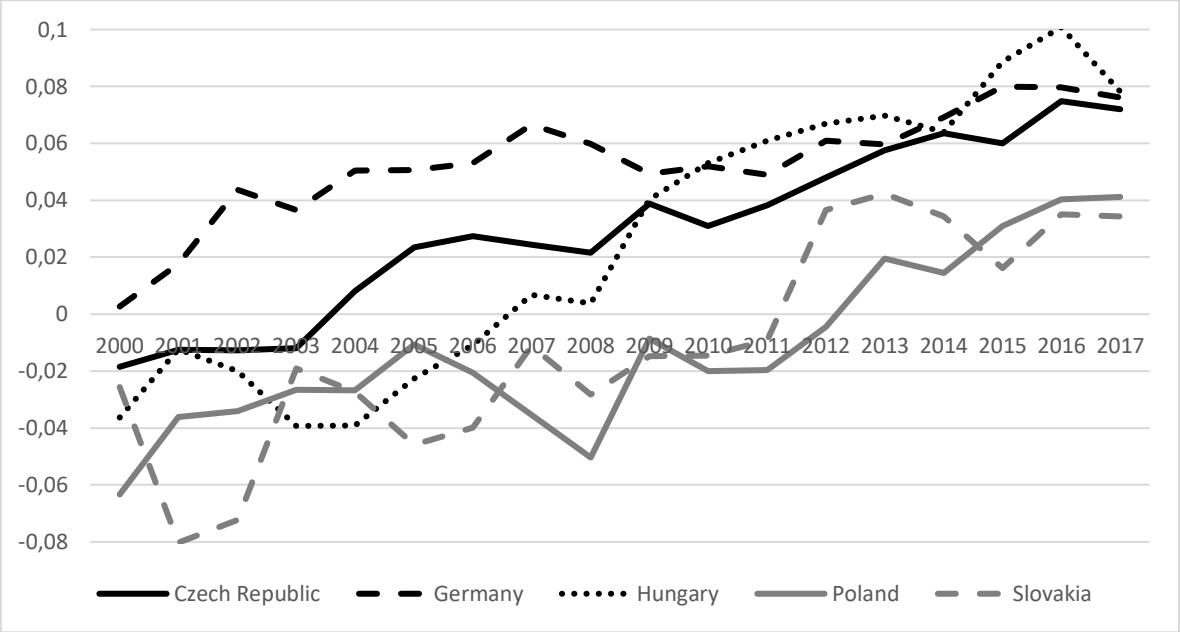
This can be explained in that way that small and weak economies are more dependent on foreign countries than large and / or more powerful economies. Of course, exceptions can exist, where powerful economies are dependent on foreign trade, or less powerful economies are not so dependent of foreign trade, even if they are relatively small. However, this is not an example of analysed countries. Less dependent seems to be Germany (powerful and large country) and Poland (not powerful, but large country with a lot of inhabitants), where the Czech Republic, Slovakia, and Hungary (relatively small and weak economies) seem to be more dependent on foreign trade.

Relation between Foreign Trade and GDP Development

Previous chapter analyses the openness of analysed economies with one of the possible tools, namely export on GDP ratio. The results have been not surprising, but this chapter is analysing the impact of foreign trade in national economy. It other words, in this chapter is the analysis of net balance of foreign trade on GDP. As was mentioned in previous text, in the formula of product in open economy can be found net exports, which can be calculated as a difference between exports and imports in particular economy in analysed year. The analysis in this chapter describes how many percent from GDP is presented by

net balance of foreign trade (net export). The results of this analysis are described in the following Fig. 5.

Figure 5 Net Balance of Foreign Trade on GDP Ratio (%)



Source: own calculations based on Eurostat a (2017), Eurostat b (2017)

It is quite obvious that all countries except Germany had been dealing with negative trade balance. That means that foreign trade was not helping generate the GDP, but it was worsening it. The Czech Republic turned into positive balance in 2004, Hungary in 2007, Slovakia in 2012, and Poland in 2013.

Analysis of each country can be done as follows. Germany is relatively closed economy (previous chapter), but despite of this fact, the foreign trade generates more than 7.6% of GDP. With respect to the fact that GDP in this country is significantly higher than in other analysed countries, net balance of foreign trade in Germany is also significantly bigger than in other countries. Even if Germany is not so dependent on foreign trade, it can generate a lot from it.

Even if Hungary turned into positive balance in 2007, it had the highest ratio in 2017 (almost 8%). Hungary had also the second highest export on GDP ratio. It can be explained in that way that Hungary is relatively open economy, where foreign trade is currently helping create the product in this country.

The third highest ratio has the Czech Republic (little bit more than 7%), where this country has had also the third highest export on GDP ratio. The explanation in this country can be same as in case of Hungary.

Poland is relatively closed economy (relatively low export on GDP ratio), and foreign trade in this country is not so much participating on creation of product, where it generates only little bit more than 4%. On the other hand, it is not so surprising result based on the fact that Poland is relatively closed economy.

As far as Slovakia is concerned, the results in this country are relatively surprising. Despite the fact that Slovakia has the highest export on GDP ratio (it is the most open economy), the foreign trade on GDP ratio is the lowest. Even if Slovakia is relatively dependent on foreign trade, it is not generating product in this country. In other words, Slovakia is exporting a lot, but it is also importing and the final impact of foreign trade on GDP is low.

4 Conclusions

The aim of this article was to analyse the selected aspects of foreign trade countries from central Europe, namely in the Czech Republic, Poland, Hungary, Slovakia, and Germany. Firstly, this article analyses the development of GDP in selected countries, secondly the development of foreign trade in terms of goods and in terms of services. Consequently, the relation between export and GDP and between foreign trade and GDP are analysed as well.

The analysis of GDP development shows relatively expected results. Germany is the strongest evaluated economy; it has the highest level of GDP not only in absolute value, but also in recalculation per capita. The second highest GDP in absolute value has Poland, because it is the second largest economy, where after recalculation per capita has the second highest GDP the Czech Republic, and Poland is the weakest.

In terms of trade with goods is Germany again the strongest economy, net balance has been in surplus in whole analysed period, and even after recalculation per capita has Germany serious lead. All other analysed countries have been dealing with deficit for some time, they are all in surplus now, but for example in case of Poland is this surplus really small. The second highest surplus is in the Czech Republic.

The analysis of trade with services shows relatively surprising results. All members of V4 have been in surplus for almost all period, where Germany has been in serious deficit for whole analysed period. However, the development is not steady at all, where the net balance in some countries grew (comparison between 2000 and 2017) and in other countries decreased.

The analysis of export on GDP ratio shows again relatively expected results about openness economy. Germany seems to be relatively closed economy, because it is strong and powerful country, and therefore it is not so dependent on foreign countries. Relatively closed economy seems to be also Poland, where this ratio is also low (around 50%). Poland is not developed country, but it is relatively large country with a lot of inhabitants. Small countries as the Czech Republic, Slovakia, and Hungary, seem to be relatively open economies with huge dependency on foreign trade.

However, the last analysis from this article shows again a little bit surprising results. Even if Germany is relatively closed economy, the share of net balance on foreign trade on GDP is relatively high in this country (more than 7%). High share can be seen also in the Czech Republic and in Hungary, where these countries are relatively open. However, Poland has relatively low share, but it is relatively closed economy. On the other hand, Slovakia has also low share despite the fact that it is relatively open economy.

To sum it up, foreign trade is very complex issue; it has a lot of aspects and factors of influence. It can be seen in this article, where sometimes the results are relatively surprising, strong economy has low dependency on foreign trade, but it still has a relatively huge influence on GDP, where in relatively open economy has the foreign trade only low impact on GDP. The authors plan to analyse foreign trade from different perspectives in following research.

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Labour Taxation in the European Union. Comparative Analysis and Conclusions for Poland

Anna Krajewska, Magdalena Kapela

Warsaw University of Technology
College of Economics and Social Sciences
Łukasiewicza 17, 09-400 Płock, Poland
E-mail: Anna.Krajewskal@pw.edu.pl
E-mail: Magdalena.Kapela@pw.edu.pl

Abstract: *Labour tax burdens consist of two main elements: personal income tax and social security contribution. Both have been subjects of multiple changes in European Union countries. The aim of the article is: 1) to present main directions of those changes, 2) to show their influence on tax wedge in different EU countries, 3) to show specification of labour taxation in Poland. Tax wedge in Poland demonstrates very low progressivity, that means it does not take into consideration income and family situation. Internal structure of tax wedge is also untypical because of great share of social security contribution. In the article there has been undertake an attempt to present causes of tax wedge otherness in Poland and resulting economic and social fallouts. Also, there are postulated directions of changes. In the paper analysis were based on Eurostat and OECD statistics and research on labour taxation carried out in Poland.*

Keywords: labour taxation, personal income tax, social security contribution, tax wedge, redistribution of income

JEL codes: E62, E64, H20, H21, J08

1 Introduction

The aim of the paper is to present main directions of labour taxation in European Union. We also intend to explain specific features of labour taxation in Poland.
The stress is put on the following issues:

- Evolution of labour taxation in selected EU countries,
- Redistributive aspects of tax wedge,
- Internal structure of tax wedge.

In conclusion we try to suggest directions of changes in taxation of labour in Poland.

2 Evolution of labour taxation

The basic foundations of the modern labour taxation system in the countries of Western Europe were formed after World War II and although in the following decades they underwent numerous modifications, the characteristic features of this system still persist.

Among the main features of personal income tax in Western European countries (Krajewska 2012, 88-97) should be mentioned:

1) The progressive nature of the tax reflected by the number of tax thresholds (currently from 2 in Ireland to 17 in Luxembourg) and the level of the lower (in the past, in the 1970s, amounted even 3-5-10%, but now slightly higher) and upper tax rates (currently mostly within 40-50%, in Sweden 57.1% (Taxation Trends.. 2017, p. 30)
2) The existence of the tax-free income, which is the result of a social consensus and which takes into account the level of income defined as the subsistence minimum, as well as civilization, cultural factors and social welfare. This amount changes along with the change in income, prices, costs of living, state of the economy.
3) The tax system indexation, automatic or steplike, consisting in adjusting the tax burden to the changing costs of living, and thus an increase in the amount of tax-free income and the amount of tax reliefs, raising the amount of income within the existing tax scale;
4) The existence of tax reliefs taking into account the family situation of taxpayers (such as for example the possibility of joint taxation of spouses' income, number of children,

their age and state of health, as well as the age and state of health of the taxpayer) or related to the method of disbursement of income (investment, construction, education reliefs and donations).

The aforementioned elements of tax structures were an important tool for the redistribution of income, especially in the post-war period of 30 years (the 50s, 60s, 70s of the 20th century). Taxes back then were very high (as the current criteria), and the scope of reliefs was extensive (Krajewska 2012:94-96). However, at the same time, the economies of Western Europe then were developing dynamically. Economic historians with fondness recall these "golden thirty years". Tax reforms carried out under the slogan of tax reduction and simplification as well as reduction of tax reliefs began in the 1980s along with the dissemination of neoliberal trends. In practice, however, it turned out that the process was relatively slow. The redistribution of income through progression, tax allowance and reliefs, although perhaps to a lesser extent, continued. The financial and economic crisis that started in 2008 not only stopped this process, but also caused that the tax stimulus and stabilizing function began to be noticed.

The anti-crisis packages included activities such as:

- raising the amount of tax allowance amount,
- reducing the lower PIT rate,
- implementation of a new (additional) upper PIT rate (it is worth recalling that under the presidential campaign in France, Francois Hollande proposed raising the upper PIT rate up to 75%),
- introduction of new reliefs or their raise,
- tightening the tax system.

All transforming countries in Central and Eastern Europe had to carry out thorough tax reforms. They had to face the following choice: to imitate solutions adopted in Western European countries (i.e. tax progression, tax allowance, tax reliefs) or to adopt their own solutions based on simple flat taxes. In the initial period of transformation, the countries of the Visegrád Group and Slovenia adopted solutions similar to the Western tax systems, and the Baltic countries adopted a flat tax. However, in a quick time, the flat tax spread in the countries of Eastern Europe. In Poland such attempts were made, but finally the tax scale was reduced from 3 to 2 rates (18% and 32%). Slovenia was the only country in which switching from progression to a flat tax was not considered. Progressive PIT also occurs in Croatia.

The second component of the tax wedge are social security contributions. European Union countries have not yet developed such a consistent system as in the case of income taxation. Differences between countries are very large.

The amount of social security contributions depends on public programs offering social security for citizens, financed from these sources, as well as on the age structure of the society. The increase in the level of benefits observed in economically developed countries, accompanied by the aging of the society, means that the tax burdens is growing. For example, in Sweden until the mid-1960s, the social security contribution was 7% of gross wages, in 1986 it increased to 36% so almost five times (Andersson, Norman, 1987, p. 144) and showed an upward trend in the following years – up to 38.4% in 2010 (European Commission… 2012, s. 159).

It is worth noting that relatively recently, social security contributions were not collected in Denmark, Finland and Australia. An even now, those contributions constitute only a few percent of the tax burden imposed on labour. Still an exception – a country, where there are no mandatory insurance premiums is New Zealand. This means that funds financed for retirement and disability pensions payments come from income taxes, which in these countries are therefore high.

Social security contributions burden employees and employers. The classic system that evenly burdens the employees and employers with contributions ("fifty-fifty" or in similar proportions) has now been preserved only in a few countries: in Germany, Switzerland, Luxembourg, the USA, Turkey, Korea, and also in Poland (OECD, 2013). The distribution

of the burden of employees and employers with contributions was subject to changes depending on the bargaining position and the power of both parties. During the 30 years after the war, strong trade unions were trying to transfer the burden of contributions more and more to employers. However, with the strengthening of the neo-liberal ideology, the position of employers grew, which in turn favoured transferring the burden of insurance contributions on employees. However, this process was quite slow. The global crisis, which began in 2008 and the increase in unemployment, especially among young people, caused that in many countries social security contributions, especially for young and unqualified employees, showed a declining trend.

In empirical research on the tax wedge, the most attention is paid to its height and impact on the labour market. Most often the conclusion that is drawn is that a high tax wedge reduces the demand for labour and leads to an increase in unemployment (Dolenec, Laporsek 2010, pp. 356-357; Góra et al. 2006; Tvrdon 2011; Wojciechowski 2008). Hence the conclusion is that the tax wedge should be lowered because it will allow to reduce unemployment. The research shows that the negative effects of the tax wedge affect the unqualified and low-paid employees the most, because their remunerations are less flexible than the ones of employees with high earners. Thus, a high tax wedge may slightly affect the employment decline of highly qualified employees, while it creates high unemployment among low-qualified employees. Thus, the macroeconomic consequences of the tax wedge depend on the qualification structure of employees. They are stronger in countries with a large share of low-qualified employees and lower in those where their share is low (Góra et al., 2006).

3 Tax wedge redistributive aspects in EU countries

In the Eurostat and OECD statistics, the tax wedge is defined as a percentage ratio of taxes imposed on labour to the total labour costs borne by the employer. The numerator of this fraction therefore includes the following elements: Income tax of natural persons performing a paid work, social security contributions paid by the employer, social security contributions paid by the employee and other taxes related to the employment of the employee. In turn, labour costs are: gross wages (net wages + personal income tax + contributions paid by employees), contributions covered by the employer and other taxes related to employment (OECD, 2014).

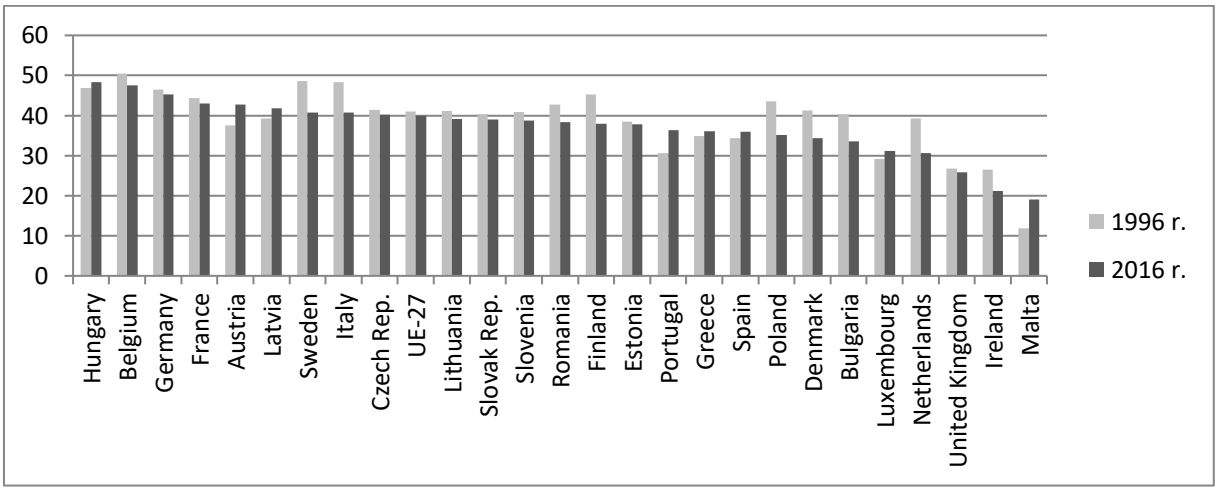
The tax wedge can be presented in the form of the following formula:

$$\text{Tax wedge} = \frac{\text{taxes imposed on labour}}{\text{labour costs}} \cdot 100\% \qquad (1)$$

Tax burdens imposed on employees depend to a large extent on the amount of their earnings and the family situation (number of children, working or non-working spouses). For this reason, for the analysis of the tax wedge level, the most common are single, childless persons earning 67% of the average remuneration. This level of remuneration is treated as the median of average remuneration due to the concentration of high earnings in the upper deciles. In turn, the median is the basis for determining the remuneration defined as *low pay earners.* In the OECD and Eurostat statistics, it is assumed that remunerations defined as low are less than 2/3 of the remuneration median for the economy.

Over the past 20 years, the tax burden of low-paid work fluctuated (Figure 1). In some countries they have decreased. In others, they slightly increased. Comparing the tax wedge in 1996 and 2016, it turns out that with a general decrease in tax burdens in 8 EU countries, the tax wedge showed an upward trend. The fastest tax wedge increase took place in Malta (increase by 7.5 percentage points). However, it should be taken into account that it is the country with the lowest taxes (19% in 2016 only, and in 1996 only 11.9%). During the period of the crisis after 2008, in some countries there was a pressure to raise taxes in order to reduce the budget deficit. This concerned, among others countries such as Greece, Spain and Portugal, where international organizations, in exchange for financial assistance, forced governments to take actions to discipline public finances.

Figure1 Tax Wedge for a Single, Childless Person Earning 67% of Average Wages in EU Countries (%)



Source: Eurostat – Data Explorer, Tax Wedge on Labour Costs, http://appsso.eurostat.ec.europa.eu/nui/print.do (11.05.2018)

The tax wedge is calculated for various types of households differentiated in terms of family income, number working persons in the family and their income, and the number of children.

Table 1 Tax Wedge for a Single, Childless Person, Earning 67% and 167% of Average Wages in Selected EU Countries (%)

Wyszczególnienie	2000			2017		
	67%	167%	Difference (p.p)	67%	167%	Difference (p.p)
Ireland	18	39	21	21	38	17
Luxembourg	30	44	14	29	44	15
Italy	44	51	8	41	54	13
Belgium	51	63	11	47	60	12
Finland	43	53	10	37	49	12
France	44	52	9	43	54	12
…	…	…	…	…	…	…
Czech Republic	41	45	4	41	45	5
Slovak Republic	41	45	5	39	44	4
Estonia	40	43	3	38	40	2
Latvia	42	44	3	42	44	2
Poland	37	39	2	35	36	1
Hungary	51	59	8	46	46	0

Source: Own study based on OECD 2018, http://stats.oecd.org/Index.aspx?DataSetCode=AWCOMP (11.05.2018)

A comparison of the tax wedge amount of single, childless persons, earning 67% and 167% of the average wage in selected EU countries (Table 1) and the analysis of changes that took place in 2017 compared to 2000 lead to the following conclusions:

1) In the Western Europe countries, the tax burden on labour is high. At the same time, however, in most of these countries, differences between the tax wedge of persons earning 67% and 167% of the average wage are usually several percentage points.

2) The attention is paid by the relatively high level of tax wedge for low paid earners in Eastern European countries, at the same time with not very high taxes for higher paid earners, which means that the labour tax system to a small extent in these countries is used to redistribute income. In the Czech Republic, Estonia, Slovakia and Hungary a flat tax applies. In Poland, although there are two rates: PIT-18% and 32%, the income of over 98% of taxpayers is settled at a lower rate, and the tax allowance amount is also low. This causes that the difference between taxes of persons earning 67% and 167% accounted for only 2 percentage points in 2000 and 1 percentage point in 2017. It put Poland in the penultimate place in the EU before Hungary, where both groups of employees pay equal labour taxes.

3) In the last several years, changes in labour taxation have been aiming towards lowering the tax wedge and increasing the redistributive function of labour taxation. To the largest extent, such activities were undertaken in Western European countries and were a reaction to the global crisis initiated in 2008. An important element of anti-crisis packages were changes in the income taxation system aimed at increasing global demand, such as raising tax allowance amount, implementing or extending tax reliefs addressed mainly to large families and disadvantaged families, reducing the lower rates of PIT. The situation on the labour market also forced a change in social security contributions. As part of the fight against unemployment, mainly among younger and poorly educated people, actions were taken to lower the contributions (Krajewska, 2012, pp. 215-224).

An important element of the structure of labour taxation is to take into account the taxpayer's ability to pay and his/her family status. It is possible, among others through the use of pro-family relief system. The experience of European Union countries on taking into account pro-family aspects in the tax system is very diverse. This is evidenced by the data included in Table 2 presenting a tax wedge for a single person, childless, earning 67% of the average wage and a single person receiving the same remuneration, but raising two children in 2000 and 2017.

As far as labour taxation system, in Poland, the family situation of the taxpayer has not been taken into account for many years. For example, in 2000, the difference between the tax burden of a single person earning 67% of the average wage, childless and with two children, was only 7 percentage points. This defect of the tax system has been repeatedly pointed out in Poland (Kryńska 2014, Rekas 2012, Nadolny 2009, Ślesicka 2011). In 2007 a relief based on a tax deduction was introduced, but it was not beneficial for people with low incomes (Budlewska, 2016, pp. 729-730). Only changes introduced in 2014[4] made Poland the best in this respect compared to EU countries. The next such example is Ireland, where the payment of grants for children made that net wages were higher than gross wages.

Clear tax preferences related to bringing up children are also found in the tax systems of Denmark, Luxembourg and the Netherlands, as well as Slovenia. The lowest level of family redistribution was marked in Greece, where single people paid taxes only by 4 percentage points smaller than those bringing up two children.

Table 2 Tax Wedge for a Single Person Earning 67% of Average Wedge, Childless and Having Two Children in Selected EU Countries (%)

Specification	**2000**			**2017**		
	without children	with 2 children	Difference (p.p)	without children	with 2 children	Difference (p.p)
Poland	37	30	7	35	-21	56
Ireland	18	-1	19	21	-17	38

[4]Starting from 2014, the portion of the pro-family relief, which is not deducted due to insufficient tax, is refunded to the taxpayer, however, in the amount not higher than the sum of social security and health insurance contributions deducted in the tax return.

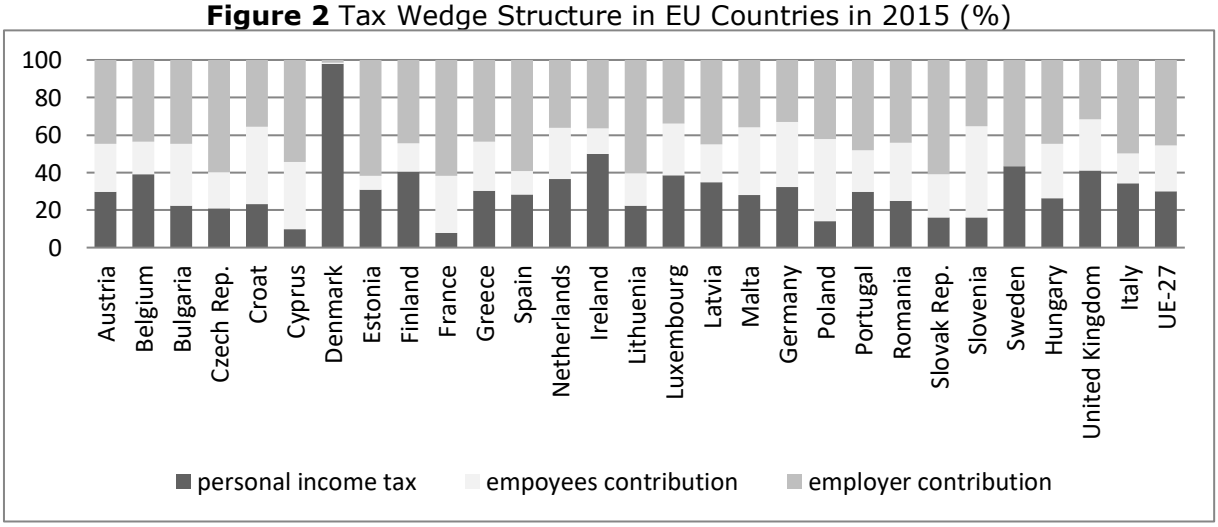
Denmark	38	12	26	34	6	28
Slovenia	43	13	30	40	13	27
Luxembourg	30	4	26	29	5	24
Netherlands	42	26	16	31	7	24
…	…	…	…	…	…	…
Czech Republic	41	13	28	41	22	19
Belgium	51	36	15	47	33	14
Slovak Republic	41	25	16	39	28	11
Finland	43	28	15	37	26	11
Sweden	49	40	9	41	34	7
Greece	36	35	1	37	33	4

Source: Own study based on OECD 2018, http://stats.oecd.org/Index.aspx?DataSetCode=AWCOMP (11.05.2018)

4 Internal structure of tax wedge

The tax wedge consists of two main parts: personal income tax of persons receiving income from work (PIT) and insurance contributions charged to employees and employers. Other taxes burdening work are found only in some countries and, moreover, they are rarely more than 1% of the entire tax wedge. They will therefore be omitted from this analysis.

Figure 2 Tax Wedge Structure in EU Countries in 2015 (%)



Source: Own study based on: Rogers, Phillipe (2015, p. 7)

Graph 2 presents data on the internal structure of the tax wedge in 2015. Tax reforms have been carried out for years in EU countries, although they were based on similar principles, they had to take into account historical legacy and social conditions. For this reason, the labour taxation systems are very diversified in the European Union. The internal structure of the tax wedge is also diversified.

Here are two extreme examples: Cyprus and Denmark. In Cyprus, not only, as it already was referred to earlier, the tax wedge was very low in 2015 (19.2%), but the internal structure of labour taxation was also atypical. Income tax accounted for only 1.9% of the labour cost (gross pay plus contributions covered by the employer). Admittedly, income taxation is progressive with rates of: 0, 20, 25, 30 and 35%, but at the same time a high tax allowance amount (EUR 19.500) caused that this tax was hardly noticeable by an employee earning an average income. Also, social security contributions burdened the employer more than the employee. In turn, Denmark is unusual for another reason. Income taxes are high and, in addition, account for almost 98% of the tax wedge. Income tax consists of two parts: a progressive central tax supporting the state budget and a municipal, a flat tax contributing to the local budget and the church, set by local authorities

at a quite high level (22-28%). In turn, the social security contribution is low (2.1% of the total labour tax burden).

In Western European countries, as a rule, the share of income tax in the tax wedge is higher than in the new Member States. In Poland, this share is maintained at a particularly low level, in 2015: 14.1% total labour tax burden (compared to an average of 30% to EU-28) This can be explained by referring to the beginnings of taxation reform in Poland. Then, enterprises paid 20% tax on payroll fund and high contributions (45% of the payroll fund for social security + 3% for the Labour Fund). In 1992, a personal income tax with three rates was introduced: 20%, 30% and 40%. The first tax rate (20%) was so defined that it included over 90% of taxpayers. It allowed to introduce the universal income tax efficiently and without social resistance. The rates for health and social insurance have remained at the previous level. This, however, meant a serious limitation of the redistributive function, and also led to a distortion of the internal structure of the tax wedge.

The high level of tax wedge in Poland, accompanied by its low progressivity and incorrect structure leads to many negative effects, among others:

- unemployment in the group of people with low earnings,
- malfunctioning of the labour market and development of the shadow economy in order to avoid paying taxes and contributions,
- deepening of poverty among people with low earnings.

5 Conclusions

Analysis of statistical data on labour taxation in European Union countries makes it possible to formulate the following conclusions:

1) In Poland, the average level of the tax wedge is, against the background of the European Union countries, moderate. However, it is characterized by very low progressivity, taking on the account the level of income, and until 2014 also the taxpayer's family situation. It is unfavourable for professional groups with low qualifications and low earnings, because it is difficult to enter the labour market and it is difficult to maintain on it. It seems, therefore, appropriate increasing the progressiveness of income tax, among others, by raising the amount of tax allowance and increasing the number of tax thresholds.

2) There are large differences in the internal structure of the tax wedge in the European Union. The high share of contributions in the total tax wedge and the resulting negative consequences for the labour market caused that in many countries measures have been taken to reduce the tax burden of contributions, especially for some groups of employees – unqualified low-income earners, taking their first job, etc.

3) In Poland, the structure of the tax wedge is atypical. Poland was on the last place among EU countries in terms of social security contributions percentage in total tax wedge (85.5%). The high share of contributions is badly assessed by Polish entrepreneurs as it leads to an increase in labour costs, it lowers the competitiveness of Polish enterprises and leads to the development of grey zone. At the same time, however, reducing the share of social security contributions in relation to budget revenues from taxes and to GDP is difficult due to the situation on the labour market and relations of people who work and pay contributions to non-working, pensioners. Possible changes would, therefore, have to relate not only to contributions, but to the entire taxation system. More often, in this context, attempts are being made to discuss the concept of a single tax on labour.

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Taxation of Consumption in Poland. Redistribution and Fiscal Effects

Anna Krajewska[1], Katarzyna Osiecka[2]

[1]College of Economics and Social Sciences
Warsaw University of Technology
Łukasiewicza 17, 09-400 Płock, Poland
E-mail: anna.krajewska@pw.edu.pl

[2]College of Economics and Social Sciences
Warsaw University of Technology
Łukasiewicza 17, 09-400 Płock, Poland
E-mail: katarzyna.osiecka@pw.edu.pl

Abstract: *Consumption taxes constitute important source of budgetery revenues. In time of crisis the role of those taxes had raised – the rates of VAT and excise rose. The aim of this paper is to present those tendencies, and next to show their redistribution and fiscal results, mainly on Polish case. Redistribution tax effects are verified by 1) presentation of empirical research findings concerning VAT and excise burdens on households in Poland, in cross-section decyl groups and distinct social-economic groups. 2) comparison Gini's coefficient before and after taxation and transfers in Poland and in secected EU countries. Analysis of fiscal effects of consumption taxation is based on 1) demonstration of correlation between contribution of indirect taxed in GDP and shadow economy in EU countries, 2) showing dependency between level of taxes and shadow economy by the example of tobacco market in Poland. Last chapter of the article shows actions taken in Poland aimed on insulating tax system.*

Keywords: consumption taxes, VAT, excise, redistribution, shadow economy

JEL codes: H20, H21, H25, H31, E62

1 Introduction

The aim of this paper is to analysis the role of consumption taxes in budget revenues and to show their redistribution and fiscal effects.

We start with statistical data showing big differences in the structure of budget revenues in EU countries and presentation of empirical research concerning impact of consumption taxes on redistribution of income. We also use Gini coefficients to present redistributive effects of tax and social policy. Moreover the relation between taxation of consumption and the size of the shadow economy is analysed. The stress is put on tabacco market in Poland.

In conclusion we show actions taken in Poland aimed on insulating tax system.

2 Taxation of consumption in European Union and Poland. Statistical data.

On average, in the EU-28 countries, consumption taxes account for about 30% of total budgetary revenues, but their share in the budgets of individual countries is highly diversified. In the 1970s analyses of the structure of taxes in Western Europe were conducted and the historical character of these differences was clearly emphasized - countries with a "southern" and "northern" tax mentality were distinguished [Hansmeyer, 1977, p. 570]. In countries with the "southern" mentality, the size of shadow economy is high, and the efficiency of the tax administration is low. In this situation, expanding consumption taxes, especially excise duty, can feed to the budget with tax revenues that "escape" direct taxes. In turn, in countries with the "northern" tax mentality, tax collection is higher, the share of taxes in GDP higher, and moreover, the state budget may be more based on income taxes. The first group included Greece, Italy, Portugal and Spain, while the second included Sweden, Denmark, Germany, Austria and Belgium. EU actions aimed at harmonizing VAT and selected excise products were aimed at both creating better conditions for the free movement of goods and services, as well as to achieve a better

balance between direct and indirect taxes. Tax and shadow economy details for different countries are shown in Table 1.

Table 1 Taxes and Shadow Economy

Country	Total taxes/GDP (2015) [a)]	Consumption taxes/Total taxation (2015) [a)]	Shadow economy (2017) [b)]
Germany	38,6	28,5	10,4
Belgium	45,1	29,3	15,6
Czech Republic	34,3	36,5	14,1
Poland	**32,5**	**40,1**	**22,2**
Romania	28,0	47,6	29,6
Bulgaria	29,0	53,5	26,3

Source: a) European Commission 2017, p. 193; b) Schnider 2017, p. 154

After the enlargement of the EU by 10 new members in 2004, and in the following years by 3 next members (Bulgaria, Romania and Croatia), there were again large differences in the structure of budget revenues. The new member states have a clearly "southern" structure of budget revenues. In 2015, indirect taxes in Bulgaria accounted for 53.5% of total tax revenue and 47.6% in Romania, while only 28.5% in Germany and 29.5% in Belgium.

The reasons why indirect taxes have become the most important source of the budget revenues result from economic difficulties which Poland and other transforming economies had to face. Revenues from the public sector were diminishing fast, the fiscal apparatus was inefficient and the tendency to avoid taxes was high. It was considered that VAT and excise duty, despite its drawbacks, could best guarantee the security and stability of public finances (Owsiak, 1997, p. 369 and others).

In Poland, in the years 2003-2015, indirect taxes were of 41.0-44,3% of total tax revenues (including obligatory social security contributions). The EU-28 average was 33.7-35.1%, so this means that in Poland the share of indirect taxes was by 6-7 percentage points higher. On the other hand, in the Czech Republic, indirect taxes accounted for 36.5% of total tax revenues, i.e. they were close to the EU-28 average.

The share of tax revenues from the sale of tobacco products and alcohol (VAT + excise duty) in the budget revenues from taxes is also significantly different: from 9.6% in Bulgaria to 1.2% in Germany. The budget revenues of several other new EU members from these taxes are relatively high: Romania 5.8%, Estonia 5%, Lithuania 5%, and Poland 5.1% (European Commission 2017, p. 195).

Table 2 VAT Standard Rates in the EU Member States, 2008-2017

Country	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Belgium	21	21	21	21	21	21	21	21	21	21
Bulgaria	20	20	20	20	20	20	20	20	20	20
Czech Republic	19	19	20	20	20	21	21	21	21	21
Denmark	25	25	25	25	25	25	25	25	25	25
Germany	19	19	19	19	19	19	19	19	19	19
Estonia	18	20	20	20	20	20	20	20	20	20
Ireland	21	21,5	21	21	23	23	23	23	23	23
Greece	19	19	23	23	23	23	23	23	23	24
Spain	16	16	18	18	18	21	21	21	21	21
France	19,6	19,6	19,6	19,6	19,6	19,6	20	20	20	20
Croatia	22	22	23	23	25	25	25	25	25	25
Italy	20	20	20	20	21	21	22	22	22	22
Cyprus	15	15	15	15	17	18	19	19	19	19
Latvia	18	21	21	22	22	21	21	21	21	21
Lithuania	18	19	21	21	21	21	21	21	21	21

Luxembourg	15	15	15	15	15	15	15	17	17	17
Hungary	20	25	25	25	27	27	27	27	27	27
Malta	18	18	18	18	18	18	18	18	18	18
Netherlands	19	19	19	19	19	21	21	21	21	21
Austria	20	20	20	20	20	20	20	20	20	20
Poland	**22**	**22**	**22**	**23**	**23**	**23**	**23**	**23**	**23**	**23**
Portugal	20	20	21	23	23	23	23	23	23	23
Romania	19	19	24	24	24	24	24	24	20	19
Slovenia	20	20	20	20	20	22	22	22	22	22
Slovakia	19	19	19	20	20	20	20	20	20	20
Finland	22	22	23	23	23	24	24	24	24	24
Sweden	25	25	25	25	25	25	25	25	25	25
United Kingdom	17,5	15	17,5	20	20	20	20	20	20	20
EU-28	19,5	19,9	20,5	20,8	21,1	21,5	21,5	21,6	21,5	21,5

Source: DG Taxation and Customs Union

Consumption generally falls during the crisis, leading to a reduction in the share of indirect tax revenues. In this situation, the state can react in two ways: lowering consumption taxes in order to stimulate global demand or raise VAT and excise rates in order to maintain budget revenues. During the recent crisis of 2008-2010, the first of these types of activities was used very rarely. In 2008, Portugal lowered the standard VAT rate by 1 percentage point and in 2009 temporarily by 2.5 percentage points. The VAT was raised in the United Kingdom (but in the next year, the previous rate was returned), and in 2010 by 0.5 percentage points the VAT was raised in Ireland. In total, since 2008, a standard VAT rate has been raised in 20 out of the 28 EU countries (Table 2). To the largest extent, the standard VAT rate was raised in Hungary (from 20% to 27%) and in Greece (from 19% to 24%). In 2017, standard VAT rates were: 18% in Malta and 19% in Germany and 25% in Denmark, Sweden and Croatia. The 23% VAT rate in Poland is therefore high for European standards. In Poland, the standard VAT rate was raised (from 22 to 23%) in 2011, announcing that it will be valid for one year, at most two-three years. But this situation has lasted for 8 years and nothing foreshadows change.

In EU countries, VAT ensures about 60% of revenue from consumption taxes (European Commission, 2017, p. 22). It should be expected that the increase in VAT rates should positively affect the increase of budget revenues from this tax. Data presented in Table 3 indicate that there are no major changes in the share of VAT in tax revenues of EU countries.

Table 3 The Share of Consumption Taxes in the Budget Revenue from Taxes (in %)

Country	Total consumption taxes					
	2003	2005	2008	2010	2012	2015
EU-28	**28,7**	**28,6**	**27,6**	**28,7**	**28,6**	**28,7**
Portugal	38,2	41,0	37,6	37,4	37,7	35,7
Ireland	36,9	37,0	36,3	35,5	33,5	33,3
Italy	25,3	26,2	24,3	25,7	25,7	25,8
Belgium	24,3	24,7	24,0	24,5	23,3	22,8
Czech Republic	27,8	30,2	30,0	32,7	35,1	34,8
Poland	**37,1**	**37,9**	**37,6**	**39,4**	**36,7**	**35,2**
Croatia	50,2	49,2	46,5	47,5	49,0	50,1
Bulgaria	45,1	51,2	53,7	52,7	53,2	50,8
Slovakia	34,3	37,9	34,7	34,6	32,8	31,9

Source: European Commission 2017, p. 193

In addition to raising VAT rates, excise duty rates (in particular on fuels, tobacco and alcohol) have been raised many times in most EU countries (European Commission, 2011, p. 34).

3 Impact of consumption taxes on the redistribution of household income.

The high share of consumption taxes in total tax burdens, the increase in the standard VAT rate and the increase in excise duty rates in Poland have a negative impact on the situation of households, as:

1) it leads to a decrease in disposable income, which means that they can buy less products and services,
2) it causes socially undesirable redistributive effects, because consumption taxes due to their regressive nature lead to an increase in the diversification of household incomes in various cross-sections,
3) the decline in real incomes and the increase in prices caused by the increase in taxes prompts people to make purchases in the grey market, where products may be of inferior quality, come from an illegal source, may threaten your health and expose you to fraud, etc.

Interesting research on the redistributive consequences of taxation of individual consumption in Poland in the years 1995-2006 was carried out by Dobrowolska (2008). The main source of information was the unpublished GUS data from Household Budget Surveys. The data were aggregated up to the sixth level of grouping (subcategories) of the Polish Classification of Products and Services. The following conclusions arise from the statistical and econometric analyses:

1) In the analysed period, household burden with indirect taxes increased systematically. Average burdens of approximately 7.48% in 1995 increased to 11.23% in 2006.
2) Indirect taxes are the biggest burden for the poorest households, those in the 1st decile of income group. The average income burden with indirect taxes (for the period 1995-2006) was 11.88%, while in the X group they were lower than in other decile groups and amounted to 8.87%
3) The regressivity of indirect taxes is increasing. This is evidenced by the deepening difference between the burdens in the I and X decile group. In 1995, the burdens of households in the X decile group were 2.9 percentage points lower then the burdens of households from the I decile group. In 2006, differences in tax burdens increased to 5.28 percentage points.

When analysing the distribution of households' burdens with indirect taxes, Dobrowolska distinguishes five socio-economic groups: households of employees, households of employees using farms, households of farmers, households of self-employed entrepreneurs and households of pensioners. The analysis of the distribution of tax burdens in this cross-sections show that:

1) to the greatest extent, indirect taxes are borne by households of farmers (15.5% in 2006) and households of employees using farms; this is because these farms, apart from consumer goods, purchase VAT and excise duty products and services used for agricultural production;
2) the burden on self-employed entrepreneurs' is relatively high (11.38%), which can be partly explained by the higher level of consumption of this social group;
3) households of employees are burdened with indirect taxes to the smallest extend (10.5%) and pensioners (9.83%);
4) it turns out that in the analysed period, the burdens of households with the lowest incomes (pensioners) were growing faster (169.78%) and the slowest (139.29%) growth was that of the wealthiest households of self-employed entrepreneurs.

The next empirical studies conducted by Dziura (2015) concern households' excise duty burdens for the years 2004-2012. The obtained results confirm previous observations, but at the same time bring new threads resulting mainly from the analysis of not only household budgets, but also statistical data on shadow economy, mainly illegal trade in fuels, smuggling and illegal production of tobacco and alcohol.

The observations that especially deserve underlying are:

1) Poorer households are more heavily burdened with excise duty than the richest households (e.g. in 2004, this burden constituted 2.27% of net income in the first decile group, while in the X group it was much less - 1.79%), but the spread between these groups, during the analysed years reduced (in 2004 it was 0.48 pp, and in 2012 it decreased to 0.29 pp), i.e. the degree of regressivity is weakening.
2) Fiscal burdens of consumption with excise duty from year to year are decreasing (except in 2006 and 2008-2009, when there was a slight increase compared to previous years). This applies to both decile groups and types of households.
3) To the greatest extent, the households of self-employed entrepreneurs and pensioners are burdened with the excise duty

Dziura explains those trends by referring to changes in the consumption structure of various groups of households. The increase in excise tax on tobacco products and alcohols to a greater extent stimulated wider use of the shadow economy by poorer households, farmers and pensioners, and the increase in excise tax on motor fuels increased the excise duty burden on self-employed entrepreneurs' households.

The redistributive effects of tax policy can be measured by comparing Gini coefficients before tax and transfers, as well as after taxes and transfers. The data presented in Table 4 show that taxes and transfers are the main tool for redistribution in Germany - the difference in Gini coefficients in the analysed years was usually 24-28 pp. In Belgium, the difference in Gini's coefficient remained at a similar level of 20-21 pp, that is at a slightly higher level than in the Czech Republic, where taxes and transfers allowed for a reduction of the coefficient by around 20 pp. The redistribution tools were much weaker in Poland and Romania, and worst in Bulgaria, where since 2007 the high Gini coefficient, sometimes exceeding 50%, thanks to fiscal and social policy, was reduced by only a dozen (14-15) percentage points.

Table 4 Gini Coefficients Before and After Tax and Transfers in Secected EU Countries (in %)

Country	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Gini coefficients before tax and transfers											
Belgium	48,7	46,7	48,0	46,6	46,5	47,1	47,7	47,1	47,6	48,0	48,8
Germany	55,2	54,4	56,0	54,4	55,4	55,5	54,4	56,4	57,7	56,4	55,5
Poland	53,0	51,4	49,8	48,2	47,9	47,8	47,5	47,7	47,9	47,9	46,7
Czech Republic	45,2	44,9	44,1	43,7	43,8	44,1	44,5	44,1	45,0	44,9	44,9
Bulgaria	52,8	50,4	49,7	46,4	46,7	48,1	47,5	49,1	50,8	51,6	52,8
Romania		55,6	54,7	54,0	53,2	53,4	52,9	53,8	53,2	53,2	53,3
Gini coefficients after tax and transfers											
Belgium	27,8	26,3	27,5	26,4	26,6	26,3	26,5	25,9	25,9	26,2	26,3
Germany	26,8	30,4	30,2	29,1	29,3	29,0	28,3	29,7	30,7	30,1	29,5
Poland	33,3	32,2	32,0	31,4	31,1	31,1	30,9	30,7	30,8	30,6	29,8
Czech Republic	25,3	25,3	24,7	25,1	24,9	25,2	24,9	24,6	25,1	25,0	25,1
Bulgaria	31,2	35,3	35,9	33,4	33,2	35,0	33,6	35,4	35,4	37,0	38,3
Romania		38,3	35,9	34,5	33,5	33,5	34,0	34,6	35,0	37,4	34,7
Difference between Gini coefficients before and after tax and transfers											
Belgium	20,9	20,4	20,5	20,2	19,9	20,8	21,2	21,2	21,7	21,8	22,5
Germany	28,4	24,0	25,8	25,3	26,1	26,5	26,1	26,7	27,0	26,3	26,0
Poland	19,7	19,2	17,8	16,8	16,8	16,7	16,6	17,0	17,1	17,3	16,9

Czech Republic	19,9	19,6	19,4	18,6	18,9	18,9	19,6	19,5	19,9	19,9	19,8
Bulgaria	21,6	15,1	13,8	13,0	13,5	13,1	13,9	13,7	15,4	14,6	14,5
Romania		17,3	18,8	19,5	19,7	19,9	18,9	19,2	18,2	15,8	18,6

Source: www.epp.eurostat.ec.europa.eu

4 Taxation of consumption and the size of the shadow economy

The concept of shadow economy is difficult to define precisely and unambiguously. Generally speaking, this term covers economic activities carried out outside the state registration and regulation, hence not subject to taxation. Therefore, the shadow economy includes both legal actions, but not reported to the tax office, as well as actions on the borderline of the law, as well as illegal and even mafia activities.

In the transforming economies, the shadow economy has already appeared in the initial phase of the transformation period, accounting for 23.4% of GDP in the countries of Central and Eastern Europe and 32.9% in the countries of the former USSR. At the turn of 2000-2001, the share of the shadow economy in the countries of Central and Eastern Europe increased to 29.2%, in the former USSR countries up to 44.8%, in some countries (Azerbaijan, Kazakhstan) exceeding even 60% (Schneider, 2010).

The main reasons for the rapid development of the shadow economy in transforming economies include: high tax burden that persuades individuals and businesses to evade taxes; high social security contributions that encourage private employers, especially those who do business to a small extent, to employ illegally and weak and inefficient tax administration system that makes tax collection low, and sanctions for tax evasion - low and inconsistently enforced (Krajewska, 2012, pp. 296-298).

According to a recent Schneider researches (2017), the share of shadow economy in GDP in the EU-28 countries was estimated at 29.6% (Bulgaria), 26.5% (Croatia) and 26.3% (Romania) to 8.2% (Luxembourg) and 7.1% (Austria), with an EU-28 average of 17.1%.

In Poland, estimations of the size of the shadow economy are published by the Central Statistical Office (CSA) and the Institute of Economic Forecasts and Analyses (IEFA), which, when examining the shadow economy, covers a wider group of entities than the Central Statistical Office. Both institutions indicate that the size of shadow economy is decreasing. According to the CSA, the share of the shadow economy in GDP is falling from 13.3% GDP in 2014 to 13.2% in 2017, and as estimated to 12.9% in 2018, and according to IEFA, respectively, from 19.5% GDP up to 18% (Fundowicz, Łapiński, Wyżnikiewicz, 2018, pp. 21-22).

Among the most important factors affecting the reduction of the shadow economy in recent years can be considered (Fundowicz, Łapiński, Wyżnikiewicz, 2018, p. 23):

1) favourable condition of the economic situation, encouraging enterprises to conduct activities not hidden from the tax office;
2) government action aimed at sealing the tax system, and in particular with regard to VAT collecting (mainly in the fuel sector);
3) effective fight against illegal activities - limitation of production and trade in drugs and designer drugs, decrease of cigarette smuggling, elimination of illegal gambling.

As an example, the market for tobacco products can serve to show the negative impact of the increase in excise tax on budget revenues. The shadow economy is particularly extensive there and covers two areas. The first one is the smuggling of cigarettes from the eastern border (Russia, Belarus, Ukraine) and their illegal sale in Poland. The second one is the illegal production of counterfeit goods from well-known brands and placing them on the market without applicable excise marks or illegal exports to Western Europe (mainly Germany, Great Britain, Sweden and Italy).

The big difference between the price of cigarettes in Poland and the eastern border is a serious incentive to smuggle tobacco products. For example, in 2015, the price of a packet

of cigarettes in Poland was PLN 12.85, while PLN 4.65 in Russia, 3.26 PLN in Belarus and PLN 3.20 in Ukraine (Skwirowski, 2016). Such a large difference in prices makes smuggling a deal for both organized gangs and small smugglers, so-called "Ants" - most often unemployed, pensioners crossing the border several times a day. Customs officers estimate that only in the Warmian-Masurian voivodship there are about 10,000 smugglers. This is confirmed by the data of the Central Statistical Office, which shows that the unemployment rate in most border-crossing entities with border crossings is decreasing much slower than the average in their voivodships, and slower than in poviats neighbouring with border counties (Fundowicz, Łapiński, Wyżnikiewicz, 2018, p. 19). This means that the proximity of the border is not conducive to take up legal activities.

On the other hand, the illegal production of tobacco products is encouraged by low production costs, simple technology, high taxation (VAT and excise duty account for over 80% of the price of cigarettes in Poland) and the possibility of illegal exports to Western European countries. High profits from illegal production make possible penalties in the case of detecting illegal activities are not perceived as onerous.

In the opinion of experts, the shadow economy on the tobacco market in Poland grew rapidly - from 12.3% in 2008 to 21% in 2012 and 25% (Poniatowski, Głowacki 2018). According to some estimates it reached 25-30% (Association of Entrepreneurs and Employers 2016).

To a large extent, the development of the shadow economy on the tobacco market results from the rapid increase in excise tax rates, especially in 2010-2014. During this period, the increase in excise duty rates exceeded the pace required by the EU's obligations regarding the harmonization of excise tax on tobacco products. The level of excise taxation required by the EU until 2018 has been reached or even exceeded in Poland already in 2014. However, this decision has had a negative impact on excise duty on tobacco products. In 2013-2015, excise tax revenues decreased in absolute terms, and in 2016 they increased slightly, but the percentage of total excise tax on tobacco products in total tax revenues was still lower than in 2010 (Table 5).

Table 5 Budget Revenues from Excise Tax on Tobacco Products in Poland

	Tax income (in PLN bilion)	Revenues from excise tax on tobacco products	
		in PLN bilion	in %
2010	222,5	17,4	7,8
2011	243,2	18,3	7,5
2012	248,3	18,6	7,5
2013	241,6	18,2	7,5
2014	254,8	17,8	7,0
2015	259,7	17,8	6,9
2016	273,1	18,5	6,9

Souce: Own study based on the Statistical Yearbooks of the Central Statistical Office

5 Conclusions

The Polish tax system is very much based on consumption taxes. The share of VAT and excise duties in budget revenues from taxes is high. The standard VAT rate (23%) is one of the highest in EU countries. The rates of excise tax are also high. This leads to negative effects, both for households (reduced disposable income, and the regressivity of indirect taxes which deepens social disparities), as well as for the economy (a large share of the shadow economy with its negative consequences).

In recent years, various measures have been taken in Poland to strengthen the fiscal function of consumption taxes, e.g., increasing the collection of VAT and excise taxes, limiting cash turnover and replacing it with non-cash transactions, implementing a monitoring system for transporting sensitive goods (the obligation to report the carriage of so-called "sensitive" goods) to and through Poland to the electronic register and its ongoing updating, also introducing legislative changes to limit the shadow economy on the

tobacco market. The effects of these activities are now visible and according to EU estimates in 2015, the so-called VAT gap was 23.9% of potential revenues, while the EU average was 12.8%. In 2017, the gap was at the level of 14%, which is close to the average recorded in the EU. In Poland, VAT revenues increased by 0.4% of GDP, while only France, Malta, Cyprus and the Netherlands managed better with the VAT collection (Cieślak-Wróblewska 2018).

The impact on reducing the negative redistributive effects of VAT and excise duty is a wider problem, going beyond the reform of indirect taxes. These should be comprehensive activities, including an increase in the redistributive income tax function (increase in the amount of tax-free income, increasing tax progression), reform of social security contributions, as well as the introduction of cadastral tax.

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Problems in the Banking Sector

Jan Krajíček

Masaryk University
Faculty Economics and administration, Department Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: krajicek@econ.muni.cz

Abstract: *The paper dedicated to some problems in the banking sector. Banks have different problems. Are some different between great, middle and small banks. Conditions that affect it and the possibilities for further development. Emphasis placed on the development of interest rates and their impact on the economy and management of banks. The decline in interest rates would itself be a problem for banks such as resources grow in the banking sector. Growth in deposits not only in banking, but in the financial sector, and has its consequent reflection in both the declining risk aversion and the need to create new products and services. The decline in risk aversion also reflected in the design of new products, where risk is transferred to raise immediate profits problems are dependent on the size of the bank. Large banks have different problems than medium and small banks, due to their client focus.*

Keywords: bank, loans, revenue, risk

JEL codes: C15, E37, E42, G20, G21

1 Introduction

Management of Balance sheet credits his structure forms the crux of bank management and is an essential part of the financial management of the bank. It's a way of managing the balance sheet structure of the bank, which is an overview of the bank's assets and sources of its financing (Krajicek 2017).

Management of assets and liabilities refers to the bank as a whole. Bank to manage bank risk diversification, risk limitation specifying upper and lower volumes borders while respecting the criteria of profitability and bank profitability. When management assets and liabilities of the bank always acts in the space defined by the central bank and must respect its actions regarding prudent banking and monetary policy. While it is necessary to understand the management of assets and liabilities as a whole, management liability has its rules and peculiarities, by analogy Asset Management which is followed by risk management.

Influence of credit risk on the bank's economy:

- It has a direct impact on the bank's profit, which reduced as a result of provisioning, write-off of loans granted, the creation of reserves and lower interest income of the bank;
- It is closely related to liquidity:
  - Instead of becoming a liquid asset from an illiquid asset, the balance remains an illiquid item,
  - Interest payments for missing resources drain bank liquidity,
  - The resources used in the credit relationship not valued as a result of interest payments,
  - The credit principal was not returned, causing the bank's cash flow,
- There is also a fundamental relationship between credit risk and the risk of interest rate movements. When changing interest rates to the detriment of the borrower, the credit risk increases.
- The ultimate effect of credit risk growth is the pressure to reduce staffing. A lower number of employees reduces labor costs and consequently increases undistributed earnings during the year and profit at the end of the year. There has a positive impact on bank regulation indicators.

The risk of a loan portfolio in the area of credit operations of a bank is necessary to manage and monitor not only the risk of specific loans but also the risk of the entire loan portfolio. The more diversified the structure of the loan portfolio, the lower the bank's credit risk. High concentration per client, an economically linked group of clients, to one economic sector or region, the bank's credit risk is always substantially increased.

2 Methodology and Data Banking sector

For the stable development of the bank is a necessary qualified asset and liability management, which form the focus of bank management and is an essential part of the financial management of the bank. It's a method of managing the balance sheet structure of the bank, which is an overview of the bank's assets and sources of its funding, with the aim of maximizing profits.

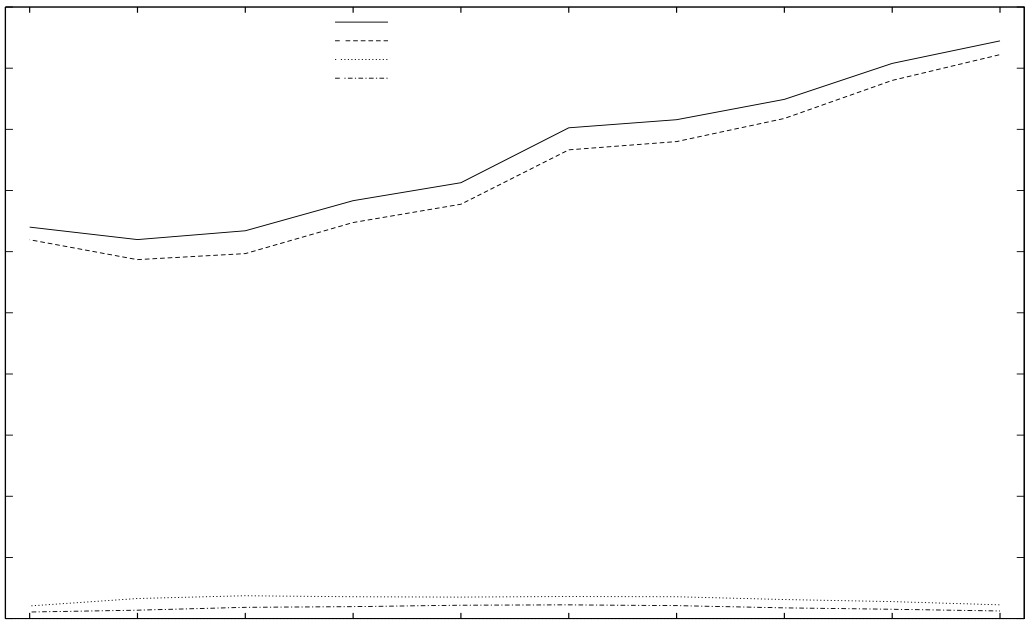
To bank management also reflects the macroeconomic effects of regulation of the banking sector in particular, as currently applicable to Basel II and Basel III, banks are implanted Slovik and Cournede (2011).

The paper mainly used for data analysis, which is available in the system ARAD CNB (2018). The analysis is focused exclusively on the Czech Republic for which data are available over a sufficiently long time series, which allows the adoption of conclusions. Use of a literature search is limited primarily to the basic literature, which dedicated to banks and their evaluation.

The decisive is considered primarily an analysis of profits about the development of, particularly interest rates, interest rates and risks in the banking sector. For purposes of evaluating risk, development again used data from ARAD CNB (2018).

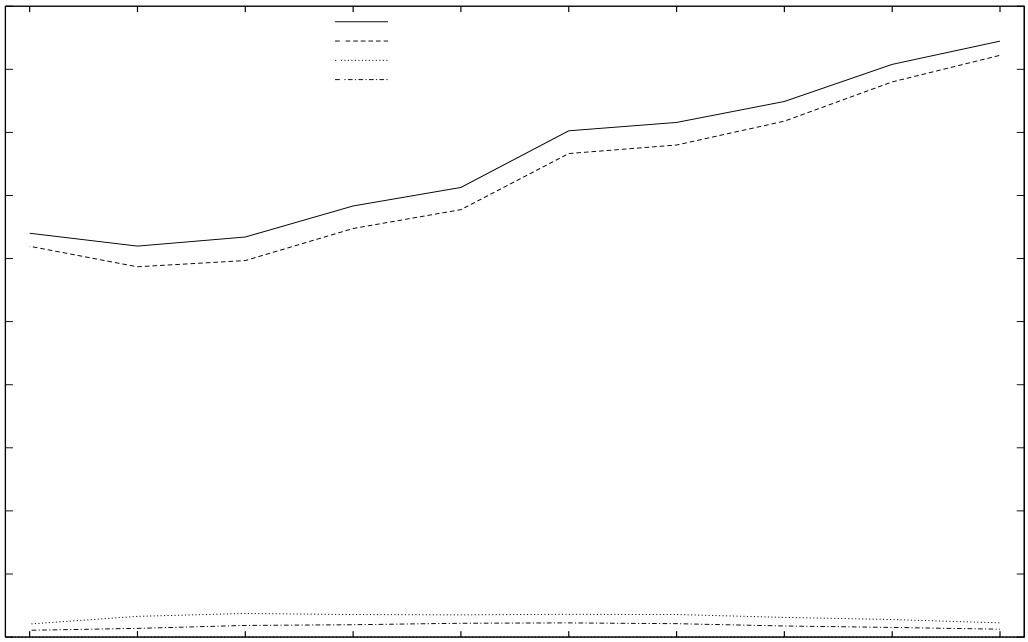
The crucial focus is not on how to analyze the current situation in the banking sector, especially the excess of liabilities reflected in the financial results of individual bank groups. As the basis for the analysis used data ARAD CNB (2018). Their classification is according to the size of banks on small, medium and large banks. Development of receivables demonstrates the following figure.

Figure 1 Receivables in Banks Total



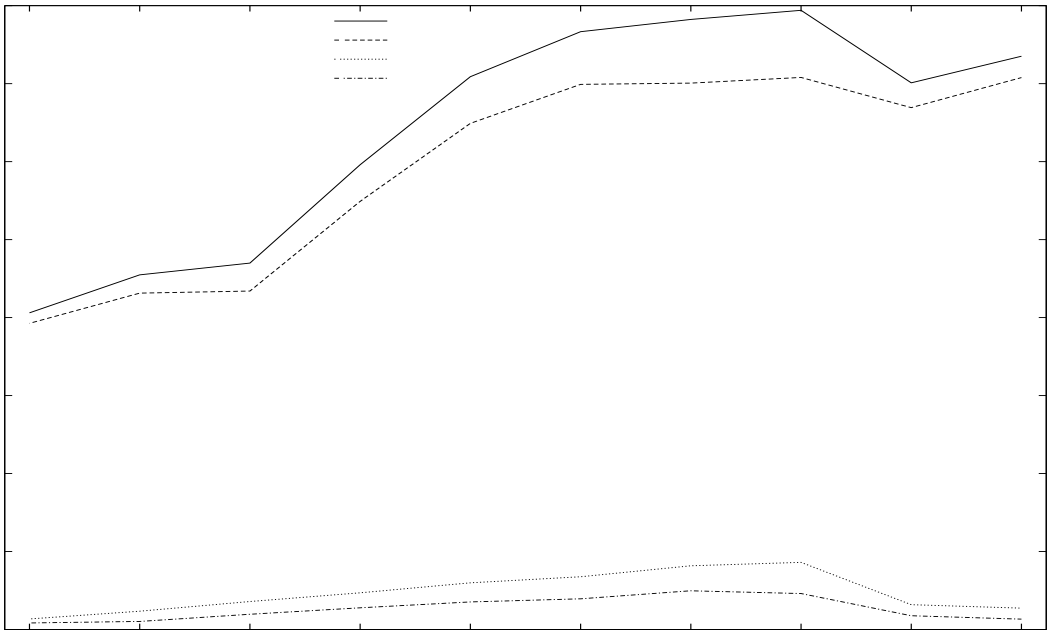
Source: Own processing on basis data ARAD CNB (2018)

Figure 2 Receivables in Great Banks



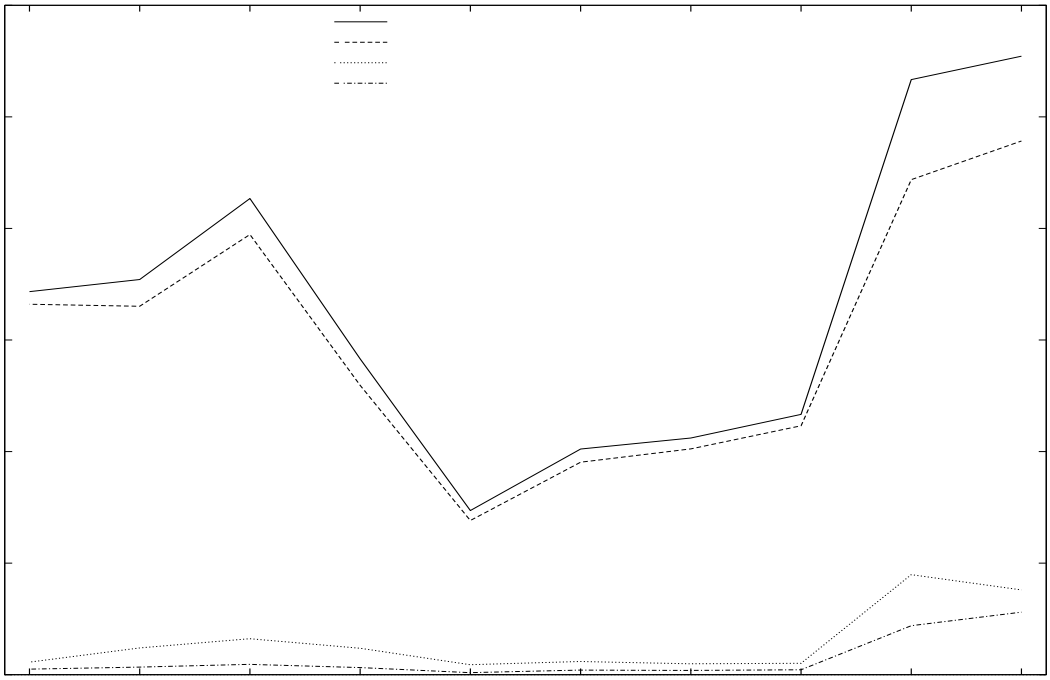
Source: Own processing on basis data ARAD CNB (2018)

Figure 3 Receivables in Middle Banks



Source: Own processing on basis data ARAD CNB (2018)

Figure 4 Receivables in Small Banks



Source: Own processing on basis data ARAD CNB (2018)

3 Results and Discussion

The analysis is based exclusively on available data published by the CNB. It focuses exclusively on the Czech Republic, for which data are available in sufficiently long time ranges, which allow me to take relevant conclusions.

The banking sector has a very balanced development of receivables without default, which evolves in line with total receivables, due to a significant increase in receivables. At the same time, there is a slight decrease in receivables in default and loss receivables. However, it is fundamentally different if we focus on banks related to their client orientation and size. The size of the bank also determines their orientation.

The current developments, when interest rates on deposits have declined significantly, with the current excess of liquidity in Czech banks, are strongly reflected in their orientations. Especially small banks are trying to find a trick on the market. Critical for them is the provision of retail loans. Here, however, they are beginning to get more and more into battles with non-bank providers of consumer credit.

Large banks have the advantage both in their client portfolio and thus not endangered.

The key problem remains with medium-sized banks that are trying to compete with large banks by taking corporate clients and pushing for consumer credit.

The current favorable development in the portion of the loan in default in the loan portfolio also influenced by the growth in the absolute value of the loan portfolio. The portion of defaulting credit also reflected in the relatively short credit expansion period, particularly in the area of retail loans and housing loans. With a prolonged credit expansion period, risk aversion to banks will decline as a result of high deposits. It can assume that this will result in a significant increase in default credit.

The following charts document developments in the banking sector, and it is likely that small banks will be expected to expect problems in the future.

4 Conclusions

Development of economic indicators in the banking sector at the current low-interest rates depends mainly on the orientation of the bank, the result of the woods reach small banks.

For further development of the banking sector and individual banks, it is crucial:

- Client orientation of the bank, whether the bank-oriented to corporate clientele, retail, mortgage lending,
- The size of the bank, which closely linked to the ability of the bank to focus on client demand,
- The size of the bank at the same time also has a decisive influence on the Bank's potential for further development.
- In particular, small banks are expected to increase outstanding loans, which are related to their expansion policy.

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The Impact of Behavioral Finance on the Financial Performance of an Enterprise

Peter Krištofík[1], Michaela Novotná[2]

[1] Matej Bel University
Faculty of Economics, Department of Finance and Accounting
Tajovského 10, 975 90 Banská Bystrica, Slovakia
E-mail: peter.kristofik@umb.sk

[2] Matej Bel University
Faculty of Economics, Department of Finance and Accounting
Tajovského 10, 975 90 Banská Bystrica, Slovakia
E-mail: michaela.novotna@umb.sk

Abstract: *Behavioral finance is an increasingly accepted approach to explaining human behavior in the market. Traditional financial theories treat financial markets and their participants as rational subjects. This paper focuses on behavioral finance and its impact on Slovak medium and large enterprises. It points to different perceptions of rationality in classical economics and behavioral economics. The aim is to create a linear regression model and to investigate the impact of deviations from the rationality on the company's financial performance, measured through ROA and ROE. The paper employs a primary data source: a questionnaire survey, completed by 33 corporate managers. It tests six linear regression models. These show that deviations from rationality, and age affect the financial performance of enterprises.*

Keywords: behavioral economics, behavioral finance, deviations from rationality, regression models, financial performance of enterprises

JEL codes: G02, C58

1 Introduction

Traditional financial theories treat participants in financial markets as rational subjects. They assume that if new information emerges on the market, entities will adjust their preferences and attitudes rationally. They then take decisions that are in line with the theory of maximizing their personal benefit. The theory of rational behavior thus appears to be clear, well defined, standing on logical foundations. It would be sufficient if its forecasts were confirmed by practice. However, after many years and especially in today's chaos on the financial markets, it is clear that such theories cannot be fully applied to the real world of people, especially in terms of individual investor behavior.

This is related to the emergence of behavioral economics and behavioral finance. The central theme of these disciplines is precisely economic decision-making - the way in which we decide, the possible causes of our action, and possibly its inconsistency with economic rationality.

Behavioral approaches used to address the variety of financial problems are referred to as behavioral finance. Behavioral finance represents a new approach to financial markets that has emerged in response to a totally inappropriate model of rational behavior.

Kahneman and Tversky (1979) describe several classes of choice problems in which preferences systematically violate the axioms of expected utility theory. In the light of these observations they argue that utility theory, as it is commonly interpreted and applied, is not an adequate descriptive model. They propose an alternative account of choice under risk. This is prospect theory: a response to the inability of the theory of expected utility to explain certain phenomena that seem to conflict with its underlying assumption that people behave perfectly rationally. Prospect theory suggests that there may be limitations to human thinking that lead to a systematic violation of the underlying assumptions of probability theory.

Psychology and neurology have shown that a person does not always only act rationally. In addition to reason, emotions are important for behavior, even to a greater extent than logical considerations. Most decisions are made on the basis of intuitive approaches that arise from personal preferences and character traits. Some deviations from rationality are called adaptable, because they allow people to adapt to certain situations and take more rapid and hence efficient solutions. Other deviations from rationality arise as a result of people failing to develop proper mental mechanisms to solve certain problems or using mechanisms that are ill suited to dealing with these specific problems (Pilch, 2014).

As Pilch (2014) states, deviations from rationality can occur at any stage of the decision-making process, starting from the form in which the new information is presented, and continuing until the decision is taken. The decision-making process has several phases, each of which can be changed significantly.

Furthermore, we may sort the deviations from rational behavior on whether they result from incorrect information processing, or from the personal characteristics of the investor. Accordingly, we divide them into cognitive and emotional (Baláž, 2006).

Cognitive deviations from rational behavior are based on incorrect collection, analysis, and interpretation of information. They can be corrected by learning, or by appropriate financial counseling (Pilch, 2014a).

Emotional deviations from rationality in thinking and acting are conditioned by emotional factors, especially by desire and concern. Not every emotion is an expression of irrationality. Emotions, however, support the adoption of fast and economical decisions. These are especially beneficial when the problems are very complex and their rational solution would take more time than is tolerable. In certain situations, emotions can suppress rational thinking and result in mistaken or irrational behavior.

2 Methodology and Data

The aim of the paper is to point out the importance of psychological aspects in decision-making and the dependence between the financial performance of an enterprise and deviations from rational behavior. Based on the results of empirical studies, we assume that the performance of a company measured through the ROA and ROE has a strong impact on cognitive, emotional and mixed deviations from rationality.

We used a primary data source, specifically a questionnaire survey. The aim of the questionnaire was to determine the presence of selected deviations from rationality on the part of the respondents. We chose the most frequent deviations from rationality, and the questions were formulated on the basis of various previous research. The questionnaire consisted of closed questions with one choice of answer, and closed questions with multiple choices of answer. The questionnaire was completed by 33 corporate managers. The group of managers comprised 26 men (78.79%) and 7 women (21.21%). All the managers who worked for the addressed companies had work experience of over 12 months.

After evaluation, we created regression models, where the dependent variable was ROA or ROE, and the independent variables were individual distortions, age, and respondent gender.

The ROA was calculated as the share of the economic result before tax and the deduction of interest (referred to as EBIT), and total assets. We measured ROE as a share of net profit and equity.

We will use data from the results of the questionnaire survey and the information we have been able to obtain from our financial statements about the companies' financial performance.

3 Results and Discussion

We began with a regression model with the ROA indicator as the dependent variable. In the first model we only examined the effect of deviations from rationality on this indicator

and we call it Model 1. Firstly, we evaluated the statistical significance of the individual variables entering the model. For all our models we tested the hypotheses:

H_0: βi = 0, the variable is statistically insignificant,

H_1: βi ≠ 0, so the variable is statistically significant, it is not zero.

For Model 1, the p-value of all indicators is less than the significance level α = 0.05, hence we not reject H_0, and all the variables are statistically significant. Then we evaluate the sign of each of the regressive coefficients. A negative sign "-" represents indirect proportionality, and a positive sign "+" represents direct proportionality. If we have a negative sign for all regression coefficients, this implies that if the number of individual deviations from rationality increases, economic performance, measured by the ROA indicator, will decrease. Our first linear regression model, Model 1 has the form:

$$\begin{aligned} y_i = {} & 0.29549 + (-0.03030\ Overconfidence\ bias) + (-0.03172\ Aversion\ to\ loss) + \\ & (-0.02707\ Aversion\ to\ loss\ and\ willingness\ to\ risk) + (-0.02895\ Availability) + \\ & (-0.03491\ Overestimate\ of\ low\ probabilities) + (-0.02862\ Mental\ accounting\ 1) + \\ & (-0.02824\ Mental\ accounting\ 2) + (-0.03213\ Myopia\ 1) + (-0.02361\ Myopia\ 2) + \\ & (-0.03203\ Anchoring\ effect) \end{aligned} \quad (1)$$

The importance of all models as a whole was tested by the F-test. We tested the hypothesis:

H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$,

H_1: non H_0.

Model 1 as a whole can be evaluated as statistically significant because the p-value of the F-statistic is 6.3E-143, and thus we reject the null hypothesis about the non-importance of the model. Furthermore, the model as a whole is evaluated using the R^2 coefficient of determination. It states, after multiplying by 100, the percentage variability that can be explained by the variability of the independent variables in a given model. The closer the coefficient of determination is to 100%, the better the model. Our Model 1 has an R^2 value of 84.39%. So approximately 84.39% of ROA indicator changes depend on deviations from rationality. The disadvantage of this coefficient is that if we add parameters, its value will increase. This disadvantage is removed by calculating the adjusted (corrected) determinant coefficient R^2_{adj}. This adjusts for the number of variables, and like R^2 the higher its value, the better the model. In our Model 1 it is 83.97%.

In the second model, Model 2, we examine the impact of all deviations from rationality, age and gender on the ROA indicator. First, we again evaluated the statistical significance of each variable. The P-value of the statistical gender variable is very high and therefore, at all current levels of significance, the zero hypothesis is not rejected and the gender variable is statistically insignificant. All other p-values are less than the significance level α = 0.05, so we can reject the H_0 hypothesis and all other variables are statistically significant. For the variable age, there is a positive sign, which is a direct dependence, and therefore with the manager's increasing age, the financial performance of the business measured through the ROA indicator also increases. The sign of variables that represent deviations from rationality are negative, indicating indirect dependence. Based on the calculated coefficients, Model 2 will have the form:

$$\begin{aligned} y_i = {} & 0.13285 + 0.00355\ Age + (-0.02528\ Overconfidence\ bias) + \\ & (-0.02754\ Aversion\ to\ loss) + (-0.02250\ Aversion\ to\ loss\ and\ willingness\ to\ risk) + \\ & (-0.01997\ Availability) + (-0.02724\ Overestimate\ of\ low\ probabilities) + \\ & (-0.02055\ Mental\ accounting\ 1) + (-0.02415\ Mental\ accounting\ 2) + \\ & (-0.02573\ Myopia\ 1) + (-0.01430\ Myopia\ 2) + (-0.02578\ Anchoring\ effect) \end{aligned} \quad (2)$$

The P-value of the F-statistic equals 5.6E-145, the H_0 hypothesis is rejected, the model as a whole is statistically significant. The value of the determination coefficient is 85.22%. Compared to Model 1, this value is higher, and so we can say that Model 2 has a better predictive power than Model 1. Similarly, the value of the adjusted determination coefficient has risen to 84.74%. In Model 2 we have one statistically insignificant variable,

so we have compiled a third model in which we have omitted this statistically insignificant variable, we call it Model 3. All p-values of the coefficients were lower than the significance level α = 0.05, which means that we reject the H_0 hypothesis and all the variables are statistically significant. The sign of variables that represent deviations from rationality is again negative, that is, the indirect dependence between ROA and deviations from rationality. The sign of the variable age is positive, and therefore it is the direct dependence of the ROA variable and the variable age. Model 3 takes the form:

$$\begin{aligned} y_i = {} & 0.13177 + 0.00356\ Age + (-0.02523\ Overconfidence\ bias) + \\ & (-0.02750\ Aversion\ to\ loss) + (-0.02240\ Aversion\ to\ loss\ and\ willingness\ to\ risk) + \\ & (-0.01995\ Availability) + (-0.02722\ Overestimate\ of\ low\ probabilities) + \\ & (-0.02055\ Mental\ accounting\ 1) + (-0.02407\ Mental\ accounting\ 2) + \\ & (-0.02569\ Myopia\ 1) + (-0.01431\ Myopia\ 2) + (-0.02574\ Anchoring\ effect) \end{aligned} \quad (3)$$

For Model 3, the p-value of the F-statistic was 3.9E-146, which means that we reject the H_0 hypothesis and the model as a whole is statistically significant.

The determination factor of R^2 is 85.22% for Model 3, which is the highest value of this indicator so far. Similarly, the value of the adjusted determinant increased to 84.78%. We can say that Model 3 is the best designed and most powerful of the models.

In the second case, we will build models where the ROE indicator is the dependent variable. This indicator is not as complex as ROA, so we expect the results will differ. First, we constructed a model called Model 4. In this model, we examined the impact of the deviations from rationality on the financial performance of a business, measured through the ROE. All ten deviations enter the model. In this case, we have variables that are statistically insignificant. It is a variable of aversion to loss, mental accountancy 1, shortsightedness 2. Variable mental accountancy 2 has a boundary p-value, which means that at the level α = 0.05 we would also consider it statistically insignificant. The sign before the coefficients is again negative, even in this case it is an indirect dependence, and therefore with the increasing deviations, the value of the ROE indicator will decrease. The model as a whole, despite the insignificant parameter, can be evaluated as statistically significant as the p-value of the test F-statistic is 1E-57. H_0 hypothesis is rejected. Model 4 has the form:

$$\begin{aligned} y_i = {} & 0.63449 + (-0.10012\ \text{Overconfidence bias}) + (-0.02879\ \text{Aversion to loss}) + \\ & (-0.04685\ \text{Aversion to loss and willingness to risk}) + (-0.11064\ \text{Availability}) + \\ & (-0.07312\ \text{Overestimate of low probabilities}) + (-0.04005\ \text{Mental accounting 1}) + \\ & (-0.04284\ \text{Mental accounting 2}) + (-0.05804\ \text{Myopia 1}) + (-0.01176\ \text{Myopia 2}) + \\ & (-0.07045\ \text{Anchoring effect}) \end{aligned} \quad (4)$$

The determination coefficient R^2 is 54.63% for this model, which is much less compared to models built on the ROA indicator. Even the adjusted determination coefficient R^2_{adj} has a low value compared to previous models, at only 53.41%. We can say that Model 1, which has the same independent variables but is constructed on the basis of the ROA indicator, has a better predictive power than Model 4.

As with the ROA indicator, we also constructed an ROE model in which, besides the deviations from rationality, we included variables for age and gender. This model is called Model 5. Even in this case, the model has statistically insignificant variables. These are the variables of aversion to loss, aversion to loss and willingness to risk, overestimation of small probabilities, mental accountancy 1, mental accountancy 2, myopia 1 and myopia 2. The P-value of these variables is higher than α = 0.05 and we do not reject the zero hypothesis about the statistically insignificant variables. The sign on deviations from rationality is again negative, that is, indirect dependence. Direct dependence is on age and gender. Model 5 thus has the form:

$$\begin{aligned} y_i = {} & 0.03623 + 0.01447\ \text{Age} + (-0.07914\ \text{Overconfidence bias}) + \\ & (-0.01139\ \text{Aversion to loss}) + (-0.02689\ \text{Aversion to loss and willingness to risk}) + \\ & (-0.07430\ \text{Availability}) + (-0.04206\ \text{Overestimate of low probabilities}) + \\ & (-0.00766\ \text{Mental accounting 1}) + (-0.02511\ \text{Mental accounting 2}) + \end{aligned}$$

$$(-0.03165\ \text{Myopia 1}) + (-0.01408\ \text{Myopia 2}) + (-0.03316\ \text{Anchoring effect}) + 0.00667\ \text{Gender} \quad (5)$$

Despite the statistically insignificant variables in the model, the p-value of the test F-statistic is very low at 5,87E-60, and thus we reject the null hypothesis and the model as a whole is statistically significant. The value of the determination coefficient in this case is 55.85%, which is higher than in Model 4, but is still smaller than in the previous models. Even the adjusted coefficient value is low, namely 55.39%. Even so we can say that Model 2, which has the same independent variables, has better explanatory power than Model 5. If there are statistically insignificant variables in the model, the professional literature recommends that one deletes such variables, beginning with the least significant, and re-estimating at each stage. This procedure leads to Model 6, which has only four variables: age, overconfidence bias, availability and anchoring effect. Model 6 has the form:

$$y_i = 0.25386 + 0.01900\ \text{Age} + (-0.09263\ \text{Overconfidence bias}) + (-0.07966\ \text{Availability}) + (-0.03979\ \text{Anchoring effect}) \quad (6)$$

Dependence is again indirect in deviations from rationality; in the age it is a direct dependence. The model as a whole is also evaluated as statistically significant. The P-value of F-statistic is 1.22E-65, so we reject the null hypothesis about the non-importance of the model as a whole. The value of the determination coefficient is 56.82%, which is higher than the previous values, but is still lower than in the models we used for the ROA indicator. The same is true for the adjusted coefficient of determination, which is 55.42%.

4 Conclusions

After designing all the models and evaluating them, we can conclude that psychological aspects have an impact on the performance of the business. As we have seen, there were statistically significant variables in each model that represented deviations from rationality. Psychological aspects affect company performance measured through ROA and ROE.

In addition, entrepreneurs as investors are influenced by financial factors other than rational expectations and the assumption of an efficient market. This has been confirmed in the design of linear regression models.

We can also say that there is an indirect dependence between the investor's financial decision-making measured by ROA, ROE, and cognitive deviations from rationality. We can confirm this hypothesis on the basis of coefficient markers in each model that clearly demonstrated the indirect dependence between deviations from rationality and the financial performance of the business, measured through ROA and ROE.

Monitoring deviations from rationality and linking them to companies` financial performance is not widely studied. Indeed, our research is unique. Until now all behavioral finance research has focused only on individual investor behavior.

Traditionally oriented economists question the methods used in behavioral economics, especially experiments and tests. They point to the fact that people often say one thing but do another. However, if experiments and tests are performed professionally, their results are comparable in different situations and environments (Baláž, 2006).

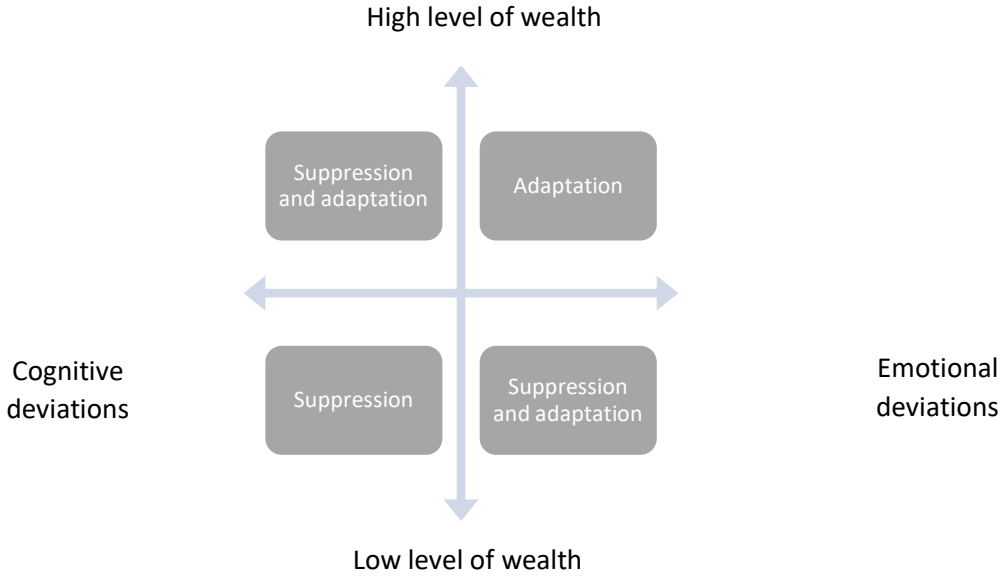
Richard Thaler sampled several thousand volunteers and found that patterns of behaviour are determined by mental abbreviations, resulting in systematic and predictable mistakes (Thaler, 2008).

Kahneman and Tversky (1984) have been able to systematically question the traditional theory of rational theory in their numerous experiments.

Behavioral economics provides us with a number of practical results that can be used to better understand behavior. By recognizing its radical findings people can correct mistakes and achieve greater value in their decisions. As the scope of behavioural economics expands and more anomalies are explained, more people will become aware of its implications and their decision-making will improve.

Asked whether the financial adviser should try to suppress or deviate from traditional rationality, Pompian (2006) based his answer on two key factors. The first is the wealth of the investor. According to the author, the advisor should adjust to the deviations of richer investors but try to suppress deviations by investors with only small assets. The logic of this advice is that while deviations from traditional rationality may threaten a client`s standard of living, the impact is relatively less important the richer the client. The second factor is the nature of the deviations from rationality. If cognitive deviations predominate, the advisor should try to suppress them as the explanation and the provision of comprehensive information can minimize investor cognitive deviations. On the other hand, emotional deviations are mostly related to the nature and impulsivity of the investor and are very difficult to influence. Scheme 1 below illustrates the principles of adapting or suppressing deviations.

Figure 1 Illustration of Adaptation or Suppression of Deviations



Source: Own processing, following Pompian, 2006

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Using of Non-financial Data in Predictive Models

Zuzana Kubaščíková[1], Miloš Tumpach[2], Zuzana Juhászová[3]

[1] University of Economics in Bratislava
Faculty of Business Informatics, Department of Accounting and Auditing
Dolnozemska 1, 852 35 Bratislava, Slovakia
E-mail: zuzana.kubascikova@euba.sk

[2] University of Economics in Bratislava
Faculty of Business Informatics, Department of Accounting and Auditing
Dolnozemska 1, 852 35 Bratislava, Slovakia
E-mail: milos.tumpach@euba.sk

[3] University of Economics in Bratislava
Faculty of Business Informatics, Department of Accounting and Auditing
Dolnozemska 1, 852 35 Bratislava, Slovakia
E-mail: zuzana.juhaszova@euba.sk

Abstract: *Forecasting the company's future economic situation arose in the early 20th century. First of all, a multidimensional discriminatory analysis was used to construct prediction models, later replaced by logistic regression. The new challenge in predicting financial development is neural networks representing a more reliable financial forecast compared to mathematical and statistical methods. The neural network, by mimicking the capabilities of human brain neurons, is capable of modeling the course of dependencies between individual indicators and results. A disadvantage of the original prediction models is also the low range of empirical accounting data and the fact that they are focused only on financial data. The introduction of the financial statements registers led to the possibility of free access to full data from the financial statements, which opens the door to new possibilities in scientific research. For the purpose of this paper an annual report of 20 selected companies were tested. The aim of this paper is to accept or reject the claims that non-financial „narrative" data could be also used for the assessment of the financial position and financial performance of the companies. The results of our sentiment analysis supported the hypothesis that financially distressed companies use a different tone of language in their annual reports compared to financially stable companies. These findings confirmed the relationship between the tone which managers use in constructing annual report narratives, and the financial performance of the company. Therefore, it is advisable to incorporate non-financial data into the forecasting models.*

Keywords: financial statements, financial analysis, neural network, deep learning, data mining

JEL codes: M49

1 Introduction

The goal of financial analysis is to recognize what is bad and good for the business, which can cause problems in the future, and vice versa, to identify its strengths that can be relied upon in the future (Šlosárová, 2014). The forecasting of the financial situation of enterprises is considered to be a relatively young area of scientific research, which dates back to the 30s of the 20th century. At the beginning experts predicted the future financial situation by comparing financial ratios. Beaver (1966) examined the financial indicators on the basis of a one-dimensional discriminatory analysis. There are known following prediction models - Altman (1968), Deakin (1972), Ohlson (1980), Taffler (1982) or Zmijewski (1984).

At the end of the 1960s, multidimensional discriminatory analysis began to be used for forecasting. Based on the multidimensional discriminatory analysis, it was the first model of the Altman (1968) predictive model for publicly-traded joint stock companies (the so-called Model Z-score) which some other theoreticians and practitioners have already been

taking in the short time, Deakin (1972) and Blum (1974). In the 1980s, logistical regression was gradually brought to the forefront of financial forecasting research, which gradually replaced multidimensional discriminatory analysis. First, he used logistic regression to create a model to predict the future financial situation of Ohlson (1980).

Prognosis of the future situation of a business entity through methods of multidimensional discriminatory analysis and logistic regression is very widely used, but in reality, when predicting company failures, these methods have certain limitations that largely result from their very nature. One of the basic assumptions of multidimensional discriminatory analysis and logistic regression is dichotomic dependent variability. What requires groups of companies with a good financial situation and an unsatisfactory financial situation to be clearly defined and clearly distinguishable. In practice, however, this assumption is very difficult. The problem is the very definition of defaulting companies, from which the classification of the companies on which the prediction model is based depends. Most models use a sample composed of two priority groups "unsuccessful" and "successful" companies. Models constructed on the basis of multidimensional discriminatory analysis and logistic regression have limitations that relations between financial ratios are unstable over time and, due to changes in inflation, economic cycles in a given country, interest rates. instability over time leads to a change in the set coefficients of the ratios or changes in the boundary classification values. The disadvantage of these approaches is also the low scope of empirical accounting data, moral wear and tear in countries where these analyzes were directly related and further low usability in the conditions of the Slovak Republic, as they use data which have a low prediction ability in the Slovak environment or some data are not available at all (for example, market price of shares). These facts should lead to regular testing of the model and its re-verification, if necessary.

One of the first studies dealing with the comparison of neural networks (NN) with classical mathematical and statistical techniques in forecasting the financial development of enterprises was the Odom and Shard study of 1990. Neural networks represent one of the areas of machine learning. By machine learning, we mean a set of methods and approaches that allow the machine to learn. The system's knowledge gains from the training set of data. This system (in our case the neural network) should also have the ability to generalize.

In 2015, Blanco-Oliver published a collection of study authors focusing on creating a model for micro-accounting units. They introduced non-financial information into the model and constructed it using neural networks. In this study, we conclude that predicting bankruptcy through neural networks can achieve greater predictive power and lower cost of classification errors than with logistic regression and the introduction of non-financial variables improves the predictive precision of models. According to this study, the introduction of neural network access and the introduction of non-financial variables are two important means to improve the predictive precision of predictive models (Blanco-Oliver, Irimia-Dieguez, Oliver-Alfonso, Wilson, 2015).

A very large number of published studies to compare classical mathematical and statistical methods with neural networks confirm the conclusion that neural networks are better suited to predicting bankruptcy and have significantly higher predictive precision than logistic regression or multidimensional discriminatory analysis. The introduction of non-financial or macroeconomic variables into the model through independent indicators greatly improves the predictive precision of the model and the use of any method to model. It is not necessary to note that questions about modeling through neural networks such as the integration of data mining methods, the selection of suitable parameters, the selection of functions, a wide range of different techniques, etc., which are currently not universally and sufficiently relevant, are still open based on previous research, and should therefore do research in the future to answer these questions.

Machine learning is widely used nowadays to review contracts, leases, invoices, and other documents. The adoption of machine learning within the accounting profession is still, admittedly, at an early stage. To accelerate the wider use of this technology, it is necessary to create economies of scale by integrating its cognitive capabilities in the areas of textual

analysis, voice recognition, image and video parsing, and judgment support into the financial analysis and audit process. This article discusses how the cognitive capabilities of machine learning of non-financial data from annual reports could be applied to financial analysis and predictive models and to enable improve decision making.

2 Methodology and Data

For the purpose of this paper we analyzed annual reports of companies divided into two groups based on Altman's bankruptcy prediction model: financially distressed companies likely to go bankrupt within the following two years and financially stable companies with the high probability to survive. This model proposed bankruptcy based on financial ratios based on current financial results. We examined whether the qualitative information contained in annual report narratives indicated the bankruptcy alongside this quantitative information. Thus, we analyzed whether companies likely to go bankrupt employed a different tone of language compared to financially stable companies.

For this purpose, we selected 20 companies out of the Fortune 1000 list (Fortune, 2018). We divided them into two equal groups according to Altman's Z-score obtained from the Factiva database portal. Further, in order to obtain the data, we collected annual reports, 10-K filings, of U.S. companies from the EDGAR database (EDGAR, 2018). In total, we examined 20 annual reports for the fiscal year 2016.

Table 1: Companies Classified into the "Distress Zone" According to Altman's Z-score

Rank	Company	Z-score	Industry (SIC)
1.	Anadarko Petroleum Corp.	0,71	Crude Petroleum and Natural Gas
2.	Apache Corp.	0,55	Crude Petroleum and Natural Gas
3.	Caesars Entertainment Corp.	-0,24	Hotels and Motels
4.	Darling Ingredients	1,53	Animal and Marine Fats and Oils
5.	Freeport-McMoRan, Inc.	0,22	Copper Ores
6.	Leucadia National Corp.	0,46	Investors, NEC
7.	Post Holdings, Inc.	1,06	Cereal Breakfast Foods
8.	The ADT Corp.	0,99	Security Systems Services
9.	WestRock Co.	1,35	Die-Cut Paper and Paperboard and Dardboard
10.	Windstream Holdings, Inc.	0,62	Telephone Communications

Source: Factiva Companies and Executives, 2018

The following table lists the "safe zone" companies, the industries in which they operate, and their Altman's Z-score:

Table 2: Companies Classified into the "Safe Zone" According to Altman's Z score

Rank	Company	Z-score	Industry (SIC)
1.	Applied Materials, Inc.	4,17	Semiconductors and Related Devices
2.	Campbell Soup	3,19	Canned Specialties
3.	Cisco Systems	3,14	Telephone and Telegraph
4.	Citrix Systems, Inc.	3,83	Pre-packaged Software
5.	Exxon Mobil	3,72	Petroleum Refining
6.	Johnson & Johnson	5,09	Pharmaceutical Preparation
7.	McDonalds Corp.	5,25	Eating and Drinking Places
8.	PepsiCo, Inc.	4,01	Bottled and Canned Soft Drinks
9.	Phillips 66	3,56	Petroleum Refining
10.	The Walt Disney Co.	4,5	Motion Picture and Video Production

Source: Factiva Companies and Executives, 2018

Although the companies were selected across various industries, we attempted to choose similar industries within both the safe zone and distress zone. This would help us to prevent the situation where industry-specific attributes would undermine the results as some words are more characteristic for some industries than others. Thus, the companies within both groups operated in telephone communication, the food sector, entertainment, petroleum refining, and security systems and software.

To assess the sentiment used in annual report narratives, we processed and analyzed this data with the LIWC2015 (Linguistic Inquiry and Word Count) textual analysis program. This program analyses text on various sentiment categories, including positive emotions, negative emotions, certainty, risk focus and others.

Linguistic Inquiry and Word Count (LIWC) is a text analysis computer program that provides output in the form of a percentage of the words contained in the text from the categories mentioned. For example, if the text contains 1,000 words, the dictionary might find 50 words which occur in the text express positive emotion, so then it allocates score 5 to positive sentiment. Thus, within each category the score ranking from 0 to 100 may be attributed to the specific text. The more words the software analyses, the more reliable the results are. As our samples contained texts ranging from 7,000 to 22,000 words, we consider the results obtained to be reliable (LIWC, 2018).

We employed this computer-assisted dictionary in order to analyze the sentiment aspect of annual report. Each of the companies was, firstly, analyzed individually on several categories of sentiment. Then we synthesized the results obtained for "distress zone" companies and "safe zone" companies in order to get the full picture about the differences between these two.

3 Results and Discussion

Although the idea of artificial neural networks dates back to the 1950s, such networks could not be called real artificial intelligence until recent advances in computational power and data storage enabled the development of deep neural networks that model the structure and thinking process of the brain. The hidden layers of a deep neural network automatically "learn" from massive amounts of data (especially semi-structured or unstructured data) received by the input layer (e.g., also images, annual reports, text files), recognize data patterns in more and more abstract representations as the data is processed and transmitted from one hidden layer to the next, and classify the data into predefined categories in the output layer.

Deep learning algorithms further enrich financial analysis by identifying related concepts or topics, recognizing entities (e.g., people, place, events, companies), extracting emotions (e.g., anger, joy, sadness, disgust), and understanding subject-action-object relationships. In addition, they can link concepts to a document and tag them accordingly. Deep learning technology—an emerging form of artificial intelligence that can be trained to recognize patterns in vast volumes of data that would be impossible for humans to process. This still evolving technology represents a way to utilize big data to create supplementary audit evidence that improves the effectiveness and efficiency of audit automation and decision making.

For example, financial analysts can select data attributes in order to predict bankrupt (auditors can predict fraud); the selected attributes are then combined with traditional financial or nonfinancial data fields to develop a new deep learning prediction model. Deep learning performs as an appropriate prediction algorithm in this case because, by introducing the extracted attributes, the number of predictors is much larger than what a traditional machine-learning algorithm could process. For each assertion, the output of the model could be the predicted risk level or suggested follow-up tests, depending upon the nature and the label of the training data.

For the purpose of this paper, we analyzed the companies according to the Altman Z-score to find out whether the qualitative information expressed in narrative reporting differs between companies with a high probability of bankruptcy and those in a financially stable

position. Thus, we could assume that the annual report narratives of financially distressed companies show sentiment which is more negative and more uncertain compared to the financially healthy companies.

We found out that financially healthy companies achieved a slightly higher score on positive sentiment compared to distressed companies (2,79 vs. 2,77). When we examined more deeply the companies themselves, we found that companies from the distressed group which had suffered a loss in fiscal year 2015 employed less positive and more negative emotions than the distress- classified companies which, however, achieved a profit.

However, when we further examined the negative emotion elements, we could see that companies with probable financial problems tended to employ more anxious language compared to the other group (0,26 vs. 0,21). This may be due to the fact that distressed companies are worried about the future because even though they might not fall into financial problems yet, it is likely that they will experience them within the next two years. Thus, they expressed their concerns through this category of words even before the bankruptcy or insolvency appears. However, when we considered only the companies which already suffered a loss in fiscal year 2015 from the distressed group, these have a much lower level of anxiety compared to the rest of the group (0,20 vs. 0,30) and a slightly higher level of certainty (0,79 vs. 0,76).

Interestingly, the financially distressed companies ranked lower on two almost opposing categories: certainty (0,77 vs. 0,84 achieved by the safe group) and tentativeness (1,79 vs. 1,94 achieved by the safe group). Even though these results are relatively surprising, distressed companies with a poorer financial performance were found to be more certain and, at the same time, more uncertain compared to the better-performing companies. It might be caused by the fact that these companies, on the one hand, connect uncertain terms with the financial situation and, on the other hand, the certain terms with activities to handle the poor financial situation. Therefore, in our case, we could use the reasoning that financially distressed firms are less tentative in terms of handling their financial situation, for example, implementing new strategies, restructuring programs, and other initiatives in order to prevent the possible bankruptcy. However, they are still more uncertain referring to their future financial situation compared to companies from the safe zone which can be almost sure they will not experience bankruptcy during future years.

Then the five additional categories were examined. Those are Affiliation, Achievement, Power, Reward focus, and Risk focus. All of them belong to LIWC2015 categorization. They could provide important clues about what specifically drives company performance and/or which categories the managers would like to place the highest emphasis on in their reporting while assessing company financial performance and future trends.

Companies within the safe zone achieve a higher score on the first four categories - affiliation (2,6 vs. 2,5), achievement (1,8 vs. 1,65), power (2,74 vs. 2,69), reward (1 vs. 0,65). The financially distressed companies only outperform them on the risk category (0,96 vs. 1,09). The power category, on which both groups score the highest (2,74 and 2,69) reveals interest in status and dominance. However, this category is likely to comprise words like "boss", "president", or "strong". Thus, it is obvious that such words appear in the annual reports of the companies. Therefore, this category does not have a huge explanatory power for the purpose of our analysis.

What is, however, more interesting is the fact that financially distressed companies already see the higher risk connected with their financial performance, and we can see that this is reflected in the texts of their narratives. Therefore, this analysis might help us to predict the financial performance of the firms to some extent. The full picture which combines the insight into all of these five categories together could, therefore, provide us with some evidence about the worsening financial performance of a company expressed in the textual part of the annual reports.

4 Conclusions

The financial data comprised in annual reports are important indicators of current financial performance and may also indicate future financial development via the application of prediction models such as Altman´s Z- score. However, they do not provide us with insight into all of the circumstances that led to these results, information about future trends, development and managers' expectations. For this purpose, the qualitative data is especially useful.

For the purpose of this paper the annual reports of 20 selected companies were tested. Companies were randomly selected from database Fortune 1000. Their Altman Z-score was obtained from the Factiva database. We have chosen companies across various industries. Firstly, we focused on the tone used by managers when discussing company performance, position and future trends in annual reports. For this purpose, was used computerized text analysis program.

Although annual report narratives are more subjective compared to the financial data, we suggest they may be indicative of future financial developments, as demonstrated by the language managers use to disclose information. In this study we used a textual analysis software in order to accept or reject the claims, that non- financial "narrative" data could also be used for the assessment of the financial position and financial performance of a company. Our analysis focused on the Management Discussion and Analysis section (MD&A) of the 10-K reports. Here managers comment on financial performance, but also express predictive statements about future trends, expectations and challenges. Therefore, the information comprised in these sections indicate future financial performance.

The results of our sentiment analysis supported the hypothesis that financially distressed companies use a different tone of language in their annual reports compared to financially stable companies. These findings confirmed the relationship between the tone which managers use in constructing annual report narratives, and the financial performance of the company. Therefore, it is advisable to incorporate non-financial data into the forecasting models. This can be incorporated into prediction models based on neural networks.

However, the research presented has its limitations that could subsequently affect the reliability and accuracy of the results achieved and on which our recommendations are based it can be possible to eliminate the drawbacks by using neural networks but this requires a bigger data sample and automated input data processing.

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The Role of Apparent Signs of Financial Distress in Test Samples and Verification Samples of Bankrupt Models

Michal Kuběnka, Renáta Myšková, Josef Novotný, Vít Jedlička

University of Pardubice
Faculty of Economics and Administration, Institute of Business Economics and Management
Studentská 84, 532 10, Czech Republic
E-mail: michal.kubenka@upce.cz; renata.myskova@upce.cz; josef.novotny@upce.cz; vit.jedlicka@student.upce.cz

Abstract: *Financial bankrupt models are characterized as quite accurate and above all very fast tools for quantitative evaluation of financial health of company. The creators report the accuracy of the predicted bankruptcy usually in the range of 70 to 90%. But the problem of bankruptcy models is the test sample on which the models were created. The sample affects the predictive power of these models. Usually indicated accuracy rate differs from the real predictive power of these models. The financial distress of certain businesses may be obvious even without the use of bankruptcy models. Apparent signs of financial distress may be insolvency, negative equity, VAT unreliability, negative economic result for several years in a row. Survey conducted by more than 270 companies has shown that more businesses with apparent signs of financial distress in the sample increase the reported accuracy of the bankruptcy model. The research carried out also has determined the real accuracy of selected bankruptcy models on the standard sample of Czech firms and also on a sample of companies where companies with obvious signs of financial distress were eliminated. Due to the modification of the test sample subsequently the accuracy of the selected models changed radically.*

Keywords: bankrupt models, financial distress, prediction

JEL codes: G32, M10, C38

1 Introduction

The legislation on insolvency proceedings in the Czech Republic is contained in Act no. 182/2006 Coll., "On Bankruptcy and Methods of its Settlement", as amended (hereinafter the Insolvency Act). This Act entered into force on 1st January 2008 and replaced the previous regulation contained in Act no. 328/1991 Coll. The position of insolvency administrators in charge of this issue is regulated by Act no. 312/2006 Coll. on Insolvency Administrators, as amended. According to the Insolvency Act, it is possible to solve not only if financial failure has already occurred but also the imminent bankruptcy. Insolvency act (§3) defines the concept of bankruptcy with three conceptual features - plurality of creditors, the existence of repayable obligations for more than 30 days and the inability to perform financial obligations.

Table 1 Insolvency Proposals in the Czech Republic in 2010-2017

Year	Corporates	Individuals	Total
2010	5559	10559	16118
2011	6753	17600	24363
2012	8398	23830	32228
2013	6021	30888	36909
2014	3563	31577	35140
2015	3004	29349	32353
2016	2438	27067	29505
2017	1803	21343	23146

Source: CreditReform 2012, 2015, 2017

Table 1 shows that insolvency proposals are tens of thousands each year. Therefore, it is important to prevent a situation where this situation occurs in one's own business or

business partner. Timely disclosure of incoming bankruptcy may cause avoidance of bankruptcy or minimize losses as a result of the bankruptcy of a business partner.

Bankruptcy models are based on the assumption that an enterprise has been showing signs of bankruptcy for years and years before it has gone bankrupt. A prediction of financial bankruptcy in advance could thus avert an imminent bankruptcy. Attempts to find a simple and yet accurate model that would be able to classify future financial decline appears in the middle of the last century. The break was 1968, when prof. Altman (Altman, 1968) created a bankruptcy model Z score using multivariate analysis. This model is based on financial data contained in account books. Therefore, the input data is easily accessible and subsequent enterprise application is possible for the general public. His model works with five financial ratios. Relatively soon it was followed by other specialists, who also used other mathematical and statistical methods. For instance, for creation of his bankruptcy model J. A. Ohlson used the logit linear probability in 1980 as the first one (Ohlson, 1980). In the year 1985 the factor analysis was used in order to get independent variables for the logit model (Zavgren, 1985). Later the progress has led to methods of artificial intelligence that mainly use the neural networks (NN) for creation of prediction models since nineties of last century. Tam and Kiang (Tam, 1991), (Tam & Kiang, 1992) belong to pioneers of NN usage. Particular methods (MDA vs. Logit vs. NN) of models creation were compared many times. The results show NN as the most suitable method as proven by (Pendharkar, 2005) (Liang, 2005) (Rafiei, Manzari and Bostanian, 2011). After the passage to the market economy (nineties 20th century) the bankrupt models also started to origin in the Czech Republic and Slovak Republic in order to predict the company bankruptcy. These models should regard the market specificity of these countries. The model (index) IN95 (Neumaierová & Neumaier, 2002) has appeared as the first one, being designed as the creditor´s model, as i tis mostly used for subjects in the creditor´s position (banks and business partners). In 1999 the same authors brought the so-called ownership´s model, named IN99. Its function consists in the prosperity prediction based on the positive economic value added (EVA). In 2001 they created the model IN01 that connected properties of both previous models, i.e. it predicts the bankruptcy as well as the prosperity. Just in the year 2005 it was updated to the version called index IN05 (Neumaierová, 2005). There is a lot of models for earnings prediction (e.g. Hou & Van Dijk & Zhang, 2012; Sheng & Thevenot, 2012; Duspiva & Novotný, 2012; Banker & Chen, 2006) but only IN05 predicts EVA. Before the economic crisis two models focused on the agriculture appeared in Slovakia. It was CH-index from 1998 (Chrastinová, 1998) and G-index from 2002 (Gurčík, 2002). After the economic crisis in 2008 only few bankruptcy models appeared at the territory of the Czech Republic and the Slovak Republic, i.e. P´model (Delina & Packová, 2013) and the bankruptcy Index of Karas and Režňáková (I_{KR}) (Karas & Režňáková, 2013). Čámská emphasizes that the application of these types of model is „user friendly as they do not require any specific mathematic and statistic knowledge of the user" (Čámská, 2013). The authors of model I_{KR} determine the model accuracy 91.71% (calculated as the weighted average of sensitivity and specificity). The authors of model P´ determine the bankruptcy prediction accuracy 21.26% and the bankruptcy prediction return at 71.84%.

Kuběnka and Slavíček (Kuběnka and Slavíček, 2014) claim that although prosperity and bankrupt models were created differently, their construction is similar, which means a combination of ratios and assigned weights of importance. Financial diagnostic and prediction models vary predominantly in their targeting. However, despite a long history of these models there are still used groups of simple ratios for economic and financial stability analysis, e.g. (International Monetary Fund; Černohorská & Linhartová, 2013).

Let´s suppose that the bankruptcy model is accurate at maximum when applied in the region (country) of its origin (due to the differences of accounting methods (see more Honková, 2015), market environment, etc.). Let´s also suppose that the market environment in the Czech Republic and the Slovak Republic is still very close. Thus we shall test just last two mentioned models (I_{KR} and P´model) in order to define their accuracy on sample of companies with and also without of apparent signs of financial distress. Altman´s Z score models are the most famous in the world. That is why one of them is also tested.

The goal of this survey is to answer the question whether a sampling pattern on which the accuracy of the model is validated by its structure does not affect the resulting accuracy of the model. The investigation will determine how far the specified accuracy of the models changes after eliminating the obvious bankruptcy features.

2 Tested models

The original **Altman Z-Score** of 1968 was designed for publicly traded joint stock companies. On the other hand, the Z'score (1983), which was published in 1983, was compiled for public limited companies and non-publicly traded shares. Below is a modification of the previous model where the X_4 indicator has been altered from the market value of the equity to the book value of the equity. The stated accuracy of this model is 82% (18% error of type I.). The model has the following form (Altman, 1993):

$$Z' = 0{,}717*X_1 + 0{,}847*X_2 + 3{,}107*X_3 + 0{,}420*X_4 + 0{,}998*X_5 \quad (1)$$

where:

X_1 = working capital / total assets;
X_2 = retained earnings / total assets;
X_3 = earnings before interest and tax / total assets;
X_4 = book value of equity / total assets;
X_5 = sales / total assets.

Creditworthy enterprises should have a score of more than 2.90, and on the other hand enterprises in default below 1.23. The results between boundary values (1.23; 2.90) cannot be clearly explained.

Index of Karas and Režňáková (I_{KR}) is one of the newest bankruptcy model with different structure of variables calculation. All known bankruptcy models (based on author´s knowledge) use 4 ratio indexes at minimum, whereas I_{KR} use only two of them. The first one (X_2) is the assets turnover and the second one (X_3) is the ratio of quick assets and sales. In addition, it contains the variable of absolute amount (X_1) that represent the value of total assets in EUR. The authors of index (Karas & Režňáková, 2013) created the model based on the sample of 880 financially stable and 628 bankrupted companies. Data were drawn from the accounting statements from the period 2007 to 2012. All 1508 companies belonged to the processing industry, based on their business activity, (NACE rev. 2, section C: Manufacturing).

In their text the authors (Karas & Režňáková, 2013) state that the model construction is based on the connection of linear discrimination analysis and the Box-Cox transformation variables. The model is shown as follows:

$$I_{KR} = 1.841*\frac{(X_1+16783.91)^{0.02941}-1}{0.02941} + 1.112*\frac{(X_2+1)^{-0.35627}-1}{0.35627}*13.55*\frac{(X_3+1.112)^{-2.97955}}{2.97955} - 17{,}319 \quad (2)$$

where:

X_1 = value of total assets (EUR)
X_2 = turnover of total assets
X_3 = quick assets a sales ratio

The border limit was determined by the 0 value. Then the company with achieved value IKR > 0 should be financially healthy and with IKR < 0 business goes bankrupt.

Delina and Packová (2013) proposed their own bankruptcy model using the ration indexes used in analyses models (Z-score, Creditworthiness Index, IN05) and regression analysis. The so-called **P´ model** has the following form:

$$P' \text{ model} = 2.86 - 0.0001278X_1 + 0.04851A_2 + 0.2136A_3 - 0.000071A_4 + 0.0001068B_1 - 0.0006116B_4 \quad (3)$$

where:

X_1 = (financial assets – short-term liabilities) / (operating expenses –depreciations)

A_2 = retained earnings / total assets
A_3 = profit before interests and taxes / total assets
A_4 = registred capital / (long-term + short-term liabilities)
B_1 = cash flow / total liabilities
B_4 = earnings before taxes / total operating revenue

The evaluation scale does not contain the interval of non-specified values of P´ model. The critical limit for the company classification is at the value 2,856. When P´< 2.856 the company tends to bankrupt, when P´ ≥ the company is financially healthy and the bankruptcy probability is very low.

3 Research sample description

I was found 273 companies with defined parameters. This sample was used for finding of current accuracy of selected tested model (test no. 1). The sample consist of the companies operating in the manufacturing industry, in bankruptcy, who had available financial statements both in the year of bankruptcy and in the previous year, in order to be able to monitor the possible occurring negative events even in previous years.

In general, the following may be considered as negative events: bankruptcy, execution, insolvency, claim, enforced execution, liquidation, extinction, negative equity, VAT unreliability or loss for several consecutive years. And the last one was one of the main indicators of bankruptcy, along with negative own equity and negative economic performance observed on the sample being tested.

Out of the original 273 companies, 135 companies were eliminated on the basis of the observed loss for several consecutive years, the negative equity and the negative economic result. For the rest of 138 companies selected bankruptcy models were applied, detected accuracy evaluated (test no. 2).

Table 2 Frequency of Occurrence of Negative Events

Negative events	Absol. frequency	Relat. frequency
Loss for several consecutive years	34	25%
Negative equity & negative economic result	41	30%
Negative economic result	63	47%
Negative equity	82	61%
Total	135	100%

Source: Own research

4 Results

Test no. 1 consisted of applying models to a whole sample of enterprises (273 pcs) in bankruptcy. P' model evaluated correctly as bankrupt 203 businesses, it is 74.36% of sample. This has become the most successful model in testing. Only 71.44% (28.56% type I. error) assigned creators accuracy of the bankruptcy prediction. Sample application without apparent signs reduced the model's accuracy by 6.59% to 67.77%.

Z´ score evaluated 185 companies (67.77%) in bankrupt, which is less than the creator states (82.00%). The least successful was the I_{KR} model, where the authors report accuracy of 69.91% and test no. 1 indicates accuracy 62.27%, i.e. 170 enterprises classified as bankrupt. Rank in success of prediction in test no. 1 is as follows:

- P´model (74.36%)
- Z´score (67.77%)
- I_{KR} (62.27%)

The reliability interval π for these results can be, according to Pacáková (2003), determined as follows.

$$P\left(p - z_{1-\frac{\propto}{2}} * \sqrt{\frac{p(1-p)}{n}} < \pi < p + z_{1-\frac{\propto}{2}} * \sqrt{\frac{p(1-p)}{n}}\right) = 1 - \alpha \quad (4)$$

where:

- p – found current accuracy of models (74.36%, 67.77%, 62.27%)
- n – the size of the base π, means number of companies in sample,
- α – determined at the level of 5%,

Table 3 states original accuracy stated by author, current accuracy checked in test no. 1, confidence interval of current accuracy and accuracy without apparent signs checked in test no. 2.

Table 3 Accuracy With and Without Apparent Signs

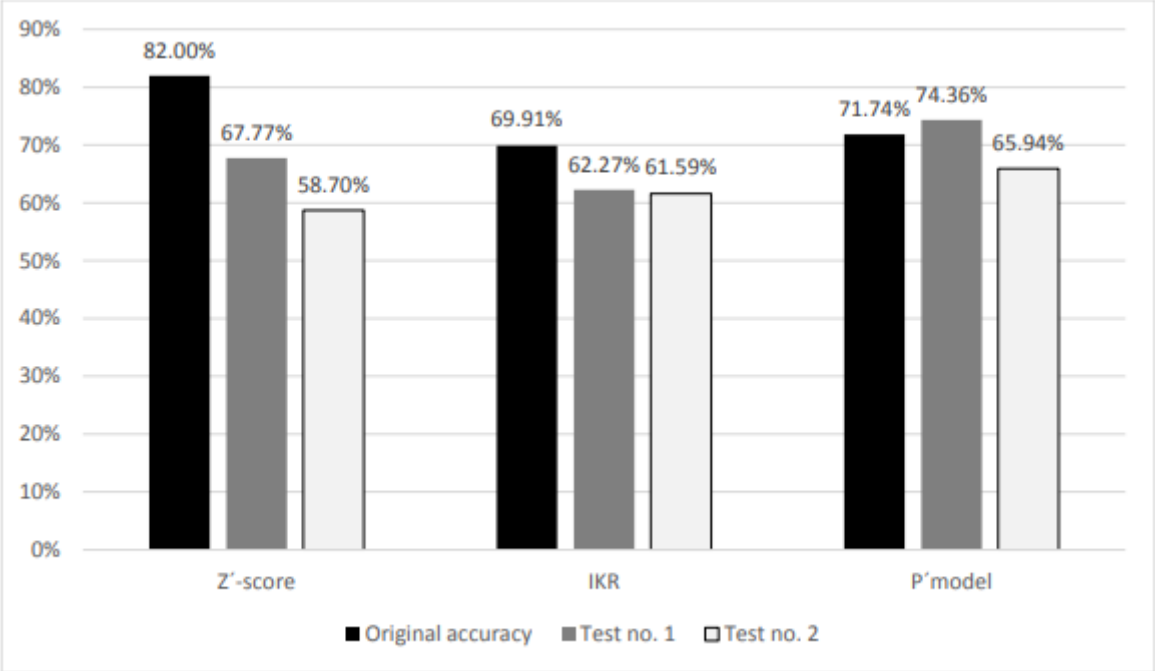
Model	Creator´s accuracy	Current accuracy	Confidence interval	Without apparent signs
Z score	82.00%	67.77%	62.23; 73.31	58.70%
I_{KR}	69.91%	62.27%	56.52; 68.02	61.59%
P´model	71.84%	74.36%	69.18; 79.54	67.77%

Source: Own research

Accuracy without apparent signs was stated after reduction of research sample to 138 companies. As a result, the resulting order of accuracy will change as follows:

- P´model (67.77%)
- I_{KR} (61.59%)
- Z´score (58.70%)

Figure 1 Success of Business Failure Prediction



Source: own

Accuracy of Z´score and P´model in test no. 2 (without apparent signs) is out of confidence interval of accuracy checked in test no. 1. It means that usage of visible features of bankruptcy leads to distortions in the stated accuracy of the models. In case of Z´score and P´model it was confirmed with statistical significance. Success of prediction of IKR has also fallen specifically from 62.27% to 61.59% but without confirmation of statistical significance.

5 Conclusions

Every day many subjects need to evaluate in fast manner the financial health of business partners, loan applicants, debtors, etc. To this purpose there have been developed many failure prediction models. However their accuracy depends on many factors. On this basis authors have set themselves the task to answer the question whether a sampling pattern on which the accuracy of the model is validated by its structure does not affect the resulting accuracy of the model.

In order to meet this goal the classification of companies in 2009-2013 was confronted with the fact that these companies went bankrupt one year later.

I_{KR} model showed the worst prediction power in test no. 1, where was used a research sample of 273 companies. It correctly predicted a business failure in 62.27% of cases based on the data available a year earlier. Order accuracy has changed within the application to the reduced sample (without apparent signs) in test no. 2. Model moved from third to second place.

P´ model was the best in bankruptcy predicting, namely in 74.36% of cases in test no. 1. In test no. 2 the accuracy fell down to 65.94%. This change is statistically significant. This model is the most successful also in test no. 2.

Z´ score showed average accuracy in test one. This model has the worst results in test no. 2. From point of view of authors are more important the results of test no. 2 with the sample without of apparent signs.

The investigation has shown that the sample structure has a key impact on the reported accuracy of the bankruptcy model.

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The Anti-Tax-Avoidance Measures in the EU – from Denials to Wide Acceptance

Jana Kubicová

University of Economics in Bratislava
Faculty of National Economy, Department of Finance
Dolnozemská cesta 1, 852 35 Bratislava, Slovak Republic
E-mail: jana.kubicova@euba.sk

Abstract: *In July 2016 the European Commission adopted the Anti-Tax Avoidance Directive (ATAD). The Directive lays down common harmonized rules of several kinds of anti-tax avoidance measures. Those rules are not brand new, in contrast, they have been well known for years in the national tax systems around the world. This paper presents survey of the former key decisions of the Court of Justice of the European Union concerning national exit taxation provisions and compares them to the current ATAD exit taxation provisions. The legal analysis suggests that several former Court of Justice of the EU decisions considerably differ from the adopted ATAD exit taxation rules. This shift might suggest that judgements of Court of Justice of the European Union and tax policy of the European Union institutions might not provide enough consistency and legal certainty. The paper hypothesizes four unspoken reasons which might lay behind introduction of the common harmonized exit taxation rules in the EU.*

Keywords: tax avoidance, exit tax, Court of Justice of the European Union, harmonization

JEL codes: H26, K2, K34, K42, M21

1 Introduction

In July 2016 there was adopted the *Directive laying down rules against tax avoidance practices that directly affect the functioning of the internal market* (EC, 2016) (hereinafter ATAD). The ATAD introduces common harmonized provisions of several anti-tax avoidance measures with aim to tackle and eliminate aggressive tax planning practices. Namely they are: limitations to the deductibility of interest, also known as thin capitalization rules, exit taxation, taxation of controlled foreign companies' rules, rules to tackle hybrid mismatches, and general anti-abuse rule (GAAR). Those rules are not brand new, in contrast, for years they have been integral part of the national tax systems around the world, especially in the most developed countries, including several "old" European Union Member States.

The Preamble of the ATAD lists several objectives of the ATAD, they are:

- to ensure that tax is paid where profits and value are generated;
- to restore trust and the fairness of tax systems and allow governments to effectively exercise their tax sovereignty;
- to find common yet flexible solutions at the EU level consistent with the OECD BEPS conclusions;
- effective and swift coordinated implementation of the anti-BEPS measures at the EU level;
- to ensure good functioning of the internal market;
- to discourage tax avoidance practices and ensure fair and effective taxation in the Union in a sufficiently coherent and coordinated fashion;
- to strengthen the average level of protection against aggressive tax planning in the internal market;
- to establish rules applicable to all taxpayers that are subject to corporate tax in EU Member States;
- to lay down rules against the erosion of tax bases in the internal market and the shifting of profits out of the internal market (EC, 2016).

For those who have been carefully watching development of international income taxation rules, including willingness of nations and the European Commission to adopt anti-tax avoidance measures applicable on corporate income taxation, the adoption of ATAD

measures by European institutions must be a surprise. This is because it is not so long ago, when the European Commission had been quite aware when it came to the elimination of tax barriers within the European Union internal market. For years the European Commission and the Court of Justice of the European Union watched cautiously compliance of the national anti-tax avoidance measures with fundamental rights and freedoms guaranteed by the now Lisbon Treaty. In fact, it is not so long time ago, when the European institutions were quite reluctant to accept existing national anti-tax avoidance measures.

Several judgements of the Court of Justice of the European Union state that national provisions governing exit taxation, thin capitalization rules or taxation of controlled foreign companies rules violate fundamental freedoms, mostly freedom of movement, freedom of establishment, freedom of payments, and freedom to provide services, all of them guaranteed by the EU law. Though, currently, almost out of the blue, the European Commission changed its mind and decided to lay down common harmonized rules of anti-tax avoidance measures and adopt ATAD.

Above in this paper there are listed *formal* reasons to introduce common harmonized anti-tax avoidance measures and adopt the ATAD. This paper aims to go further, dive deeper, and search for other, not publicly articulated reasons that might explain the sudden change of mind of the European Commission and Court of Justice of the EU concerning presence of the anti-tax avoidance measures in the national tax systems of the EU Member States.

The aim of this paper is to demonstrate that that there are thoughtful differences in the attitudes of the European Commission and Court of Justice of the European Union towards presence and application of the anti-tax avoidance measure, namely exit taxation, before and after 2016. This paper is also inquiring the actual reasons that might lay behind the abrupt adoption of the ATAD measures.

To reach the goals, I adopt the legal analysis method and analyze judgements of the Court of Justice of the European Union that focus on national exit taxation legislation. I also search for those EU Member States that are likely to be mostly affected by the obligatory adoption of the common harmonized anti-tax avoidance measures.

The paper proceeds as follows: the second section presents details of the legal analysis procedure, and the third section presents results of the legal analysis, namely how exactly the Court of Justice of the EU had evaluated national exit taxation provisions before ATAD was adopted. This section also presents brief description of the currently adopted common harmonized exit taxation provisions laid by the ATAD. The fourth section discusses unspoken reasons for lying down common harmonized exit taxation measure. Finally, there is conclusion which summarizes findings and points out some open questions to be answered by future research.

2 Methodology and Data

As I have already mentioned earlier, this paper aims to show that there are significant differences in the approaches of the European Commission and the Court of Justice of the European Union towards presence and application of the exit taxation provisions before and after 2016. To make those differences observable, I compare current and former attitudes of the European Commission and the Court of Justice of the EU towards exit taxation.

To show *former* attitude of the EU institutions, I take a list of judgements of the Court of Justice of the EU about national exit taxation provisions launched before 2016, and subject those judgements to legal analysis where I am looking how the Court evaluated national exit taxation provisions before 2016. What I am interested in is to find, whether former non-common non-harmonized national exit tax provisions were pronounced as being in line with then EU law, or whether they were declared as national provisions that had violated the EU law.

Legal analysis of judgements of the Court of Justice of the European Union consists of three consecutive questions that must be answered in hierarchical order. They are as follows:

Question 1 focuses on the compliance and possible violation of the EU law.

- Do interrogated national exit tax provisions restrict some fundamental freedom guaranteed by the Treaty of the European Union or any provision of the Secondary EU Law?

Question 2 focuses on the justification of the national exit taxation rules.

- Can be the interrogated national exit tax provisions justified if the answer on the question 1 is affirmative?

Question 3 focuses on the proportionality of the national exit taxation rules.

- If the answers on questions 1 and 2 are affirmative, are the interrogated national exit tax provisions proportional to the goals they intend to pursue?

To show *current* attitude of the EU institutions towards exit taxation, I briefly describe exit taxation provisions as laid down by the ATAD in 2016.

Before running legal analysis I demonstrate presence of the exit taxation provisions in the national tax systems of the EU Member States. The aim is to indicate those European Union Member States that had not had any experience with such provisions before the common harmonized exit taxation rules were adopted in 2016.

3 Results

Let us first examine presence of the exit taxation rules before the ATAD was introduced. It is obvious (see **Table**), that national exit taxation rules were incorporated in the national tax systems of the most developed countries around the world. Out of the 35 OECD Member States there were 20 with national exit taxation rules, while 15 OECD Member States did not have exit taxation rules before 2016. Twenty OECD Member States had national exit taxation rules, out of them thirteen were most developed, "old" EU Member States. In contrast, before 2016 fifteen EU Member States did not have national exit tax provisions in their national tax systems, out of them thirteen post-communist countries. They were namely: Bulgaria, Croatia, Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia. At the same time thirteen countries, all of them old EU MSs and members of the OECD had national exit taxation rules (Table).

Table 1 Presence of the National Exit Tax Rules in the EU Member States before Adoption of the ATAD

presence of national exit taxation rules							
yes				**no**			
		OECD MS	**EU MS**			**OECD MS**	**EU MS**
1	AUS	1	1	1	CZE	1	1
2	BEL	1	1	2	EST	1	1
3	DNK	1	1	3	GRE	1	1
4	FIN	1	1	4	HUN	1	1
5	FRA	1	1	5	LAT	1	1
6	DEU	1	1	6	POL	1	1
7	IRE	1	1	7	SLO	1	1
8	ITA	1	1	8	SVK	1	1
9	LUX	1	1	9	SWE	1	1
10	NLD	1	1	10	AUL	1	0
11	PRT	1	1	11	CHL	1	0
12	ESP	1	1	12	KOR	1	0
13	GBR	1	1	13	MEX	1	0

14	CAN	1	0	14	NZL	1	0
15	ICE	1	0	15	TUR	1	0
16	ISR	1	0	16	BUL	0	1
17	JAP	1	0	17	HRV	0	1
18	NOR	1	0	18	CYP	0	1
19	SWZ	1	0	19	LIT	0	1
20	USA	1	0	20	MAL	0	1
				21	ROM	0	1

Source: Author's own compilation based on (Deloitte, 2017)

The presence of the national exit taxation rules in the some EU Member States before 2016 created three major difficulties:

- *First*, national exit taxation rules in individual EU Member States become subject to investigation of the Court of Justice of the European Union because they had been accused of violation of fundamental freedoms guaranteed by the EU law.
- *Second*, national exit taxation rules had varied among the EU Member States making their tax regimes more unlike and different.
- *Third,* some EU Member States did not have any exit taxation rules. This situation might have triggered tax structuring and tax competition within the European Union.

Table 2 presents a list of judgements delivered by the Court of Justice of the European Union from 2002 to 2016; the subject matter of them was national exit taxation legislation. In fourteen cases out of sixteen the Court of Justice of the European Union or European Commission stated that national exit taxation rules *violated* or did not comply with the EU law provisions. The affected EU Member States were Netherlands (4 times), France (3 times), Deutschland (3 times), Spain (2 times), Portugal (2 times), and Denmark (1 time). These results suggest that national exit taxation rules were not, in general, welcomed by European Union institutions, either because they were alleged from violating the EU law, or they were found not justifiable or proportional.

Table 2Chyba! Nenalezen zdroj odkazů. List of Judgements of the CJ EU and Infringement Proceedings Regarding the National Exit Tax Rules

	Short case name	**Case No**	**Defendant**	**Answers of the Court of Justice of the European Union**		
				Q1	Q2	Q3
1	A Oy	C-292/16	FIN	yes	na	na
2	Jacob	C-327/16	FRA	yes	na	na
3	Picart	C-355/16	FRA	no	na	na
7	Trustees of the P Panayi Accumulation	C-646/15	GBR	yes	na	na
5	Verder Lab Tec GmbH & Co KG v Finanzamt Hilden	C-657/13	DEU	no	na	na
6	DMC Beteiligungsgesellschaft	C-164/12	DEU	yes	yes	yes
7	EC v Denmark	C-261/11	DNK	yes	na	na
8	EC v Spain	C-64/11	ESP	yes	na	na
9	EC v Netherland	C-301/11	NLD	yes	na	na
10	National Grid Indus BV	C-371/10	NLD	yes	yes	no
11	EC v Portuguese Republic	C-38/10	PRT	yes	yes	no
12	EC v Portuguese Republic	C-38/10	PRT	yes	na	na

13	EC v Spain	C-269/09	ESP	yes	na	na
14	EC v Germany	C-269/07	DEU	yes	na	na
15	Mr. N	C-470/04	NLD	yes	na	na
16	Lasteyrie du Saillant	C-9/02	FRA	yes	na	na

Legend: Q1 states for Question 1. Q2 states for Question 2. Q3 states for Question 3. The exact wording of all three questions is specified in the Section 2 in this paper.

Source: Author's own compilation

In the contrast of the previous judgements concerning the exit taxation legislation in some European Union Member States, the European Commission adopted Directive laying down rules against tax avoidance practices that directly affect the functioning of the internal market where it lays down common harmonized exit taxation provisions. They are placed in the Article 5 of ATAD, and they go as follows:

- A taxpayer shall be subject to tax at an amount equal to the market value of the transferred assets, at the time of exit of the assets, less their value for tax purposes.
- The tax shall be imposed if a taxpayer transfers assets, or its tax residence or business carried in one EU MSs to another EU MSs.
- If certain conditions are met, the taxpayer shall be given the right to defer the payment of an exit tax by paying it in instalments over five years.
- If taxpayer defers the payment, interest may be charged in accordance with the legislation of the EU MSs.
- If there is demonstrable and actual risk of non-recovery, taxpayers may also be required to provide a guarantee as a condition for deferring the payment.
- The taxpayer shall not be given the right to defer the payment if the legislation of the EU MSs provides for the possibility of recovery of the tax debt through another taxpayer.
- If a taxpayer defers payment, the deferral of payment shall be immediately discontinued and tax debt becomes recoverable immediately, if the transferred assets or business carried are sold or otherwise disposed of or transferred to the third country.
- The EU MSs of destination shall accept the value established by the EU MSs of the taxpayer (EC, 2016).

4 Discussion

Apart from formal reasons listed earlier in this paper, in my opinion it is possible to hypothesize four not articulated reasons why common harmonized exit taxation rules were adopted by the European Union institutions.

First, the reason why the European Union institutions changed their mind concerning the applicability of anti-tax avoidance measures is that the situation in the European Union changed, and also the European Union goals have changed. While before 2016 the highest priority was to develop and build the common internal European Union market ensuring fundamental freedoms and no tax barriers, after 2016, when the European Union common market has been already successfully built, the European Union institutions prioritize other goal: protection of the tax revenues by eliminating the aggressive tax planning practices.

Second, the reason which lays behind the ATAD measures is to unify, harmonize anti-tax avoidance measures so that former existing national measures are unified on the European Union level.

Third, not only the ATAD Directive does harmonize formerly existing national anti-tax avoidance measures. In addition the ATAD Directive forces those European Union Member States that did not have such measures before 2016, to adopt them now. This means, that the European Union latest attendants (EU-12) must introduce exit taxation measures into their national tax systems. The material effect of adoption of the ATAD is that by 2016 unknown exit taxation provisions must be adopted by twelve European Union Member States. To my knowledge there is no impact analysis on how incorporation of the common

harmonized exit taxation rules might affect economics and foreign investment flows in those countries. Yet, one may hypothesize that incorporation of the exit taxation rules might make those countries less competitive because they are likely to lose a tax advantage originating from soft or no anti-tax avoidance legislation they offered before 2016.

Fourth, anti-tax avoidance measures, including exit taxation rules were adopted shortly after the financial crisis 2008 had erupted and smoothed over. The European Union institutions that were formerly reluctant to adopt those measures changed its mind. In order to protect tax revenues from decline, the EU decided to launch those measures.

5 Conclusions

This paper provides analysis of the several former key decisions of the Court of Justice of the European Union (formerly European Court of Justice) concerning national exit taxation rules and compares those former decisions with the exit taxation provisions introduced by the ATAD.

In order to compare former Court of Justice of the European Union's decisions with measures adopted by the ATAD Directive, I employed the legal analysis method.

The legal analysis shows, that number of the former Court's decisions concerning national exit taxation measures were identified as violating the EU law and not being in compliance with the law provisions. Notwithstanding prior judgements of the Court of Justice of the European Union, and in contrast to some of them, the European Commission laid down common harmonized exit taxation rules. This shift might suggest that judgements of Court of Justice of the European Union and tax policy of the European Union institutions might not provide enough consistency and legal certainty.

The following questions remains open: what might be the financial effect of the introduction of the common harmonized exit taxation rules? How will business, multinational companies and wealthy individuals react? Will they anticipate exit taxation rules and decide not to settle there their future businesses, headquarters, permanent establishments and assets in the European Union? Will they prefer to settle out of the European Union to eliminate a risk of exit taxation payable later on? How much potential tax revenues will the European Union lose due to such potential outflow?

Acknowledgments

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Financial Crisis Influence on Tax Mix Changes

Gabriela Kukalová[1], Lukáš Moravec[2], Jakub Ječmínek[3], Barbora Martásková[4]

[1] Czech University of Life Sciences Prague
Faculty of Economics and Management, Department of Trade and Finance
Kamýcká 129, 165 21 Praha, Czech Republic
E-mail: kukalova@pef.czu.cz

[2] Czech University of Life Sciences Prague
Faculty of Economics and Management, Department of Trade and Finance
Kamýcká 129, 165 21 Praha, Czech Republic
E-mail: moravec@pef.czu.cz

[3] Czech University of Life Sciences Prague
Faculty of Economics and Management, Department of Trade and Finance
Kamýcká 129, 165 21 Praha, Czech Republic
E-mail: jecminek@pef.czu.cz

[4] Czech University of Life Sciences Prague
Faculty of Economics and Management, Department of Trade and Finance
Kamýcká 129, 165 21 Praha, Czech Republic
E-mail: matejkova.barca@gmail.com

Abstract: *The aim of the study is to evaluate the reaction of tax policy makers to financial crisis in the short term based on the statistical analysis of consequent tax mix changes in the EU member states. The paper describes the changes in tax structure of EU members, particularly focusing on the period 2008 – 2009. The analysis verifies the statistical significance of the financial crisis influence on the changes in tax structure of the EU member states. The post crisis changes statistical significance evaluation is realized particularly by using the paired t-test for defined groups of taxes and levies comparing the development nature in the period before and after the financial crisis in 2008 based on the data issued by EUROSTAT following the methodology ESA 95 valid in the period analyzed. The Statistica 12 software is used. The results show the statistically significant changes in tax mix as result of the slowed down economies in 2008 and also as the result of the stress on different group of taxes, applied by the policy makers, based on the tax avoidance resistance of different group of taxes.*

Keywords: tax mix, tax structure, tax policy, EU, financial crisis

JEL codes: H20, H30, H68, E62

1 Introduction

The tax mix informs about the tax structure in the given country, respectively to what share of taxes the given country gives priority. The structure of the tax mix of each country corresponds to their traditions and long-term fiscal policy. Discussing optimal tax structure is still a topical issue today. The main subject of the debate is the relationship between direct and indirect taxes in the tax system. Some countries are of the opinion that the tax burden imposed on the taxpayer should be largely exercised by its consumption through indirect taxes. This would ease the taxation of income, it would have a motivating effect on the job, and it would avoid taxpayers' general dislike to pay taxes.

An optimal tax mix is therefore the subject of a number of studies. The share of direct and indirect taxes in the tax mix is reported in contributions of Cremer, Pestieau and Rochet (2001). Eckerstorfer (2014) studied the optimal tax mix under asymmetric information in a two-type model, when individuals make relative consumption comparisons. Iosifidi and Mylonidis (2017) investigated effective tax rates that are directly comparable across OECD countries and over time. In their contribution, they point out that what matters from a redistributive standpoint is the tax mix rather than the tax rates in isolation from the rest. Huang and Rios (2016) investigated the optimal combination of a linear consumption tax

with a non-linear income tax for redistributive purposes. Kubátová and Štefanský (2016) in their contribution deal with the typology classification of tax systems of 28 EU member states in 2012 by applying variables of the tax quota and tax mix (shares of particular taxes in GDP).

The tax structure of the EU states also affects the tax competition, but above all the approximation of tax rules, tax coordination and harmonization. Vintila, Onofrei and Tibulca (2014) in their study present the evolution of taxation convergence tendencies within the European Union, using Sigma-convergence and cluster analysis. The aim of another study was to quantify the impact of single taxes and tax competition on the convergence of taxation in the EU (Bušovská and Bušovský, 2016). Delgado and Presno (2017) investigated tax convergence in 15 EU member states (data from 1975 to 2011). Bušovská (2014) in her contribution focused on the issue whether the tax systems in the EU member states are converging in the context of tax burden, tax mixes and implicit tax rates. Harmonization also penetrates other areas such as financial accounting. Hinke (2011) in his study analysed the harmonisation trends of the European Union, and used this analysis for a prediction of the development of financial accounting in the future.

Many authors in their studies assess the relationship between economic growth and the structure of taxes. Changes in the OECD tax mix in response to economic growth between 1980-1999 were examined by Tosun and Abizadeh (2005). According to Macek (2015), labor taxation (personal income taxes and social security contributions) is the most harmful for economic growth.

The tax mix also affects the tax burden in given country. As mentioned in European Commission (2017) the ration of tax collection (including social contribution) to GDP in EU-28 remain higher related to other well-developed countries. However, economists mostly agree that increasing tax burden discourages economy and implicates higher deadweight loss (Kubátová, 2009). Taxpayers' behavior is also related to the tax burden. Hinke, Zborková and Černá (2014), in their contribution, among others, notes the impact on the behavior of economic entities - legal persons. The subject of the study are also the possible social impacts of changes in the distribution of direct and indirect taxes (Smart, 2002).

The aim of our study is to evaluate the reaction of tax policy makers to financial crisis in the short term based on the statistical analysis of tax mix changes in the EU member states. The paper focuses mainly on the changes in 2008-2009.

2 Methodology and Data

Our research focusing on the impact of the financial crisis on the tax mix is a part of a wider study of the development of EU tax mixes. The states of the then EU-27 were divided into four groups according to geographical location - Nordic, Southern, Western and Eastern (Table 1). The former post-communist states, including the Baltic States, have been ranked among the eastern states, which have undergone a gradual transition from a centrally planned economy to a market one in the past two decades.

Table 1 Classification of EU-27 States into Groups According to Geographic Location

Group	States
Northern States (N)	Denmark (DK), Finland (FI), Sweden (SE)
Southern States (S)	Italy (IT), Cyprus (CY), Greece (EL), Malta (MT), Portugal (PT), Spain (ES)
Western States (W)	Austria (AT), Belgium (BE), France (FR), Germany (DE), Ireland (IE), Luxembourg (LU), Netherlands (NL), United Kingdom (UK)
Eastern States (E)	Bulgaria (BG), Czech Republic (CZ), Estonia (EE), Hungary (HU), Latvia (LT), Lithuania (LV), Poland (PL), Romania (RO), Slovenia (SI), Slovakia (SK)

Source: own work

The development of the tax mix of the EU countries has been monitored since 2004, when the European Union expanded at the most. Both Bulgaria and Romania were included in the analysis of the development of the EU average mix of taxes and individual groups of countries. (These countries were candidates for accession in 2004 and are members of the EU since 2007). The data used in our research follow the methodology of the European System of Accounts (ESA 95), which was in force in the monitored period (European Commission, 2014).

The average share of selected taxes and social insurance revenues of the EU-27 tax mix (including Bulgaria and Romania in 2004-2006) and the tax mix of the established groups of countries were monitored between 2004 and 2012 (4 years before the transfer of the crisis to Europe (2008) and another four years after the transfer to Europe). The evolution of shares in the tax mix is shown in charts 1, 2 and 3. The average EU-27 tax mix, the average of tax mixes of individual groups of countries and the real values of the tax mix of all member states were considered in these analyses. The assessment of the change in tax mixes because of the financial crisis was carried out in the then EU-27 countries (without Croatia, which became a member of the EU in 2013).

Based on the analysis of the development of the share of individual taxes and social insurance revenues on the tax structure of the EU-27 states, significant changes in the tax mix between 2008 and 2009 were found (Table 2).

An analysis was subsequently carried out to determine whether the financial crisis had a statistically significant effect on the structure of the tax mix of the 27 EU Member States in 2008-2009. The analysis was carried out by testing selected taxes (personal income tax, corporate income tax, Value Added Tax, consumption taxes) and social security contributions. The data normality was verified by the Kolmogorov-Smirnov test at the significance level of 0.05.

The statistical test using Student paired t- test was used to assess the impact. The measurement was carried out on a selected sample of the selective aggregation; the measurements were compared before the change in the share of the tax or the social revenues (2008) and after the change (2009). Testing against each other is always subject to a zero and alternative hypothesis. The following zero hypotheses were formulated:

- H01: The value of the average share of personal income tax in total tax revenues in 2008-2009 did not change, the financial crisis did not have a statistically significant effect on possible changes in the structure of the tax mix.
- H02: The value of the average share of corporate income tax in total tax revenues in 2008-2009 did not change, the financial crisis did not have a statistically significant effect on possible changes in the structure of the tax mix.
- H03: The value of the average share of social security contribution in total tax revenues remained unchanged in the period 2008-2009, the financial crisis did not have a statistically significant effect on possible changes in the structure of the tax mix.
- H04: The value of the average share of value added tax in total tax revenues in 2008-2009 did not change, the financial crisis did not have a statistically significant effect on possible changes in the structure of the tax mix.
- H05: The value of the average share of consumption taxes in total tax revenues remained unchanged during the period 2008-2009, the financial crisis did not have a statistically significant effect on possible changes in the structure of the tax mix.

The result of the test was decided based on the comparison of the p-value with the significance level $\alpha=0.05$. Analytical software Statistica 12 was used for statistical calculations.

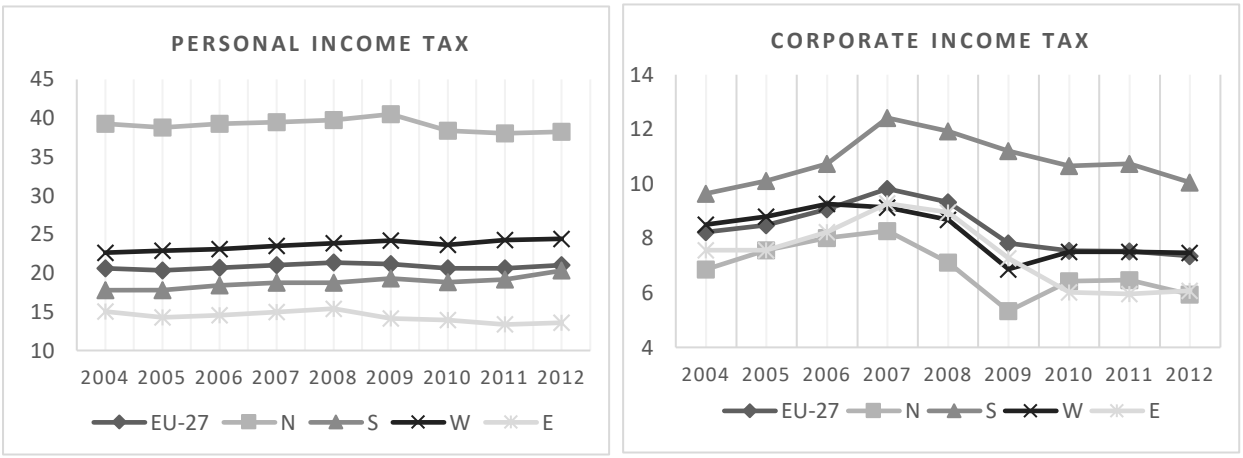
3 Results and Discussion

The assessment of the evolution of average shares of selected taxes and social security contributions in the tax mix of the EU-27 countries and the established groups of countries took place in the period 2004-2012.

Average shares of selected taxes and social security contributions in the tax mix

Based on the analysis of the evolution of average shares of selected taxes and social security contributions in the EU-27 tax mix and the established groups of countries, it was found that the biggest changes occurred between 2008-2009.

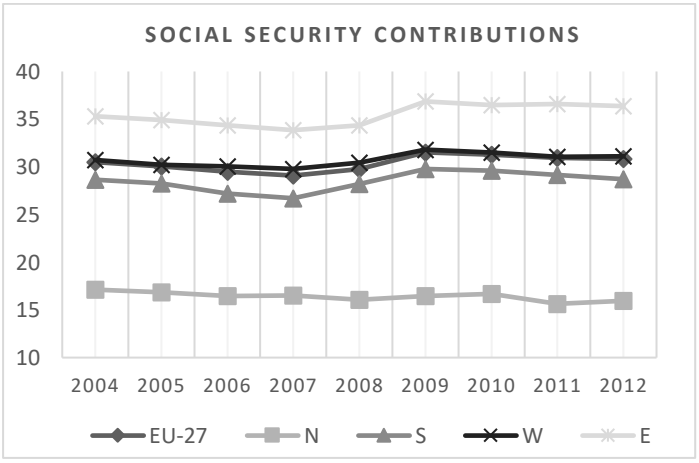
Figure 1 Shares of Selected Direct Taxes in the EU-27 Tax Mix and Groups of States (%) (left: Personal Income Tax, right: Corporate Income Tax)



Source: European Commission (2014), own work

The average share of personal income tax in the tax mix is long-term the highest in the case of a group of Nordic countries (Figure 1, left: Personal Income Tax). The high share is mainly due to Denmark, which finances retirement benefits from this tax, and causes some distortion for the entire Nordic group. Changes in personal income tax have been around 0.5% for the long-term, the only exception was a 1.3% decrease for the eastern group after 2008. Since then, the share of the Nordic and Eastern countries has declined, with a slight increase in the western and southern countries. Figure 1 (right: Corporate Income Tax) shows the variability of the share of corporate income tax, which is an important tool for tax competition among states. Since the outbreak of the financial crisis, it has been possible to observe a significant drop in shares for all groups of countries after 2007. Between 2007 and 2010, a number of countries experienced significant changes in tax rates, exemptions, or additional tax. A significant drop of the share of corporate income tax in the tax mix occurred in the Eastern Group of States. Between 2008 and 2019, the share decreased by 1.6%.

Figure 2 Share of Social Security Contributions in the EU-27 Tax Mix and Groups (%)

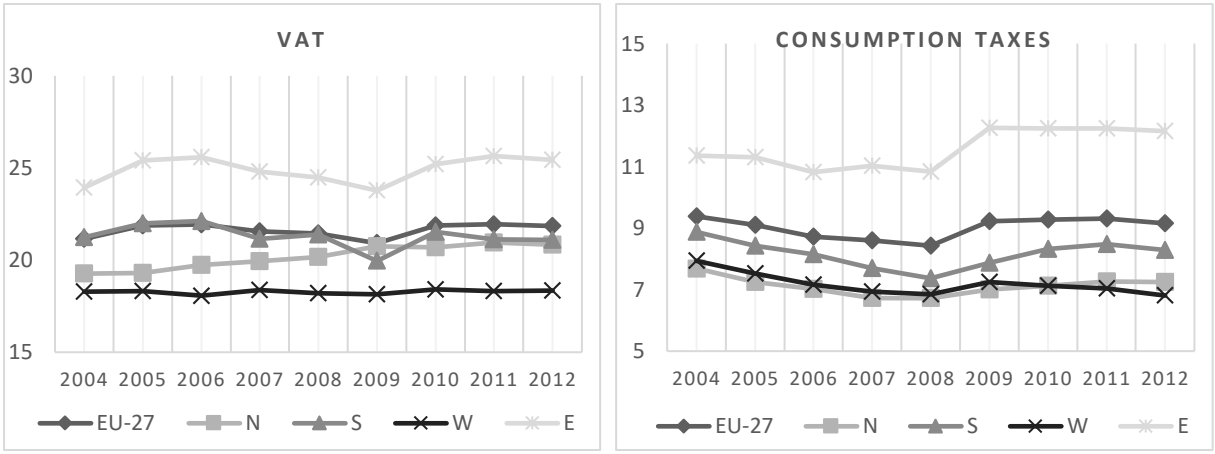


Source: European Commission (2014), own work

The share of social security contributions is the lowest in the Nordic countries (Figure 3).

South and West countries show almost identical trends and jointly copy the development of the average curve of all EU-27 member states. The Eastern Group of States is well above the average of the other groups. Even though the average shares of the groups varied very slightly, there were significant changes in individual countries between 2008-2012. Example of major changes are Lithuania (+9%), Cyprus (+5.6%) and Poland (+4.6%). The largest growth rate was recorded for the Eastern group of countries by 5.6%.

Figure 3 Share of Selected Indirect Taxes in the EU-27 Tax Mix and Groups of States (%) (left: Value Added Tax; right: Consumption Taxes)



Source: European Commission (2014), own work

The average share of VAT in the EU-27 tax mix and individual groups changed most in 2008-2010 (Figure 3, left: Value Added Tax). Between 2008 and 2009 there was a decrease in the share (except for the Nordic countries); on the contrary, between 2009 and 2010 the share of VAT in the tax mix increased, especially for the group of southern and eastern countries. The average share of consumption taxes in the tax mix increased between 2008-2009 for all groups of countries (Figure 3, right: Consumption Taxes). The largest increase in the share is evident in eastern countries (1.4%), while in the Nordic group increased by only 0.3%. The average share of consumption taxes in the EU-27 increased by 0.8%.

Changes in average share of taxes and social security contributions across EU-27 countries are shown in Table 2. Based on these data are tested statistical hypotheses.

Table 2 Share of Selected Taxes in the EU-27 tax mix (%) in 2008 and 2009

Group	State	Personal income tax		Corporate income tax		Soc. security contributions		VAT		Consumption taxes	
		2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
N	DK	52.6	55.2	6.9	4.9	2.0	2.0	21.0	21.3	6.6	6.8
	FI	30.9	31.2	8.1	4.7	28.0	29.9	19.5	20.2	7.7	8.0
	SE	35.8	35.1	6.3	6.4	18.2	17.4	20.0	20.7	5.8	6.2
S	IT	27.4	27.2	7.2	5.7	31.4	31.9	13.9	13.3	4.5	4.9
	CY	13.0	11.2	18.4	18.4	20.1	24.6	27.4	26.0	8.6	9.1
	EL	15.0	16.3	7.8	8.1	34.7	34.2	22.7	22.1	7.2	8.4
	MT	17.8	19.7	18.4	18.3	17.9	17.7	23.3	22.9	9.0	8.8
	PT	17.0	18.4	11.1	9.2	26.8	29.1	25.6	22.9	8.3	8.8
	ES	22.3	23.0	8.6	7.5	37.4	40.5	15.5	13.5	6.6	7.2
W	AT	24.4	23.4	6.2	4.4	33.6	35.0	18.2	18.9	5.8	5.8
	BE	28.4	28.2	7.6	5.6	31.5	33.4	15.7	16.0	4.7	4.9
	FR	18.1	18.0	6.3	3.0	37.7	39.9	16.5	16.4	4.9	5.1
	DE	23.2	23.1	6.9	5.0	39.1	40.3	18.3	19.0	6.6	6.8
	IE	27.9	27.8	9.8	8.7	18.1	20.5	24.6	22.7	8.3	9.6
	LU	21.7	20.6	14.3	14.7	28.3	29.8	16.8	17.3	9.8	9.7

	NL	18.4	22.4	8.8	5.6	37.0	36.2	18.5	18.3	6.0	6.0
	UK	28.5	30.0	9.6	8.0	18.1	19.4	16.9	16.4	8.6	10.1
E	BG	28.4	28.2	9.8	8.8	24.1	26.6	33.8	31.1	18.4	18.8
	CZ	10.7	10.8	12.2	10.5	45.1	44.5	19.7	20.6	9.5	10.9
	EE	19.5	16.0	5.1	5.2	36.6	36.9	24.9	24.8	10.4	14.1
	HU	19.0	18.5	6.5	5.4	34.0	32.9	19.3	21.3	8.3	8.9
	LT	21.8	20.4	10.9	5.9	28.3	32.0	23.0	22.5	11.0	13.9
	LV	21.3	3.6	8.9	6.0	31.3	42.0	26.0	24.2	9.9	11.4
	PL	15.6	14.6	7.9	7.2	33.0	35.7	23.4	23.4	13.0	11.9
	RO	12.1	13.1	10.7	9.9	33.3	34.9	28.2	24.7	9.6	11.8
	SI	15.7	15.7	6.7	4.9	37.7	40.1	22.8	21.6	9.0	11.1
	SK	9.4	8.5	10.7	8.8	40.7	43.6	23.8	23.4	9.3	9.8
EU-27		21.4	21.2	9.3	7.8	29.8	31.5	21.5	20.9	8.4	9.2

Source: European Commission (2014), own work

Testing of statistical hypotheses

The Paired Student´s T – Test was applied to verify the hypothesis as the T – Test confirms the (non)existence of statistically significant differences between the averages of two selected groups of items.

Table 3 Paired t-test: Personal Income Tax, Corporate Income Tax

	Personal Income Tax		Corporate Income Tax	
	2008	2009	2008	2009
Average share	21.35256337	21.18591463	9.326267333	7.810643407
Number of observations	27		27	
t	0.408179472		6.176503512	
t crit. (26)	1.706		1.706	
p	0.686483998		0.000002	
α	0.05		0.05	

Source: European Commission (2014), own work

According to the performed calculations, the zero hypothesis H01 (Table 3) can't be rejected. Thus, it is valid the assumption that as regards the personal income tax the financial crisis did not have a statistically significant effect on a moderate reduction of the share of tax in the total tax mix for the 27 EU member states. Changes that have occurred in individual Member States may in part be attributed to the financial crisis, but its overall impact has not been statistically confirmed.

The zero hypothesis H02 can be rejected. And we accept an alternative hypothesis. It was confirmed the assumption that the financial crisis had a statistically significant impact on the share in the tax mix of 27 EU member states. Regarding corporate income tax, we can unequivocally confirm the significant impact of the crisis on the reduction of the share. At the mean value of each period, we can see a demonstrable decrease of the share in total tax revenue.

Table 4 Paired t-test: Social Security Contributions

	Social Security Contributions	
	2008	2009
Average share	29.78052329	31.51421167
Number of observations	27	
t	- 3.892	
t crit. (26)	1.706	
p	0.0010	
α	0.05	

Source: European Commission (2014), own work

On the basis of the above data (Table 4), the zero hypothesis H03 of statistical insignificance is rejected. The financial crisis had a statistically significant effect on increasing the share of social insurance in the overall tax mix. In the monitored period, the mean value increased significantly.

Table 5 Paired t-test: VAT and Consumption Taxes

	VAT		Consumption Taxes	
	2008	2009	2008	2009
Average share	21.45299111	20.91473407	8.426352185	9.215474815
Number of observations	27		27	
t	2.161352387		-3.985292671	
t crit. (26)	1.706		1.706	
p	0.040057407		0.000485778	
α	0.05		0.05	

Source: European Commission (2014), own work

Based on the calculations performed, the zero hypothesis H04 (Table 5) is rejected. According to the alternative hypothesis, the financial crisis had an overall statistically significant effect on the VAT share in the EU-27 tax mix. The largest differences were reached in the group of eastern countries, the biggest rise of the shares recorded Hungary and the Czech Republic, while Romania and Bulgaria experienced the most significant decline.

It also follows from the calculations that the zero hypothesis H05 can be rejected (Table 5). An alternative hypothesis was adopted when the financial crisis had a demonstrably statistically significant impact on the share of consumption taxes in the tax mix of the 27 EU member states. Year-on-year comparison has seen a significant change in mean values.

The impact of the financial crisis on the change of the share of individual taxes in the tax mix has not yet been evaluated, according to available sources. Changes in the structure of the tax mix are often assessed in terms of setting rates (Iosifidi and Mylonidis, 2017) or setting up an optimal tax mix (e.g. Cremer, Pestieau and Rochet, 2001; Eckerstorfer, 2014; Huang and Rios, 2016). The impact of economic growth (eg Macek, 2015; Tosun and Abizadeh, 2005) was also studied. Široký and Maková (2014) verified the relationship between the growth rate of the gross domestic product and the public deficits on one hand and the change of VAT rates on the other hand in 27 European Union Member States within the period of 2008-2013. The influence of tax systems harmonization and convergence (Bušovská and Bušovský, 2016; Delgado and Presno, 2017 and others) was also evaluated. The influence of tax mix changes and tax rates modifications on taxpayers and consumers behavior was confirmed by Hinke, Zborková and Černá (2014) and Krzikallová (2016). The conclusions of the above-mentioned studies are in line with the presented results confirming the crisis in 2008 changed the tax policies globally.

4 Conclusions

An analysis of the impact of the financial crisis on the structure of the EU-27 tax mix has produced interesting results. Changes in average tax shares or social security contributions are apparent between 2008-2009. However, these changes cannot be attributed solely to the financial crisis. The share of a tax in the tax mix is also affected by other factors, such as a change of the rate.

In the case of the personal income tax, the test showed that the share changes were statistically insignificant. This was due to changes that only occurred in a small number of countries and in the upshot, became equal among themselves. Since 2009, the share of this tax has declined, potentially due to the fact that the member states adopted a number of measures to support national economies. The measures consisted in narrowing the bases of personal revenue tax and extending tax reliefs in order to better reflect the social position of taxpayers. Statistically significant was the impact of the financial crisis on corporation tax. Between 2008-2012, the share of this tax in the average tax mix of EU-

27 countries decreased by approximately 21%. Changes in social security contributions were evaluated as statistically significant. The share of social insurance, despite the financial crisis, was the only one of all tax groups and contributions continued to grow slightly. Testing of value added tax and consumption tax showed changes in both sub-groups of indirect taxes, the changes resulting from the financial crisis were statistically significant. For both taxes, a number of measures was adopted, including extensive adjustments in tax legislation, particularly in the area of increase of tax rates. Value added tax, particularly in southern countries severely affected by financial crisis, has seen frequent increases in tax rates. The eastern countries then manifested themselves in the introduction of a new, further reduced tax rate.

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Environmental Risk Insurability Issues – the EU Perspective

Malwina Lemkowska

Poznań University of Economics and Business
Faculty of Economics, Department of Insurance
Al. Niepodległości 10, 61-875 Poznań, Poland
E-mail: malwina.lemkowska@ue.poznan.pl

Abstract: *The aim of this paper is to evaluate insurability of environmental risk. Juxtaposition of the attributes of both environmental risk and insurance market against risk insurability factors will be the evaluation criterion. Two groups of insurability criteria have been identified: endogenous and exogenous ones. Exogenous criteria of insurability refer to the attributes of the risk itself. Exogenous ones are connected with the features of the insurance market and its participants, especially the ability of the insurance companies to deal with the specific risk. The level of environmental risk insurability is relatively low. It is because of the problem with fulfilment of both endogenous and exogenous criteria. The occurrence, which results in environmental damage is very often not sudden, random and extraordinary. The probability of accident and probable maximum loss are difficult to estimate. Additionally, environmental risk results often in catastrophic loss. Although insurance companies provide relatively high capacity, they have problem to create sufficiently large insurance portfolio.*

Keywords: environmental insurance, environmental risk, insurability of risk

JEL codes: G22, Q50, K21

1 Introduction

Evaluation of risk insurability is the basis of insurers' operations. The purpose of this article is to assess the insurability of environmental risk. Insurability is an changeable phenomenon, firstly, because of continuous evolution of risks, and secondly, technological progress concerning insurance offer. Along with an increasing number of threats in economic reality risk is becoming an ever more complex notion. Ultimately, it causes entrepreneurs to acknowledge more readily the types of risks which traditionally did not use to be subject to insurance (Swiss Re, 2017). Development of data processing technologies as well as the evolution of the methods of insurance products creation is continually increasing insurers competencies in covering formerly uninsurable risks.

2 Methodology and data

Research findings presented in this paper are the outcome of review of the subject literature on risk insurability criteria, on the one hand. On the other, an overview of legal acts on environmental law allows to identify the attributes of environmental risk. The criterion for insurability evaluation will involve a juxtaposition of the attributes of environmental risk and insurance market against risk insurability factors.

3 Results and discussion

Environmental risk

The environmental risk is understood narrowly in the article, i.e. environmental liability risk. The above results from economic practice: environmental insurance is mainly concerned with legal liability insurance. In the EU the scope of this liability is determined by Community legal acts, international conventions, (nuclear and oil-related damage) and member countries' legal acts.

Features of insurable risk

Thanks to the review of the subject literature one can distinguish more than ten risk factors of insurability. Scientists propose a variety of criteria to categorise them. Fedor (2004) names 11 features of risk insurability and divides them into two groups: absolute and

relative ones. The first one contains the conditions which absolutely have to be met to make the risk insurable (i.e. it must be a future and random event, independent of the insured's will, assessable and capable of being classified within a similarly characterised set). The other one consists of features which determine insurability in a non-definitive way (appropriate frequency of occurrences, price, susceptibility of an occurrence to phenomena related to information asymmetry i.e. moral hazard, adverse selection). Berliner (1982), in turn, identifies actuarial criteria of insurability, which require independence of risks and reliable estimation of loss probabilities (randomness of loss occurrence), manageable maximum possible losses per event in terms of insurer solvency (maximum possible loss), moderate average loss amounts per event (average loss per event), a sufficiently high number of loss events per annum (loss exposure) and no excessive information asymmetry problems (i.e. moral hazard, adverse selection). Berliner also distinguishes insurability factors determined by markets. He lists there: insurance premium level (adequate to the scope of risk, affordable), limits of insurance cover (acceptable), insurance sector capacity (sufficient). Furthermore, social conditions of risk insurability identified by Berliner refer to public policy and the legal system - insurance cover should not contradict them (Biener, Eling, Wirfs, 2015). Rejda (2014) presented the concept of ideally insurable risk. Hence, he turns one's attention to gradability of risk by giving the example of a blaze as an ideally insurable risk and unemployment as an instance of uninsurable risk. Vaughan and Vaughan (2008) mention "ideal" elements of insurable risk. These are: sufficiently large number of homogenous exposure units to make the losses reasonably predictable, definite and measurable loss produced by the risk, fortuitous or accidental loss and non-catastrophic loss. Outreville (1997), in turn, points out that ideally insurable risk is pure, static and particular. Even if, however, ideal insurability criteria are not met, a given risk may not remain uncovered (Vaughan and Vaughan, 2008). According to Faure (2001), this can be explained by the concept of 'insurer ambiguity" (Kunreuther, Hogarth, Meszaros, 1993). Its authors assert that an insurer may offer insurance cover against the types of risk which, due to their lack of compliance with measurability and predictability criteria, are considered as uninsurable. In such case the insurer charges additional premium. Therefore, Faure (2001) does not refer to insurability criteria and points to factors which determine it in a positive or negative way.

All the above factors could be categorized as **endogenous toward risk**, i.e. features of the risk itself, or as **exogenous** (the attributes of a particular insurance market). A future occurrence which is sudden, random, independent of one's will, measureable, capable of being classified within a similarly characterised set, extraordinary, resulting in reasonable damage and statistically independent can be said to meet the endogenous criteria of insurability. Exogenous conditions of insurability are met if insurers manage to control moral hazard and adverse selection, have sufficient insurance capacity, offer acceptable limits and price for the cover which are in line with their tendency to accept risk, and act in favourable circumstances relating to public policy and legal system.

Gradability of insurability categories

The concept of insurability may be interpreted in two ways. Firstly, a risk is insurable if insurers supply cover; secondly, insurability is contingent on its doctrinal criteria (endogenous attributes of risk), (Knight, 1921). In both cases insurability is a gradable category. Assuming the first approach, B. Berliner uses abstract terms of objective and subjective insurability (Berliner, 1985). The first one refers to declarations made by all potential insurers operating in the area of the given risk category that they will cover this risk (objectively insurable risk). Subjective insurability, in turn, is linked with only one individual insurer's readiness to cover a risk. This implies that between the area of objective insurability and objective uninsurability there is a space where only a few insurers offer protection. It determines the degree of this risk's insurability.

In the case of insurability viewed from the other perspective (determined by the risk attributes) this category remains gradable, just as the assessment of particular features of this risk can be gradable as well (e.g. more or less easily measureable). Changeability of

insurance supply as well as the evolution of the assessment of particular risk features in time determine the dynamics of the degree of insurability.

Environmental risk insurability – endogenous approach

Environmental risk is insurable within the area of subjective insurability. Only a few property insurers offer environmental products. One can put hypothesis that environmental risk does not meet all the criteria for endogenous insurability.

If it comes to the first premise for risk insurability (insurance accident has to realise in future), it raises doubts in the context of the natural environment. The "future" attribute may refer to different factors of risk: firstly, it may imply the event resulting in environmental damage (peril); secondly, to the damage itself; thirdly, its disclosure and finally the claim on the damage to be remedied. The timespan between the damage occurrence and the claim being made may be significantly large. This may be caused by the long stage of the damage latency[5], lack of peril peculiarity[6], gradual accumulation of the damage (serial damage, accumulative damage)[7]. What is more, the long timespan may cause more likely the damage resulting from a reaction of primary pollutant with other substances, either natural or emitted by other entities. Additionally, the future event should be sudden (Guevara, Deveau, 2012), which cannot be assigned to the attributes of accumulative damage[8].

In order to overcome insurability barriers companies may prepare "claims-made" products (Swiss Re, 2009). Making a claim – as an insurance accident – meets the condition of being a future and sudden event. Nonetheless, evaluation of the insured's past operations within underwriting process becomes a challenge to insurers.

Occurrence, which can result in damage should be random (many entities may face it and it is impossible to point at the particular entity affected by the risk) and extraordinary. Randomness refers not only to the event occurrence itself, but also its timing and consequences. The nature of environmental damage which results from business activity raises doubts about both randomness regarding the event itself and extraordinariness of risk, especially in the case of business sectors which are particularly dangerous to the environment, often requiring special permits to run business operations. Although European regulations (article 8 section 4 of ELD) make it possible to abolish environmental damage liability (so called *permit defence*), the ultimate decisions about liability exemptions are made by individual member states. Seven states have decided to levy the burden of liability for environmental damage on entities operating within the permit's scope (Belgium, Bulgaria, Germany, Hungary, Poland, Romania and France), (Bio Intelligence Service in association with Stevens&Bolton LLP, 2009; Faure, Grimeaud, 2000)[9]. As a result, randomness of the event becomes reduced, at the most, to the time of damage occurrence or to its implications, while extraordinariness often becomes eliminated (Bio Intelligence Service in association with Stevens&Bolton LLP, 2009). The problem arises especially with respect to insurance against dispersed pollution effects, where pollution amasses from various sources or reacts with other (external) chemical substances and only then does it generate environmental damage. The European regulations assume that as long as pollution can be assigned to a particular company or a confined conglomerate of businesses, administrative liability arises. Moreover, polluters have to consider a constantly

[5] A direct damage (e.g. water contamination) is discovered often through indirect damage (e.g. a drop in a particular fish species population in the contaminated area).
[6] Environmental damage is generated not only by so called direct pollution occurrences (explosion, container leakage), but also non-pollution occurrences, e.g. flood, blaze.
[7] E.g. river contamination caused by filtering of rainwater through artificially fertilised soil.
[8] Inability to meet the criterion of "suddenness" was the reason for denial of compensation payments for environmental liability in the past in the USA (Naylor, Dybdahl, 2012).
[9] The authors emphasized, that businesses acting in accordance with regulatory standards are not exempt from environmental damage liability. Hence, a socially effective protection of natural resources may require an implementation of higher standards than the legally established ones.

growing likelihood of claims on the grounds of civil law. A lot of attention has been paid to the court sentence concerning Kivalina, an Eskimo village in Alaska which filed a claim against numerous entities' insurers who had based their operations on coal power. Global warming, resulting from coal used as fuel, led to melting of the ice which protected the village from storms. Virginia state court, having analysed the insurance contracts signed by the polluters, pronounced lack of insurance cover for the occurrence described. This does not mean, however, that there are no legal grounds for a non-insurance claim against the authors of the damage and there will be no demand for cover in the future.

Pollution which naturally results from a particular business activity and is socially acceptable (in particular, as proven by a legal permit), which is a compromise between economic and environmental interests within the concept of sustainable development[10], cannot meet another insurability criterion, i.e. independence of the insured's will.

Two reversed cycles of insurers' operations (i.e. distribution prior to production and price setting prior to defining costs) touch upon the issue of risk measurability criterion. The basis for premium calculation should be a data base containing records of past random events (probabilistic risk, qualified as insurable). Estimative risk, in turn is difficult to insure (Knight, 1921). Environmental risk is in a great part an estimative one. There are at least three reasons for this. Firstly, the level of environmental knowledge still does not make it possible to assess the impact of polluting substances on the natural environment and human life and health. Secondly, although environmental damage has long been included in the regime of the polluter's liability, in the past it was hardly ever followed through (especially in the area of the environment as a common good). The third reason is that the polluter's liability is continually broadened and – according to ELD - polluters are not only held responsible for essential remedial actions but also for compensational and complementary actions. The problem of measurability appears in particular in connection with environmental liability for actions, as for which, according to the present state of technical and scientific knowledge, adverse effect on the environment has been impossible to predict (so called *state-of-the-art defence*), (article 8 section 4 of ELD). In this area, the risk cannot be categorised either as probabilistic or estimative risk. It is totally unmeasurable and consequently, endogenously uninsurable. The ELD allows exemption of the above from the polluters' liability, nonetheless, many countries, including Poland, have given up this right.

Environmental risk may materialise with reference to a large number of entities. Although the ELD pronounces administrative liability only with regard to professional activities, and additionally, in the case of damage done to waters and land surface, limits the subjective scope to the activities enumerated in the appendix, member states are eligible to expand and do expand the regulation. From the point of view of insurance, though, what matters is the size of the group which presents demand for insurance cover. Unfortunately, the European Commission's study shows a very low level of demand for insurance (European Commission, 2016). Main reasons for this situation are: lack of public reports informing about environmental damage materialisation and lack of adequate execution of environmental liability.

Environmental risk may generate catastrophic damage. First of all, it is caused by large mobility of environmental damage. Secondly, the scope of environmental liability is systematically broadened through regulations. A special example of the latter is the analysis conducted by the French government. The study concerned two instances of environmental damage which occurred in 1996 and 1997. The costs of remedying these two cases according to the legal status of the time amounted to $ 67 K and 16 K respectively. Analyses showed that if such damage were to happen at present – under the ELD – the costs of remedying would skyrocket to $ 636 K and $ 6.4 m (Institute of Sustainable Development, 2010; ACE Group, 2011). History presents a whole array of occurrences generating exorbitant costs of remedying them. It is enough to mention just

[10] The most problematic from the point of view of insurance is chronic pollution, besides diffuse pollution, long-distance pollution and historical pollution (Swiss Re, 2003).

a few: the Boliden's Doñana (Spain) accident in 1999 (approx. € 240 m (El Pais, 2010)), Kolontar, Hungary (approx. € 65 m (ACE Group, 2011; European Commission, 2016)); Moordijk, The Netherlands (€ 65,4 m (European Commission, 2016)). Despite the continuous growth of insurance capacity (European Commission, 2016) the sector itself is clearly unwilling to cover catastrophic damage (Insurance Europe, 2013). The analyses show that the average cost of remedying amounts to € 42 K. The average is calculated after the extreme events have been excluded – the few occurrences where the costs of remedying exceeded €1m. Member states have recorded five extreme events: two in Hungary and the Netherlands where the costs of remediation amounted to € 65 m, and three others – in Spain, Greece and Sweden – where the damage cost ranged between € 1m – € 10 m (European Commission, 2016).

Environmental risk insurability – exogenous approach

Not all local environmental insurance markets are working efficiently. The reasons for this situation should be sought within the exogenous indicators of insurability i.e. the ones which describe the attributes of the supply and demand sides of the market as well as its legal and political surroundings (the ability to control moral hazard and adverse selection; insurance capacity, determined primarily by insurers' capital resources, and also by legal requirements concerning the above).

Occurrence of moral hazard is a common problem of insurance companies, especially in liability insurance in the *actio directa* system. Controlling moral hazard is possible and efficient as long as it is allowed by the know-how and organisational qualities of the insurers, market-related expectations of insurers toward potential policyholders, market-verified environmental risk management standards and legal regulations[11]. An essential way of controlling adverse selection, in turn, is tailoring the premium level to the individual risk profile of the protection-seeking entity. It is difficult because of a limited demand for environmental insurance, caused by poor insurance and environmental awareness.

It is worth emphasizing that it is often not the insurers who hinder the market development. The research conducted in 2014 by Insurance Europe points at a relatively high insurance capacity of the market. Liability insurance cover against environmental damage (in the scope defined by the ELD) is usually offered at the level of guaranteed sums from € 1 m to € 5 m. Insurance capacity in some markets, however, reaches far higher, up to € 50 m, and in some individual cases - even more (Insurance Europe, 2014). If one should set the capacity declared by insurers against the size of the environmental damage registered in Europe, it can be assumed that even in the case of catastrophic events (e.g. Kolontar, Hungary) it would have been possible to sign insurance contracts for sums close to the damage values. A great diversity in the markets is the crucial barrier: large insurance claims may be paid in Germany, France or Great Britain. Developing markets' capacity is still rather limited and barriers on the demand side are an obstacle to cross-border cover purchases. However, entities which seek to insure against large risks must be aware that insurers are not going to offer limitless cover for environmental damage, as its size can exceed the whole industry's capacity (Insurance Europe, 2013).

Public policy and the legal system, as subsequent insurability factors, increase the importance of environmental damage liability issues in the global scale. The concept of society's sustainable development is becoming a contemporary paradigm. Since 1987, when the notion of sustainable development (United Nations, 1987) was coined, it remains the benchmark for creation of societies' development strategy (European Commission, 2010; Decision No 1386/2013/EU). Legislations in particular countries have been gradually, but with a growing determination, introducing preventive and repressive measures as well as regulating the legal duty to remedy environmental damage.

A legal system which defines the notion of environmental damage and liability, pre-defines environmental risk. The doctrine points at two basic areas where certain traits of the legal

[11] E.g. the structure of the obligatory insurance system, which enables the insurer to refuse to supply insurance cover.

system generate greatest problems relating to covering environmental liability. These are: changeability (Ad-Hoc Industry Natural Resource Management Group, 2009) and regulatory transfer of uncertainty connected with the cause of environmental damage to the potential insured (Faure, 2001). Changeability refers to both the content of regulations and their interpretation. In the first case a risk which arises concerns retroactive change, i.e. introduction of obligation to remedy the damage which was not encompassed by obligation to be remedied at the time of insurance contract signing. In the other, a change in interpretation of laws leads to increasing polluters, and their insurers' environmental liability. In 2004 the ELD introduced an unprecedented – in most member countries – obligation to remedy damage inflicted on waters, protected species or natural habitats[12], and additionally included a requirement concerning preventive measures. The burden of both restoring the environment and rectifying so called functional damage is extremely challenging. In the first case, it may be very difficult to establish the initial state of the environment. In the other case, the steps taken should become the compensation for the fact that some elements of the environment cannot perform their functions (Ad-Hoc Industry Natural Resource Management Group, 2009). The relatively small number of occurrences which undergo the ELD regime still results in fairly high uncertainty as for their interpretation. This in turn causes the size of liability to be less predictable.

The transfer of uncertainty connected with the cause of environmental damage to the potential insured takes place under the risk-based liability regime. This is what the ELD includes when it comes to the obligation to remedy the damage caused by entities generating an increased probability thereof. Moving forward from the general rules (fault principle) to the risk principle is a factor which limits insurability. Uncertainty connected with the source of the environmental damage cause is assigned to the insured, and, consequently, their insurer as well. As a result, the latter has the obligation to pay the compensation even if the entity covered has not caused the damage (Faure, 2001).

4 Conclusions

If insurability were to be measured only according to the market accessibility of insurance cover for environmental risk, it would have to be categorised as insurable. Nevertheless, the assessment of environmental risk through the prism of doctrinal criteria of insurability indicate the low degree of insurability. What makes environmental risk less insurable than other risk categories is the difficulties with defining environmental risk as measureable, extraordinary and independent of one's will, followed by the fact that it often materialises as a catastrophe. The above is additionally exacerbated by instability in legislation and its interpretation as well as low insurance awareness. The few available research studies of environmental risk insurability have shown that in European countries no or insufficient insurance cover refers to damage done to protected species and natural habitats (juxtaposed with a relatively high level of insurance against water and soil pollution) as well as environment impairment caused either gradually or by activity for which permission has been previously granted. Also, significantly limited insurance offer covers activities related to new technologies or activities generating an increased threat of environmental damage (i.e. activities connected with GMO, nuclear power, waste management and the use of plant protection products in farming), (Bio Intelligence Service in association with Stevens&Bolton LLP, 2009; Swiss Re, 2007).

The analysis of the degree to which insurability criteria are met serves as the basis for creating an action catalogue for the state or a business sector in order to enhance it (e.g. building data bases, creating estimation models, raising legal and insurance awareness through educational projects). Such actions will most probably remain inefficient with regard to non-insurability of environmental damage resulting from regular (non-accidental) operations of business entities. Economic development will always generate environment impairment, partly an uninsurable one. The private insurance sector will not embark on

[12] The directive also imposes a duty to remedy the damage on the soil surface, but in this respect, most countries already had some regulatory experience.

covering catastrophic damage, either. Environmental risk management in this area must be focussed on instruments of preventive impact on the scope of potential damage.

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Assessment of Factors Influencing of Final Corporate Income Tax Liabilities in Selected Sectors in the Czech Republic

Karolina Lisztwanová[1], Iveta Ratmanová[2]

[1] VSB-TU Ostrava
Faculty of Economics, Department of Finance
Sokolská třída 33, 702 00 Ostrava, Czech Republic
E-mail: karolina.lisztwanova@vsb.cz

[2] VSB-TU Ostrava
Faculty of Economics, Department of Finance
Sokolská třída 33, 702 00 Ostrava, Czech Republic
E-mail: iveta.ratmanova@vsb.cz

Abstract: *The Czech government uses corporate taxation to support desirable corporates` behaviour, for example the willingness to invest or the elimination of impact of corporates` risk etc. The object of the paper is to assess the impact of changes of the statutory tax rate, to emphasize the impact of the items reducing tax base and the influence of the tax discounts on the total tax liability. First of all, main attention is devoted to the evaluation of the impact of tax losses, research and development expenses, expenses connected with donation activities and investment incentives of the selected sectors during period 2005-2016 with using data provided by Ministry of Finance of the Czech Republic. The method of pyramidal decomposition of the final tax liability is used, so that we could state and compare the changes of above-mentioned items moreover functional method is applied in case of identification of multiplicative relationship among defined individual items. As far as our results are concerned, we are able to emphasize the items that influenced the changes of the corporate income tax liability of the selected sectors the most. We can state that the changes of the individual adjustments of tax base are the most significant in the case of all sectors, but on the other hand, when it comes to the rest of the items their impact differs.*

Keywords: corporate income tax, tax base, pyramidal decomposition, functional method, individual sectors

JEL codes: H20, G30, K34, H25, G39

1 Introduction

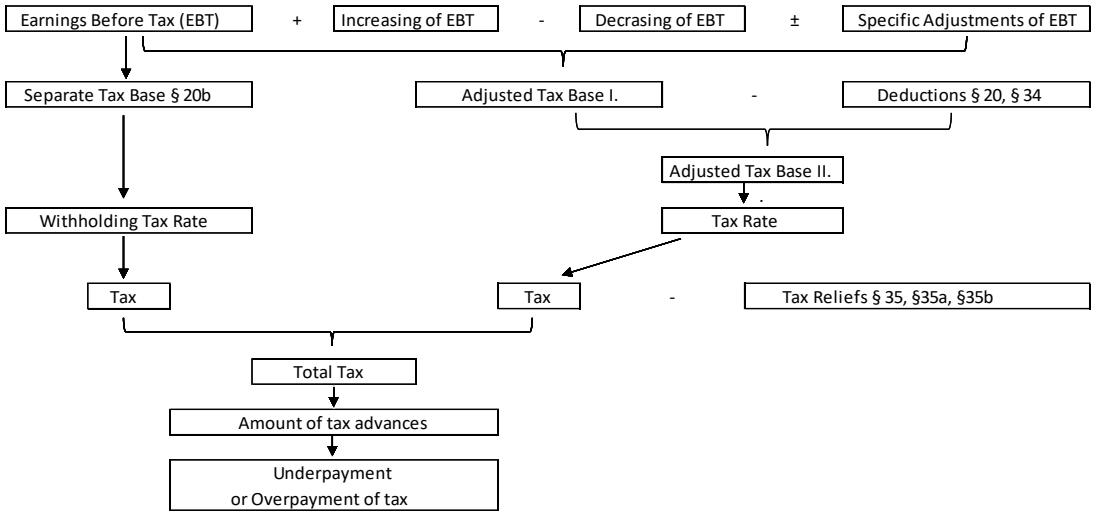
Direct taxation is closely tied with taxpayers` income. Corporate income tax as one kind of direct taxes uses this fact in order not only to create governments` tax revenues, but to support desirable activities or behaviour of individual enterprises too. Among activities, which can be in the centre of tax policy interests, we can include e.g. research and development expenses, elimination of impact of tax losses, gratuitous transactions and reliefs decreasing final tax.

Generally, it can be claimed that it is necessary to know value of corporate`s accounting profit or difference between incomes and expenses to determine final tax. However, in most countries the way, how to calculate final tax is not so simple. Because of this, not all corporate`s revenues and not all corporate`s expenses may influence total tax. There are some specific kinds of revenues, which should be excluded from total sum of revenues and there are some other specific kinds of expenses which must not influence final tax or which may be taken into account only respecting certain limit. Moreover, countries exist, which use different other kind of tax base and not only income decreased with expenses.

In the case of the Czech Republic, processing of assessment of final tax is derived, first of all from accounting profit i.e. from difference between income and expenses, which are adjusted respecting if they are or not being recognized as taxable. Detail of their assessment must respect information of section mark 23, 24 and 25 of The Act. 586/1992

Coll., on Income Taxes. The following figure briefly summarizes the prevailing structure of the tax calculation in practice.

Figure 1 Structure of tax calculation and settlement of tax liability



Source: Authors` processing according data of the Act no. 586/1992 Coll., on Income Taxes

Regarding the previous figure 1 amounts, which are able to increase or to decrease profit or loss influence determining of tax base possibly of tax loss. Deductions pursuant to section mark 20 or 34 moreover reduce tax base. In addition, the final tax is calculated respecting tax rate and tax reliefs. Moreover, it is clear from the figure that the certain part of the tax base exists which is taxed separately with withholding tax rate.

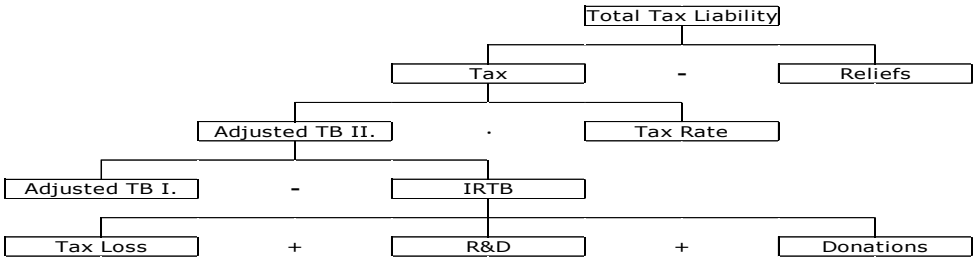
As it can be seen, there are many facts, which can influence the final total tax. It is clear, if data are available, it is not problem to identify value of these facts. If their value is known, it is not problem to assess their impact on the total tax too. The impact of individual items influencing value of the total tax respecting total corporates`data between years 2005 - 2015 have been already made (Lisztwanová, Ratmanová, 2017). The goal of this paper is to concentrate on determining and assessment corporates` tax data with regard to individual selected sectors during period 2005 – 2016 and to identify the impact of indicators on changes of the total tax. The length of the observed period was chosen with regard to data availability.

2 Methodology and Data

It would be certainly interesting to find out, how individual adjustments, deductions and reliefs influenced the final tax of corporates and their development in time. Of course, the very easy way, how to evaluate their impact, it is to calculate their ratio to the total tax value. Notwithstanding, determination of above-mentioned impact will be stated with analysis of variances which can be considered to be more sophisticated process. In addition, it can be said that the analysis of variances is applied, if there is possibility to identify data during certain period and if partial components of analysed item exist.

If the total final tax is considered to be the top indicator, relationships among individual items influencing the total tax can be described with the way mentioned in figure 2 (Lisztwanová, Ratmanová, 2017). It is clear that figure 2 should be similar to figure 1. Nevertheless, figure 2 brings the possibility to emphasize the impact of selected corrections of the tax base with section mark 20 and 34 of The Act. 586/1992 on the final tax. Above that, the final form of the created pyramidal decomposition corresponds to the structure of the available data. Generally, it can be claimed that is possible to identify decomposition of the total tax and to calculate power of influence of individual indicators. It means that changing of the top indicator can be explained with changes of individual items where individual relationships are expressed mathematically.

Figure 2 Pyramidal decomposition of total tax liability



Source: Authors` processing according data of Finanční správa

When it comes to the detail of figure 2 it is clear that mathematical expression of individual relationships among indicators can be stated through additive or multiplicative operation. In the case of additive operation, the following formula can be determined

$$\Delta x_{a_i} = \frac{\Delta a_i}{\sum_i \Delta a_i} \cdot \Delta y_x, \tag{1}$$

where $\Delta a_i = a_{i,1} - a_{i,0}$, $a_{i,0}$, and $a_{i,1}$ is the value of the indicator i respecting starting (0) and ending (1) state.

Referring to (Lisztwanová, Ratmanová, 2017) the multiplicative operations can be calculated with the functional method, which expresses the combined simultaneous impact of the all indicators explaining their influence on the top indicator (Zmeškal, Dluhošová, Tichý, 2004). Respecting the multiplicative operation between two indicators, the influences can be formulated as

$$\Delta x_{a_1} = \frac{1}{R_x} \cdot R_{a_1} \cdot \left(1 + \frac{1}{2} \cdot R_{a_2}\right) \cdot \Delta y_x, \tag{2}$$

$$\Delta x_{a_2} = \frac{1}{R_x} \cdot R_{a_2} \cdot \left(1 + \frac{1}{2} \cdot R_{a_1}\right) \cdot \Delta y_x. \tag{3}$$

where R_{a_i} and R_x are relative changes of indicators.

So that one could assess the impact of individual components of the final tax as the top indicator of the pyramidal decomposition, we used data provided by Finanční správa that provides annual value of the earnings before taxation (EBT), the tax base, and the items reducing tax base, the tax reliefs and the final total tax.

3 Assessment of Impact of Indicators of Selected Sectors

Concerning the total corporates` tax data, the final power of impact of above-mentioned

Table 1 Total power of influences of individual indicators

	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	Sum	% of sum	Order
	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK		
ΔTTL	17,662	23,335	-19,143	-27,202	-2,928	-1,203	1,512	5,300	11,206	11,326	7,191			
Reliefs	731	820	1,994	129	902	732	1,569	9,672	689	10,206	105	27,550	12,11	4
STR	11,112	0	21,481	6,664	6,268	0	0	0	0	0	0.000	45,525	20,01	2
ATB I.	26,392	22,169	6,700	20,921	3,466	3,942	2,524	18,514	8,835	1,623	6,791	121,875	53,56	1
Tax Loss	3,449	2,202	6,465	308	1,137	3,829	5,723	2,979	3,000	223	363	29,679	13,04	3
R&D	249	215	87	60	345	549	120	359	56	273	177	2,492	1,10	5
Dona-tions	87	0.21	21	6	15	35	3	204	4	7	35	418	0,18	6
												227,538		

Source: Authors` calculation according data of Finanční správa

indicators on the total tax has been already defined (Lisztwanová, Ratmanová, 2017). Table 1 presents these findings. The changes of data between individual periods, the total tax as the topic indicator of pyramidal decomposition and analysis of variances have been used to determine impact of changes of individual indicators on the top indicator. Respecting the way of processing and concerning on data of the last column of the table 1, it is clear which changes affected the most the development of the total tax. It was adjusted tax base I. On the contrary, the changes of donations caused changes of total tax at least in the selected periods. The following table 2 contains value of changes of the total tax with regard to selected sectors. The main attention has been concentrated on following sectors: agriculture (A), mining and quarrying (B), processing industry (C), production and distribution of electricity (D), construction sector (F) and finance and insurance sector (K). The sectoral designation with individual letters corresponds to the designation used by the financial administration of the Czech Republic.

Table 2 Change of total tax liability according selected sectors

	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16
	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK
Sector A	216.5	278.5	-159.3	-527.9	772.4	1,031.6	100.4	284.5	721.7	-658.3	-43.4
Sector B	-17.6	487.1	325.8	-2,276.1	1,105.9	165.6	-1,320.3	396.2	-600.7	108.1	-753.2
Sector C	1,360.8	10,425.9	-11,511.7	-12,887.9	4,235.4	452.9	1,356.3	1,534.6	11,573.0	3,581.2	4,519.5
Sector D	5,202.1	1,043.4	2,675.5	-735.8	-929.2	-3,199.2	2,905.6	-947.8	-2,663.4	-435.0	513.4
Sector F	839.3	1,259.1	-1,016.4	-673.5	-427.8	-1,737.0	-621.0	241.9	178.6	1,881.5	9.2
Sector K	-1,042.5	2,175.1	-3,579.5	2,212.9	-3,722.6	1,366.4	4,848.4	-798.5	284.9	1,711.6	-1,162.4

Source: Authors` calculation according data of Finanční správa

Because it is obvious, that changes of the total tax differ among individual sectors, data of selected sectors respecting period between years 2005 – 2016 have been tested. The way of processing was the same as of data for all businesses respecting created pyramidal decomposition and using analysis of indicators variances between years. In the following text, sector findings are always presented with two ways. First, information in mil. CZK expresses value, which caused increasing or decreasing of the total tax between two periods. It is clear that changes of the total tax liability were not only influenced with increasing of all items. It means that changes of indicators` influences could be positive or negative. Although, in order to determine the overall ranking of impacts of individual indicators, their absolute values have been used. This information can also be presented as the absolute value of individual indicators for the individual sector. Similarly, as in the table 1 information about final rank of individual indicators, respecting sectoral data are added. Thanks to this, it is easy to determine and later to compare results of selected sectors to each other.

Table 3 Total power of influences of individual indicators of agriculture sector A

	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	Sum	% of sum	Order
	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK		
Reliefs	5,279	5,279	5,279	5,279	5,279	5,279	5,279	5,279	5,279	5,279	5,279	58,073	0,86	4
STR	119,311	0,000	241,009	70,347	80,827	0,000	0,000	0,000	0,000	0,000	0,000	511,494	7,53	3
ATB I.	334,934	476,641	150,674	508,940	1 006,186	1 093,595	20,266	225,563	735,661	706,465	23,862	5 282,787	77,79	1
Tax Loss	9,284	172,496	216,568	34,232	147,686	67,002	116,653	60,077	8,052	48,181	20,215	900,446	13,26	2
R&D	1,198	3,685	3,747	0,518	0,133	1,066	0,643	0,812	1,824	2,517	3,213	19,355	0,29	5
Donations	1,970	4,051	1,722	2,724	1,176	0,523	0,463	2,162	2,247	1,114	0,570	18,723	0,28	6
												6 790,877		

Source: Authors` calculation according data of Finanční správa

According to data of the first sector – agriculture it can be seen that individual adjustments of tax base I. influenced the total tax of corporates the most. The tax loss was the following indicator that influenced observed changes the most. Vice versa, the impact of donations was the least.

When it comes to the sector of mining and quarrying, it was observed the same result as in the case of the agriculture sector. The biggest influence of ATB I.. The expenses connected with research and development t caused changes of the total tax liability the leas. Surprisingly, changes of statutory tax rate brought changes of the final tax about in the second rank.

Table 4 Total power of influences of individual indicators of sector of mining and quarrying B

	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	Sum	% of sum	Order
	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK		
Reliefs	2,353	2,377	2,215	1,237	0,347	0,896	4,098	0,356	1,118	0,936	0,273	16,205	0,16	5
STR	285,194	0,000	563,424	155,775	135,879	0,000	0,000	0,000	0,000	0,000	0,000	1 140,272	11,48	2
ATB I.	228,510	499,313	901,865	2 116,057	1 214,764	181,889	1 349,011	401,614	599,317	188,069	644,648	8 325,057	83,84	1
Tax Loss	43,470	17,332	5,700	8,446	23,300	22,105	9,189	2,332	2,560	84,091	112,887	331,414	3,34	3
R&D	0,045	0,029	0,015	0,059	0,137	0,018	0,058	2,815	1,355	0,955	1,373	6,858	0,07	6
Donations	6,718	2,686	9,188	2,926	3,895	39,354	33,718	0,627	0,905	4,102	5,411	109,530	1,10	4
												9 929,336		

Source: Authors` calculation according data of Finanční správa

Judging the impact of indicator that defines changes of the total tax in the case of processing industry it was verified the most important role of individual adjustments of tax base I. too. For the second time one can see, that the individual reliefs followed indicator ATB I. in influencing of the total tax. The indicator with the least impact is the same as in case of agriculture sector, i. e. donations influenced changes of the total tax the least.

Table 5 Total power of influences of individual indicators of processing industry C

	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	Sum	% of sum	Order
	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK		
Reliefs	922,600	501,501	1 996,656	151,628	818,572	960,508	1 579,082	2 212,027	2 213,781	661,642	19,004	12 037,002	11,48	2
STR	3 042,872	0,000	5 731,350	1 455,081	1 336,389	0,000	0,000	0,000	0,000	0,000	0,000	11 565,692	11,03	3
ATB I.	5 889,013	10 723,455	8 924,789	11 096,440	8 603,456	1 091,781	1 839,875	470,506	15 003,251	3 639,962	3 344,885	70 627,414	67,36	1
Tax Loss	398,337	191,189	1 166,825	558,197	1 876,418	593,081	1 185,453	2,254	1 187,255	751,175	1 064,204	8 974,388	8,56	4
R&D	114,335	15,897	32,253	36,665	327,061	253,368	99,068	204,793	24,138	161,872	140,005	1 409,455	1,34	5
Donations	50,071	28,696	13,236	33,543	9,640	18,114	9,165	0,170	53,332	13,626	10,574	240,168	0,23	6
												104 854,117		

Source: Authors` calculation according data of Finanční správa

The sector of production and distribution of electricity does not differ from previous sectors. Individual adjustments played significant role in determining of changes of the total tax liabilities. Nevertheless, one can identify for the second time the important impact of the tax loss generated by corporates of this sector. Surprisingly, respecting the observed period, this sector is associated with the least impact of expenses on research and development.

Table 6 Total power of influences of individual indicators of sector of production and distribution of electricity D

	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	Sum	% of sum	Order
	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK		
Reliefs	1,297	1,488	1,546	0,430	0,349	1,540	0,981	0,780	1,077	0,186	0,317	9,990	0,024	5
STR	772,534	0,000	1 956,110	755,415	751,354	0,000	0,000	0,000	0,000	0,000	0,000	4 235,414	10,174	3
ATB I.	6 036,184	994,079	4 742,141	102,426	318,348	3 206,311	2 890,840	2 697,786	5 983,323	550,410	1 305,705	28 827,553	69,248	1
Tax Loss	59,820	26,848	118,143	56,691	160,902	24,714	36,115	3 656,317	3 332,180	101,760	800,787	8 374,277	20,116	2
R&D	1,033	0,034	0,117	0,021	1,227	0,871	0,474	1,938	0,937	0,643	2,165	9,460	0,023	6
Donations	4,101	21,054	5,909	25,656	18,787	29,432	19,925	11,881	12,118	12,820	10,948	172,630	0,415	4
												41 629,325		

Source: Authors` calculation according data of Finanční správa

Regarding the calculation and data of table 7, it can be confirmed that ATB I. the most influenced changes of the total tax followed with changes of the statutory tax rate in the case of the construction sector. Vice versa, this one is the sector with the least impact of donations activities on the final tax and it is the same as in the case of processing industry.

Table 7 Total power of influences of individual indicators of sector of construction sec. F

	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	Sum	% of sum	Order
	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK		
Reliefs	25,608	20,000	10,316	162,871	103,519	6,335	115,845	4,374	6,007	1,761	0,052	456,689	3,56	4
STR	540,629	0,000	1 057,191	349,137	340,301	0,000	0,000	0,000	0,000	0,000	0,000	2 287,257	17,83	2
ATB I.	1 595,329	1 235,412	121,974	72,400	155,641	1 672,865	787,016	337,722	342,929	2 027,653	197,144	8 546,086	66,64	1
Tax Loss	135,204	108,735	80,099	22,685	73,887	34,046	19,975	108,620	174,923	139,809	210,080	1 108,062	8,64	3
R&D	46,219	62,684	76,472	67,051	38,485	43,732	26,388	6,279	18,659	0,242	0,610	386,822	3,02	5
Donations	8,394	2,384	4,114	0,685	0,029	7,258	3,846	2,098	2,091	4,795	4,348	40,043	0,31	6
												12 824,959		

Source: Authors` calculation according data of Finanční správa

Even in the latter case we can identify adjustment of tax base I. as the indicator which the most changed the total tax liability of finance and insurance enterprises. The tax loss is the indicator with the second rank in assessing indicators and regarding expenses of research and development, it can be observed the least impact on the total tax in selected periods.

Table 8 Total power of influences of individual indicators of finance and insurance sec.K

	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	Sum	% of sum	Order
	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK	mil. CZK		
Reliefs	96,302	6,320	50,185	25,349	7,712	25,888	0,039	12 067,365	1 289,760	10 773,281	2,760	24 344,961	20,54	3
STR	1 258,895	0,000	2 071,006	729,066	723,095	0,000	0,000	0,000	0,000	0,000	0,000	4 782,062	4,03	4
ATB I.	5 420,789	1 622,054	4 987,609	2 994,045	8 097,862	7 787,080	399,142	12 125,904	3 119,177	9 024,365	893,916	56 471,942	47,64	1
Tax Loss	5 528,149	563,820	6 454,254	38,717	5 074,876	6 334,863	5 275,074	703,392	1 944,701	50,520	291,093	32 259,458	27,22	2
R&D	2,092	2,816	4,327	13,853	2,684	105,899	6,365	38,759	8,351	13,772	7,304	206,222	0,17	6
Donations	14,777	7,270	12,712	24,894	13,125	5,822	21,214	192,412	161,274	0,562	12,528	466,590	0,39	5
												118 531,234		

Source: Authors` calculation according data of Finanční správa

4 Conclusions

The following table 9 provides summarized information about the power of influences of individual indicators respecting data of selected sectors. Generally, it can be claimed that, thanks to methods of the pyramidal decomposition and thanks to the analysis of variances, it has been verified respecting input data that individual adjustments of the tax base I. affected changes of the corporates` final tax regarding selected sectors the most. The influence of changes in rates of the statutory tax itself cannot be overlooked either. Comparing individual sectors, it can be confirmed that reliefs play the most important role in the case of the processing industry. The agriculture, the sector of production and distribution of electricity and the finance and insurance sector are sectors with the important influence of the tax loss in observed period. Expenses of research and development affected situation of the agriculture sector, the processing industry and of the construction sector the most. The last one – the gratuitous activities play important role in changes of the total tax during period 2005- 2016 in the case of the sector of mining and quarrying and in the sector of production and distribution of electricity.

Table 9 Ranking of indicators' impacts in individual sectors

	Sector A	Sector B	Sector C	Sector D	Sector F	Sector K
Reliefs	4	5	2	5	4	3
STR	3	2	3	3	2	4
ATB I.	1	1	1	1	1	1
Tax Loss	2	3	4	2	3	2
R&D	5	6	5	6	5	6
Donations	6	4	6	4	6	5

Source: Authors` calculation according data of Finanční správa

In addition to determining the absolute magnitude of the influence, the direction of this influence can be assessed and compared too. This direction is presented in table 10. It is clear that the frequency of occurrences of the effect of increasing or decreasing the overall tax burden within the sectors between the various items has been identified.

Regarding the influence of the statutory tax rate, it can be only observed decreasing impact. Generally, it can be claimed, that decreasing of statutory tax rate causes decreasing of the total tax liability of all sectors. The impact of the rest of indicators were so unequivocal. However, in most cases, the indicator adjusted tax base I. has contributed to the increasing of the tax burden for individual sectors. The tax loss contributed to reduction in the year-on-year tax burden on the sectors in most cases; surprisingly in the case of the agriculture and processing industry, the tax loss was more likely to increase the tax change. As regards to the impact of changes of research and development expenditures and their impact on changes in overall tax liability for individual sectors, no clear impact on the increase or decrease it has been demonstrated with usage of methods

of pyramidal decomposition and analysis of variances. However, results of individual sectors, in the case of the agriculture sector can be confirmed that if the total tax increases, research and development expenditures reduce this increasing. Unfortunately, this unambiguous relationship cannot be confirmed for other sectors. When it comes to donations as the indicator which changes influenced development of the sector`s total tax, this one more often contributed to reduction of the sector`s tax liability. The last factor - reliefs - generally can be confirmed that except the processing industry, this one decreased the total sector`s tax.

Table 10 Frequency of direction of influence of indicators' impacts on individual sectors

	Sector A		**Sector B**		**Sector C**		**Sector D**		**Sector F**		**Sector K**	
	-	**+**	**-**	**+**	**-**	**+**	**-**	**+**	**-**	**+**	**-**	**+**
Reliefs	6	5	9	2	3	8	6	5	6	5	8	3
STR	4	0	4	0	4	0	4	0	4	0	4	0
ATB I.	5	6	4	5	3	8	4	7	6	5	6	5
Tax Loss	5	6	8	3	5	6	6	5	7	4	6	5
R&D	7	4	4	7	8	3	6	5	4	7	5	6
Donations	8	3	4	7	5	6	5	6	6	5	6	5

Source: Authors` calculation according data of Finanční správa

In conclusion, it has been verified the possibility to determine factors influencing the final tax of corporates of the individual selected sectors through the usage of the pyramidal decomposition method with regard to the selected top indicator. Moreover, it has been verified that analysis of variances can be used to determine power of impact of individual indicators of the pyramidal decomposition on the final total tax. Last but not least, with regard to the real data of selected sectors for the certain period, factors that most or the least affected the change of the tax liability were identified. However, with regard to the input data, it was unreservedly confirmed with the analysis of the variances that tax-deductible items or tax reliefs have always contributed to the tax reduction.

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Financial Performance of Czech Privately-Held Firms with Multiple Owners

Ondřej Machek[1], Aleš Kubíček[2]

[1] University of Economics, Prague
Faculty of Business Administration, Department of Strategy
nam. W. Churchilla 4, 13067 Prague 3, Czech Republic
E-mail: ondrej.machek@vse.cz

[2] University of Economics, Prague
Faculty of Business Administration, Department of Strategy
nam. W. Churchilla 4, 13067 Prague 3, Czech Republic
E-mail: ales.kubicek@vse.cz

Abstract: *Privately-held firms represent the vast majority of firms worldwide. When owned by multiple shareholders, the owners become a social group who interact with each other, which affects the behavior of the firm and its financial performance. The goal of this paper is to explore the financial characteristics of Czech privately-held firms with multiple owners. Using a sample of 28,972 Czech limited liability firms, and after controlling for firm size, age, and industry affiliation, we found that the presence of multiple owners has a negative effect on asset turnover. However, the number of shareholders as such seems to have no effect on profitability, debt use, and liquidity. Instead, sole proprietorships seem to be empirically different from firms with two or more owners, as they have a significantly greater liquidity.*

Keywords: multiple owners, performance, privately-held firms, Czech Republic

JEL codes: M10, G34

1 Introduction

The relationship between ownership structure and financial performance has been subject to many studies over the last few decades. The existing body of research focused primarily on structural aspects, such as ownership concentration, the proportion of family owners, the proportion of institutional, private, government ownership, as well as the number of owners (Uhlaner et al., 2015).

Most of the existing research on corporate governance has been carried out in countries with strong legal protection and developed financial markets. The existing studies focused mostly on publicly listed firms (McCahery and Vermeulen, 2010) and in corporate governance research, a particular emphasis has been placed on the relationship between ownership structure and performance; however, the studies presented inconsistent results (Uhlaner, 2008).

Although publicly traded firms are important players in the global business, privately-held firms represent the vast majority of firms worldwide. This form of businesses encompasses all possible kinds of firms, including small family-run businesses, but also large international corporations, joint ventures, etc.

Agency theory assumes divergence of interests between owners and managers because of the separation of ownership from control. Managers pursue their self-interests (Jensen and Meckling, 1992), which creates the potential for management's opportunism and leads to agency costs. Hence, agency theorists proposed mechanisms that can protect shareholders against management's opportunism.

In publicly listed firms, governance is mostly formal (contractual), whereas in privately-held firms, governance becomes relational (Mustakallio et al., 2002). Hence, the findings on corporate governance in publicly traded firms cannot be simply applied to privately-held firms.

Moreover, it can be assumed that privately-held companies are also heterogeneous regarding governance mechanisms. Firms with a smaller number of owners, especially those owned by the same family, will rely more on informal (relational) governance mechanisms than firms with more dispersed ownership (Nordqvist et al., 2014; Uhlaner et al., 2007). It is no wonder that recent authors emphasized the need for studying the owning groups in corporate governance. This need is even more important when we realize that business-owning groups are a worldwide phenomenon; according to Uhlaner (2008), excluding publicly-traded firms, nearly half of all firms are owned by two or more people.

When multiple owners are present in a firm, they become a social group of people who "are aware of, interact with, and influence each other" (Uhlaner, 2008). The dynamics of owning group is assumed to affect the behavior of firms and their performance. Due to data unavailability, it is extremely difficult to study the dynamics of owning groups per se; however, existing databases allow for studying the effect of number of owners on various dimensions of financial performance. The goal of this paper is to explore the effects of the number of shareholders on financial ratios (profitability, liquidity, asset management and debt use) of Czech privately-held firms.

In past studies, the number of owners has often been used as a measure of ownership dispersion or firm size. The academic literature presents several findings on financial characteristics of single-owned firms and firms with multiple owners.

As to the relationship between the number of shareholders and profitability, the literature presents inconsistent evidence. A larger number of owners may result in higher agency costs, but at the same time, profit maximization may require a diffused ownership structure (Demsetz, 1983). Steijvers et al. (2006) found that in family firms, the number of owners had a positive effect on performance if the largest shareholder has an ownership share between 45% and 60%. On the other hand, a later study by Lappalainen and Niskanen (2012) found that an increase in the number of owners reduced firm profitability. Performance may also be measured using asset management ratios, such as asset turnover. This financial ratio has often been used as an inverse proxy for agency costs (Singh and Davidson, 2003; Fleming et al., 2005). In this context, Florackis (2008) found that larger UK firms had a lower asset turnover than small firms.

As the ownership becomes dispersed, the free-rider problem can occur. While few shareholders will have a strong incentive to incur the costs of management monitoring, in larger owning groups, individual shareholders will be less active. Limited monitoring will result in higher agency costs (Ang et al., 2000). Hence, we expect that increasing agency costs will result in worse performance, in particular:

H1: The number of owners negatively affects profitability.
H2: The number of owners negatively affects asset turnover.

Dalbor et al. (2004) found that the number of owners was positively associated with the amount of total debt in small restaurant firms. Similarly, Newman et al. (2013) found that single-owner SMEs had a lower propensity to take on total debt than SMEs with multiple owners. The idea that firms with multiple owners use more debt financing can be justified by several reasons. First, larger firms are more likely to have better access to external financing. On the other hand, smaller firms without formal governance mechanisms are likely to rely on internal financing (Young et al., 2008). Second, using increasingly more debt increases the risk of financial distress. Small firms are often more averse to risk, because their personal wealth, as well as the wealth of their owners' families, is directly connected to the success of their firm; also, small business owners want to avoid the loss of control over their firms (Mishra and McConaughy, 1999). Hence, we hypothesize that:

H3: The number of owners positively affects the level of debt.

We found no study evaluating the effect of the number of owners on firm liquidity (the ability to settle short-term liabilities). However, it can be assumed that larger firms, which are more likely to have multiple owners, are less risk-averse (Misra et al., 2005); a more aggressive financial policy can lead to keeping less amount of liquid assets, thus making

firms with multiple owners adopt a riskier, but potentially more profitable position. Therefore, we expect that:

H4: The number of owners negatively affects liquidity.

As far as we know, no similar study has been carried out in the Czech Republic. Several authors focused on the relationship between ownership concentration and performance (Konečný and Částek, 2016; Machek and Kubíček, 2018). In this paper, we are not interested in the effects of the amount of stock owned by individual investors, but in the number of owners, which is a straightforward indicator of the size and complexity of owning groups.

The rest of this paper is structured as follows. We present the methodology and data used in this study. Then, we present and discuss the results. Finally, concluding remarks are presented.

2 Data and Methodology

To get financial data on privately-held firms, we used the Bureau van Dijk's Amadeus database. We selected all Czech limited liability firms (s.r.o.) with one or more known shareholders, and with known data on the relevant financial ratios. To eliminate subsidiaries of foreign firms, we selected only firms located in the Czech Republic, who are owned by one or more named individuals or families, owning together between 50% and 100%. The final sample contains 28,972 firms and financial data for 2014-2016. Table 1 presents the industry affiliation of firms in the sample.

Table 1 Industry Affiliation of Firms in the Sample

Industry name (abbreviated)	Number of firms	Relative frequency
Agriculture, forestry, fishing, mining, quarrying	812	2.80%
Manufacturing	4,747	16.38%
Electricity, gas, steam, air conditioning, water supply, sewerage, waste management	437	1.51%
Construction	3,527	12.17%
Wholesale and retail trade; repair of motor vehicles and motorcycles	7,539	26.02%
Transportation and storage	1,091	3.77%
Accommodation and food service activities	766	2.64%
Information and communication	1,295	4.47%
Real estate activities	1,611	5.56%
Professional, scientific and technical activities	3,978	13.73%
Administrative and support service activities	838	2.89%
Other	2,331	8.05%
Total	**28,972**	**100.00%**

Source: Own analysis based on Bureau van Dijk's Amadeus database

To test the effect of the presence of multiple owners on financial performance, we employed correlation and linear regression analysis performed in Stata 14.

There are four models with four explained variables:

- Return on equity (net income over shareholder's funds) as a measure of profitability.
- Asset turnover (total sales over total assets) as a measure of asset management efficiency.
- Gearing (liabilities over equity) as a measure of financial leverage (level of debt).
- Current ratio (current assets over current liabilities) as a measure of liquidity.

The main explanatory variable is the number of owners. Besides that, we control for industry affiliation using eleven dummy variables (since financial characteristics differ

across industries). The analysis also controls for firm size as measured by the natural logarithm of total assets (to capture size-related effects such as returns to scale), and firm age since the date of incorporation (to capture maturation effects).

Standard regression diagnostics were applied. Possible multicollinearity has been evaluated using the variance inflation factors (VIF). However, no serious issues have been found. In all four models, means of residuals are very close to zero. Because according to the Breusch-Pagan test, the models are heteroskedastic, we used regression with robust standard errors. Finally, according to the Durbin-Watson test, there is no evidence of autocorrelation in our data.

It also makes sense to compare sole proprietorships (firms owned by a single shareholder) with firms owned by two or more shareholders. For this purpose, Student's t-test with unequal variances was used.

3 Results and Discussion

Table 2 present the descriptive statistics for the individual dependent and independent variables.

Table 2 Descriptive Statistics

	Mean	Standard deviation
Number of owners	1.752	1.370
Firm age	12.994	7.147
Firm size (ln of total assets)	5.166	1.705
Return on equity (ROE)	16.114	35.252
Asset turnover (AT)	5.674	12.825
Current ratio (CR)	5.317	7.887
Gearing (GE)	47.281	95.804

Source: Own analysis based on Bureau van Dijk's Amadeus database

As to the number of owners, there are 15,187 sole proprietorships, 9,620 firms are owned by two owners, and 2,623 firms are owned by three owners. Many firms are also owned by four owners (883), five owners (309) and six owners (115). The number of firms owned by more than six owners is rapidly decreasing.

Table 3 present the Pearson correlation coefficients between the dependent and independent variables. The correlation analysis suggests there is a negative bivariate linear relationship between the number of owners and firm age and size (both significant at the 0.01 level), but also a negative relationship between the number of owners and profitability and asset turnover (significant at the 0.01 level). No significant correlation between the number of owners and liquidity/use of debt has been found.

Table 3 Correlation Matrix

	Owners	Age	Size	ROE	AT	CR	GE
Owners	1						
Age	.181**	1					
Size	.061**	.361**	1				
ROE	–.015**	–.149**	.067**	1			
AT	–.040**	–.089**	–.041**	.016**	1		
CR	–.007	–.019	–.168**	–.036**	–.159**	1	
GE	.002	–.051**	.170**	–.019**	.065**	–.122**	1

Note: ** - significant at 0.05, Owners = number of owners, Age = firm age, Size = firm size, ROE = return on equity, AT = asset turnover, CR = current ratio, GE = gearing
Source: Own analysis based on Bureau van Dijk's Amadeus database

Table 4 displays the regression results for four models with different response variables. The results support the hypothesis that the number of owners in a firm has a negative

effect on asset turnover (significant at the 0.05 level). Contrarily to what we expected, return on equity, current ratio and level of debt seem to be unaffected by the number of owners.

Table 4 Regression Results

Dependent variable	Return on equity	Asset turnover	Current ratio	Gearing
Intercept	10.185**	67.653**	9.272**	43.314**
Number of owners	.029	-.139**	.057	-.793
Size	3.160**	-.188**	-.821**	11.199**
Age	-.922**	-.159**	.052**	-1.696**

Note: * - significant at 0.1, ** - significant at 0.05.
Industry dummies are not displayed.
Source: Own analysis based on Bureau van Dijk's Amadeus database

To compare firms with one owner with firms with multiple owners, Table 5 displays the results of Student's t-test with unequal variances. There are 15,187 firms with one owner and 13,785 firms with multiple owners in the sample. Significant differences have been found in terms of asset turnover and current ratio (in both cases, firms with one owner exhibit a greater mean than firms with multiple owners). Single-owned firms also used less debt, but the result was not statistically significant.

Table 5 Results of Student's t-test

	Mean		t statistic
	Single-owned firms	Multiple-owned firms	
Return on equity (ROE)	16.330	15.877	1.092
Asset turnover (AT)	6.038	5.273	5.073***
Current ratio (CR)	5.554	5.055	5.374***
Gearing (GE)	46.672	47.953	-1.136

Note: *** - significant at the 0.01 level, two-tailed significance
Source: Own analysis based on Bureau van Dijk's Amadeus database

To summarize the results, we found convincing evidence that the number of owners negatively affects asset turnover (H2). Not enough evidence on the effects of number of owners on profitability (H1), debt use (H3) and liquidity (H4) has been found.

The results support the hypothesis that agency costs increase along with the number of owners. This can be explained by the occurrence of the free-rider problem (Ang et al., 2000), which means that when the number of shareholder increases, the individual shareholders become less active and are unwilling to carry the costs of management monitoring. As a result, the asset turnover will decrease. This finding, however, does not apply to return on equity. Although the mean ROE of single-owned firms was higher, the difference is not statistically significant. It may also be that ROE is actually not a good inverse measure of agency costs; several authors considered them to be different constructs (see e.g. Lins et al., 2010).

Our results failed to support the hypotheses H3 and H4. The number of owners does not directly affect liquidity of firms and their use of debt. A higher use of debt can be attributed rather to the firm size (larger firms have better access to external finance) rather than to the number of shareholders.

However, it seems that single-owned firms are empirically different from firms with multiple owners as such, but the very number of owners does not play a significant role. A greater risk aversion of firms with a one owner is manifested in greater liquidity of such firms. Keeping more liquid assets acts as a "financial pillow" and reduces the risk of financial distress.

However, this study also has limitations. In the Czech Republic, only few privately-held firms have a large number of owners. The groups of firms corresponding to individual numbers of shareholders are disproportional in terms of size. For example, only one firm had 24 shareholders, and no firm had 29 shareholders. These data issues reduce the possibilities of statistical inference, since the information about the group means is distorted. A larger number of observations for various groups of firms could provide more reliable results. We also had to rely on the credibility of data extracted from the BvD Amadeus Database. However, this database has been used my many other authors in their research.

4 Conclusions

The goal of this paper was to explore the effects of the existence of multiple owners of financial performance of Czech privately-held firms. The results support the hypothesis that the number of shareholders negatively affects asset management efficiency. However, no significant effect of the number of owners on return on equity, liquidity and debt use has been found. Instead, we argue that single-owned firms are different from firms with multiple owners, as they tend to employ more liquid assets to reduce the financial risk.

However, further research is needed in this area. Some authors, such as Chrisman et al. (2004), emphasized the need for measuring not only economic (financial), but also noneconomic performance (the achievement of noneconomic goals, such as the firm reputation, contribution to society, but also family-centered goals in family firms). Moreover, future research should address the question how exactly the owning group dynamics (such as shared vision, commitment to the organization, quality of relationships) affects the performance of firms and what are the antecedents and the driving mechanisms of these effects.

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Spatial Inequality in Ownership and Activity of Banking Sector: Case of Russia

Marina Malkina

Lobachevsky State University of Nizhni Novgorod
Institute of Economics and Entrepreneurship
Macroeconomics and Microeconomics Center
Bolshaya Pokrovskaya street 37
603000 Nizhni Novgorod, Russia
E-mail: mmuri@yandex.ru

Abstract: *Our study is aimed at evaluation of spatial inequality in ownership and activity of commercial banks of Russian Federation in 2001-2016. The level of interregional inequality in banking sector was assessed for its assets, financial results, attracted deposits and provided loans, which were calculated both per capita and as their ratio to GRP of regional economies. To eliminate the effect of price level on the variables in time series we determined their real values using the cumulative GRP-deflator indices. The inequality in spatial distribution of assets, liabilities and financial results of banking sector was evaluated by means of the weighted coefficients of Gini and variation and tested for β- and σ-types convergence. We found significant growth of the spatial concentration of ownership and management of assets in Russian banking sector accompanied by low and cyclical concentration of financial results (net profits) within the sector, which meantime increased noticeably last year. At the same time, banking activity demonstrated much lower and sometimes diminishing regional disparities. First of all, we observed decrease in spatial inequality in the level of lending to enterprises and population, and the both types of convergence were proved for them. This trend was opposite to the growth of interregional disparities in the average personal deposits and almost nil change in inequality of the deposits of enterprises. We concluded that discrepancy between distribution of ownership on assets and actual implementation of banking activity, in combination with high interest rate (cost of capital), contributed to further redistribution of financial resources of the periphery in favor of the center and prevented the improvement of financial position of backward regions.*

Keywords: region, banking system, unevenness, assets, convergence

JEL codes: G21, R12

1 Introduction

The spatial inequality in the distribution of property and activities in the banking sector is a fairly new area of economic research. Previous studies in the field of spatial economics and new economic geography focused mainly on interregional inequality in GDP, employment, incomes of the population etc.

Studies of the banking sector's spatial location have been less common and usually concerned the analysis of expansion of global banks and crowding out of domestic banks in regions (Lee and Eun-Joo, 2017), or the processes of convergence of various countries' financial markets (Niţoi and Poche, 2016). Some researchers also investigated influence of financial deepening and banks development on regional economic growth (Hasan et al., 2009; Belke et al., 2016; Asteriou and Spanos, 2018) and income inequality (Haan and Sturm, 2017; D'Onofrio et al., 2017). Other scientists examined relationships between convergence in the banking sector and indicators of economic development. Thus, testing of the Turkish regions for conditional β-convergence (Birkan and Akdogu, 2016) did not provide evidence that alignment of regional financial imbalances led to an evening-out of regional gross value added per capita.

A number of studies were dedicated to analysis of the spatial distribution of the Russian banking sector's activity, its causes and consequences. For example, (Malkina, 2017) used various indices for assessment of spatial inequality in the banking sector of Russia, which

allowed to determine the level and dynamics of interregional disproportions in provision of Russian regions with banking services. Other authors (Ageeva and Mishura, 2017) analyzed the determinants of the level of development of regional banking systems in Russia and obtained evidence that it was affected by both economic and institutional factors, such as the republican status, distinctive national and ethnic characteristics and degree of regional authorities' independence. The researchers also distinguished regional, multi-regional and federal banks with extended branch network in Russia and explored their competitive advantages and weaknesses (Rykova et al., 2017). In the work by (Valiullin and Merzlyakova, 2011) the authors concluded that the territorial expansion of Moscow and other large banks contributed to the development of competition in the Russian banking sector.

The aim of our current study is to evaluate the degree of interregional unevenness in the distribution of assets, profits, loans and deposits of population and enterprises in the banking sector of Russia in dynamics, to test all these parameters for sigma- and beta-convergence and to compare inequality in distribution of the property and management and the actual implementation of banking activities in Russian regions. We expect that this study should shed light on the dynamics and conservation of regional imbalances in the Russian banking sector.

2 Methodology and Data

Our study is based on the official data provided by the Central Bank of Russia embracing the indicators of activity of all credit institutions (banks and their branches) in 80 Russian regions in 2001-2016. The analysis also involved the data of the Federal State Statistics Service of Russian Federation on the average population, gross regional product (GRP), GRP's volume and deflator indices for Russian regions in the period reviewed.

We studied two types of spatial distribution of banking activity. The first type of spatial distribution, related to property and general management in the banking system, was assessed on the basis of the data on banks registered in the regions, including value of their assets, net financial results (profits less losses), deposits and loans. The second type of spatial distribution, concerned the actual implementation of banking activities, including attracted deposits and issued loans, was evaluated on the basis of information on all credit institutions operating in the given territories: the headquarters and branches of banks registered in the regions and the branches of other banks headquartered in other regions. This type of distribution covers activities of both regional banks and cross-regional banks.

Since the economies of Russian regions differ significantly in scale, the level of banking activity in Russian regions was determined on the basis of relative indicators, such as: the ratio of annual personal deposits or loans to the average population of the regions; the ratio of assets, financial results, annual deposits or loans provided to enterprises to GRP of the regions. To eliminate the influence of the inflation factor, the procedure for deflating the nominal variables was carried out using the cumulative GRP deflator indices. Stock variables, determined on a certain date, were transformed into flow variables by calculation of their chronological mean values in the correspondent years.

The interregional inequality of bank assets and profits, deposits and loans was measured using two indices:

- the Gini coefficient (based on M. Brown formula):

$$G = 1 - \sum_{i=1}^{n} \rho_i \left(X_{i-1} + X_i \right), \quad (1)$$

where ρ_i - the share of i-th region in total population of country (for indicators related to population), or the share of i-th region in the total real GRP or assets (for indicators related to legal entities); $X_i = \sum_{i=1}^{n} x_i$ - the cumulative share of regions from the 1st to the i-th in

total value of indicator (loans, deposits, assets or profits), provided that all the regions are ranked in ascending order of its per capita or relative value y_i, and $x_i = \rho_i y_i \Big/ \sum_{i=1}^{n} \rho_i y_i$;

- the coefficient of variation:

$$CV = \sqrt{\sum_{i=1}^{n} \rho_i (y_i - \mu)^2} \Big/ \mu , \quad (2)$$

where μ - the country average of y_i, and $\mu = \sum_{i=1}^{n} \rho_i y_i$. This coefficient was also used for testing banks activities in the regions for sigma-convergence.

For the purpose of testing the banks activities in the regions for beta-convergence, we used the procedure proposed by (Baumol, 1986) and then developed in (Barro and Sala-i-Martin, 1992). This approach involves the construction of a spatial dependence of the average annual growth rate of the examined indicator on its initial value:

$$\frac{1}{T} \ln(y_{iT} / y_{i0}) = \beta_1 + \beta_2 \cdot \ln(y_{io}) + \varepsilon_i , \quad (3)$$

where y_{i0} - per capita or relative value of correspondent indicator in i-th region in the initial year of the study, t=0; y_{iT} - its value in the final year of the study, t=T; T - total number of years in time series; ε_i - residuals of the model.

The above equation can also be written in the following form:

$$(y_{iT} / y_{i0})^{1/T} = \beta_0 \cdot y_{io}^{\beta_2} + u_i , \quad (4)$$

where $\beta_0 = \exp(\beta_1)$ and $u_i = \exp(\varepsilon_i)$.

The inverse relationship in this test confirms the existence of β-convergence, that is, the catching-up of the backward regions with advanced regions by the examined parameter.

3 Results and Discussion

First of all, we should outline some relevant trends in the banking sector of the Russian Federation in the studied period. One of these trends was a sharp reduction in the number of banks, which was caused by the recession in economy and the tightening of banking regulation in Russia. At the beginning of 2001, there were 1311 credit institutions registered in various regions of Russia, and 3973 branches of credit institutions, of which 1095 were located in the same regions as their headquarters. Thus, in 2001 the share of own credit institutions in the regions accounted for 47.1% of all operating institutions. In early 2017, the number of registered credit institutions in the regions decreased to 623, the number of their branches - to 1098, of which 124 were located in the regions of the headquarter organizations. Thus, over 16 years the share of own credit institutions in the regions decreased to 43.4%, i.e. by 3.7 percentage points.

Another important trend was the expansion of Moscow banks in the regions. However, the crisis phenomena and tightening of regulation affected these banks as well. Some of large federal banks, in order to optimize activities, closed a part of their regional branches. However, on average this did not reduce the share of the banking market serviced by Moscow banks. Table 1 demonstrates the processes of concentration of banks and their assets incorporated in Moscow in comparison with other economic indicators of the capital city.

Table 1 The Share of Moscow in Some Economic Indicators, %

	2001	2004	2007	2010	2013	2016
Total population	7.0	7.4	7.8	8.0	8.4	8.6
Total GRP	20.0	19.5	19.3	17.7	18.9	18.5
Number of registered banks*	n/a	50.3	49.9	49.3	51.7	52.2
Managing banking assets*	n/a	83.9	84.4	86.1	88.8	90.6

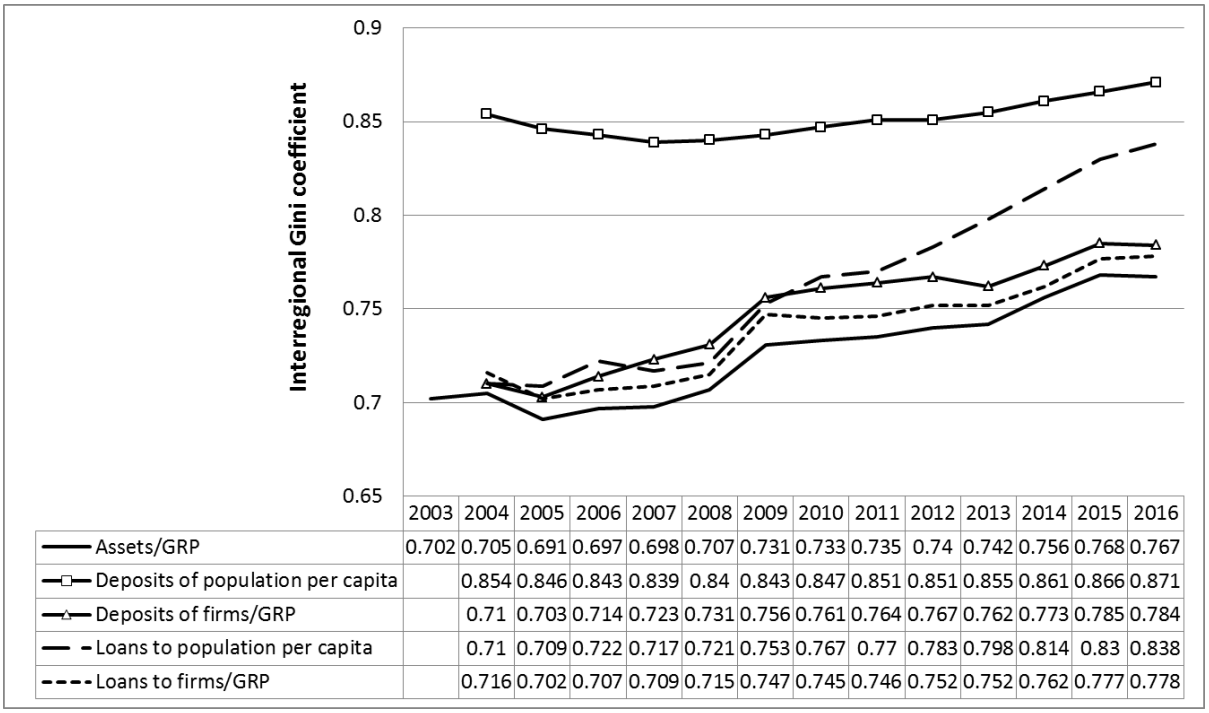
Note: *at the beginning of year
Source: author's own calculations based on the data officially provided by the Bank of Russia and the Federal State Statistics Service of Russian Federation

Now we can proceed to analysis of the levels of two types of spatial inequality in the Russian banking sector measured by means of the formulas 1-2.

Figure 1 with an embedded table represents the results of calculation of the Gini coefficient of interregional inequality for the indicators of banks registered in the regions. First of all, this figure demonstrates a high level of interregional differences in the distribution of property of bank assets. Moreover, for the deposits and loans of both population and enterprises, this inequality appeared to be even higher than for all assets on average. Among them, the maximum level of spatial inequality was observed for the personal deposits per capita, attracted by home regional banks, the minimum level - for the ratio of corporate loans to GRP provided by these banks.

The growth of inequality indices of all examined variables evidenced the concentration of property in the banking sector of Russia. Thus, the unevenness of assets distribution relative to GRP increased by 9.3% for 14 years, whereas the interregional inequality in the per capita loans provided by regional banks to population increased by 18.1% for 13 years. For banks registered in the regions, a minimum increase in inequality in 2003-2016, namely 2%, was observed for personal deposits per capita.

Figure 1 Interregional Inequality in Liabilities and Assets of Banks Registered in Regions



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Assets/GRP	0.702	0.705	0.691	0.697	0.698	0.707	0.731	0.733	0.735	0.74	0.742	0.756	0.768	0.767
Deposits of population per capita		0.854	0.846	0.843	0.839	0.84	0.843	0.847	0.851	0.851	0.855	0.861	0.866	0.871
Deposits of firms/GRP		0.71	0.703	0.714	0.723	0.731	0.756	0.761	0.764	0.767	0.762	0.773	0.785	0.784
Loans to population per capita		0.71	0.709	0.722	0.717	0.721	0.753	0.767	0.77	0.783	0.798	0.814	0.83	0.838
Loans to firms/GRP		0.716	0.702	0.707	0.709	0.715	0.747	0.745	0.746	0.752	0.752	0.762	0.777	0.778

Source: author's own calculations based on the data provided by the Central Bank of Russia and the Federal State Statistics Service of Russian Federation (FSSS)

At the same time, very interesting data were obtained for spatial inequality of the ratio of net financial results to bank assets (the so called return on assets). The interregional Gini coefficient of this indicator was moderate until recently, although highly fluctuating, but it

soared up in 2016. Moreover, we identified two cycles of regional banks inequality in ROA within the period of 2003-2016. The first cycle, covering 2003-2010, reached a bottom point in 2006 (when G=0.026), which separated the downward and upward waves, and had a peak in 2010 (when G=0.116). The second cycle, lasting during 2010-2016, reached a minimum in 2012 (G=0.038) and showed a maximum in 2016 (G=0.458). However, more than 83% of the four-year growth occurred in the last year under study, when the crisis in Russian banking sector advanced.

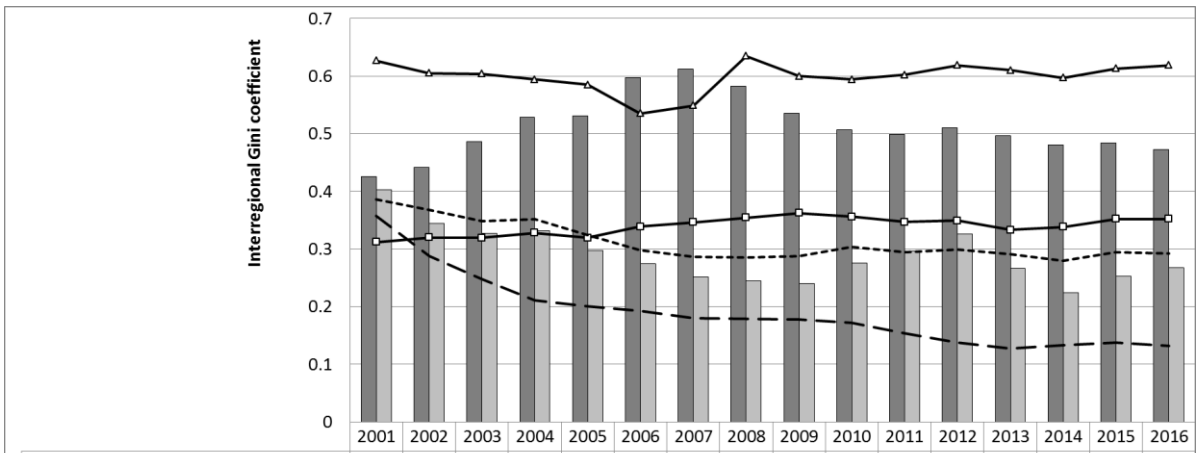
Figure 2 shows the results of calculation of the Gini coefficient for spatial inequality of actual banking activity in Russian regions. This activity embraces the performance of both regional banks and their home branches and subsidiaries of cross-regional banks registered in other regions, among which the dominant role belongs to Moscow banks. The comparison of figures 1 and 2 discovers a more even distribution of attracted deposits and provided loans in the regions than their distribution according to the place of banks incorporation. Moreover, in contrast to the observed increase in the concentration of banking assets ownership, the location of banking activity demonstrated a reduction in regional disparities.

This tendency was mainly related to the average loans to population, for which the interregional Gini coefficient declined by 63% during the period under review. To a lesser extent, it manifested itself for the level of loans to firms, which interregional Gini coefficient diminished by 24.3%. For these types of assets, the coefficient of variation decreased by 67.1% and 31.3% respectively, which proved the significant sigma-convergence of Russian regions in terms of lending.

For the loans to both population and enterprises, the hypothesis of the beta-convergence was also confirmed. The dependence between the level of loans to population in 2001 and the rate of its growth in 2001-2016 in Russian regions was described by a function with a negative slope:

$$\frac{1}{15}\ln(\hat{y}_{iT}/y_{i0}) = \underset{(0.0027)}{0.1869} - \underset{(0.0017)}{0.0494}\cdot\ln(y_{io})\ ;\ \left(\hat{y}_{iT}/y_{i0}\right)^{1/15} = 1.2055\cdot y_{io}^{-0.0494}\ ;\ R^2 = 0.912\ .$$

Figure 2 Interregional Inequality in Actual Banking Activity



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Net savings of population per capita	0.425	0.442	0.486	0.529	0.531	0.597	0.612	0.582	0.535	0.507	0.499	0.51	0.497	0.48	0.484	0.472
Net loans to firms/GRP	0.403	0.344	0.327	0.331	0.297	0.274	0.251	0.244	0.24	0.276	0.296	0.326	0.266	0.224	0.252	0.267
Deposits of population per capita	0.312	0.32	0.319	0.328	0.319	0.339	0.346	0.354	0.362	0.356	0.347	0.349	0.333	0.338	0.352	0.352
Deposits of firms/GRP	0.627	0.605	0.604	0.594	0.585	0.535	0.549	0.635	0.6	0.594	0.602	0.619	0.61	0.597	0.613	0.619
Loans to population per capita	0.357	0.288	0.247	0.211	0.201	0.192	0.18	0.179	0.177	0.172	0.153	0.138	0.127	0.133	0.137	0.132
Loans to firms/GRP	0.386	0.368	0.348	0.352	0.324	0.298	0.286	0.285	0.287	0.303	0.294	0.299	0.291	0.28	0.294	0.292

Source: Author's own calculations based on the data provided by the Central Bank of Russia and the Federal State Statistics Service of Russian Federation (FSSS)

This confirms approaching of backward regions to advanced regions on average in terms of the issued loans per capita. Indeed, the highest growth rates of the personal loans per

capita were observed exactly in the regions with their lowest initial levels, namely in the North Caucasian republics of Chechnya (where they increased 22067 times over 16 years) and Ingushetia (224.5 times), the southern border republics of Kalmykia (76 times) and Tyva (71 times), as well as in the Far Eastern republic of Sakha-Yakutia (75 times). On the contrary, the lowest growth rate of personal loans per capita (6.4 times) was found in Moscow, which used to be among the leaders by this indicator in 2001 and ranked second after the Magadan Region.

The relationship between the level of loans to enterprises in 2001 and its growth rate for 2001-2016 was slightly weaker, compared to that for loans to population, but also significant and negative by sign:

$$\frac{1}{15}\ln(\hat{y_{iT}}/y_{i0}) = -\underset{(0.0126)}{0.0708} - \underset{(0.0044)}{0.0589}\cdot\ln(y_{io})\ ;\ \left(\hat{y_{iT}}/y_{i0}\right)^{1/15} = 0.9317\cdot y_{io}^{-0.0589}\ ;\ R^2 = 0.698\,.$$

The largest increase in loans to enterprises was again indicated in the subjects of the North Caucasus Federal District - the Chechen (250 times) and the Karachay-Cherkess republics (16 times), and the subjects of the Volga Federal District - the republics of Mordovia (25 times) and Mari El (17 times). In 2001, these regions also demonstrated one of the lowest levels of lending to enterprises. However, the growth rates of corporate loans in backward regions turned out to be scattered, that can be attributed to the specifics of their economic structure, spatial location and institutional environment. It should also be noted that in 7 out of 80 regions the level of corporate loans even declined, and in all of them, with the exception of the Komi Republic, the initial level of lending was relatively higher than the national average.

For the deposits of both population and firms attracted in the regions, the level and dynamics of spatial inequality turned out to be fundamentally different. First of all, the interregional inequality of bank deposits noticeably exceeded interregional inequality of bank loans across the time. However, similar to loans, the spatial inequality of corporate deposits significantly surpassed the spatial inequality of personal deposits. Furthermore, unlike loans, which demonstrated regional convergence, regional disparities in the population's per capita deposits increased on average (according to the Gini coefficient, by 12.8%), and regional differences in the level of corporate deposits almost did not change. Meanwhile, according to the coefficient of variation, interregional inequality for both types of deposits increased (by 22.1% for personal deposits and by 11.7% for corporate deposits). This testifies existence of the sigma-divergence of Russian regions in terms of deposits.

Despite the evidence of a general divergence of Russian regions in terms of attracted deposits, the correspondent test confirmed the existence of beta-convergence for personal deposits. Indeed, the relationship between their level of 2001 and its average growth rate in 2001-2016 can be expressed by the functions:

$$\frac{1}{15}\ln(\hat{y_{iT}}/y_{i0}) = \underset{(0.0028)}{0.1688} - \underset{(0.0018)}{0.0424}\cdot\ln(y_{io})\ ;\ \left(\hat{y_{iT}}/y_{i0}\right)^{1/15} = 1.1838\cdot y_{io}^{-0.0424}\ ;\ R^2 = 0.8759\,.$$

The largest increase in deposits was again observed in the regions with their lower initial levels: in the republics of Chechnya, Ingushetia, Kabardino-Balkaria (all are the subjects of the North Caucasus Federal District) and in the Altai Republic (located in the Siberian Federal District). The smallest growth of personal deposits per capita (1.9 times) was observed in the Magadan Region, which was ranked first by this indicator in 2001. For corporate deposits, the beta-convergence was not confirmed.

The revealed mismatch between sigma- and beta- convergence for deposits of population is consistent with findings by other researchers who discovered a similar phenomenon in other spheres (Young, Higgins, Levy, 2008; Dvoroková, 2015).

Figure 2 also shows the change in regional unevenness of net per capita deposits of population (deposits minus loans) and net relative loans of enterprises (loans minus

deposits ratio to GRP). For net deposits of population the inequality initially increased, peaked in 2007, and then declined. Eventually, it increased by 11.1% according to the Gini coefficient and by 17.5% according to the coefficient of variation. For net loans to enterprises the inequality changed cyclically and ultimately decreased by 33.7% according to the Gini and by 38.5% according to the CV. In addition, the tests evidenced the absence of beta-convergence for both net personal deposits and net corporate loans.

Thus, we found a discrepancy between growing disparities in the regional distribution of ownership of bank assets and reducing disparities in provision of Russian regions with banking services, primarily lending. At the same time, the average gap between regions in the level of corporate deposits did not decrease. Besides, the gap of regions in the average personal deposits even widened, albeit these deposits were redistributed in space in favor of poor regions.

How can we explain the discrepancy? In our view, one of the reasons of this phenomenon is the high real interest rate, which largely contributes to the preservation of financial backwardness of regions - net debtors and supports further improvement of the position of regions - net creditors. Moreover, the redistribution of property rights of financial resources in favor of federal banks leads to redistribution of banks' incomes and risks in this direction as well.

4 Conclusions

Our study is dedicated to comparative analysis of interregional inequality in ownership and management of banking assets, on the one hand, and implementation of actual banking activities, on the other hand. For this purpose we evaluated inequality in spatial distribution of banking assets, profits, deposits and loans to population and enterprises relatively to distribution of population, GRP and banking assets in regions. The interregional inequality was assessed for both credit organizations incorporated on a certain territory and credit organizations operated there. The level of spatial inequality was evaluated in dynamics by means of the weighted Gini coefficient and the coefficient of variation and tested for sigma- and beta-convergence using the technique developed by Baumol and Barro & Sala-i-Martin.

As a result, we found a significant increase in the spatial concentration of ownership and asset management in the Russian banking sector and the growing expansion of Moscow banks to other regions. Meanwhile, these processes were accompanied by the alignment of actual banking activities in the regions. The difference between the level of borrowing of enterprises and the population from the banking system has significantly reduced, and for corporate and personal loans both types of regional convergence were confirmed. On the contrary, the deposits of population per capita demonstrated an increase in interregional imbalances. However, the sigma-divergence of regions by personal deposits was accompanied by their beta convergence by this type of liabilities. Further, the deposits of enterprises showed only sigma-divergence, according to the coefficient of variation. Ultimately, we came to the conclusion that the opposite tendencies in the distribution of property and actual activity in the banking sector, combined with a high real interest rate, could lead to a further redistribution of the financial resources of the periphery in favor of the federal center and prevent the equalization of financial conditions of Russian regions.

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The Use of Backtesting in Assessment of the Value-at-Risk on Unites States, Great Britain and German Capital Markets

Tomáš Meluzín[1], Marcin Fałdziński[2], Michał Bernard Pietrzak[3], Adam P. Balcerzak[4], Marek Zinecker[5]

[1] Brno University of Technology
Faculty of Business and Management
Kolejní 2906/4, 61200 Brno, Czech Republic
E-mail: meluzint@fbm.vutbr.cz.

[2] Nicolaus Copernicus University in Toruń
Faculty of Economic Sciences and Management
Ul. Gagarina 13a, 87-100 Toruń, Poland
E-mail: marf@umk.pl

[3] Nicolaus Copernicus University in Toruń
Faculty of Economic Sciences and Management
Ul. Gagarina 13a, 87-100 Toruń, Poland
E-mail: michal.pietrzak@umk.pl

[4] Nicolaus Copernicus University in Toruń
Faculty of Economic Sciences and Management
Ul. Gagarina 13a, 87-100 Toruń, Poland
E-mail: adam.balcerzak@umk.pl

[5] Brno University of Technology
Faculty of Business and Management
Kolejní 2906/4, 61200 Brno, Czech Republic
E-mail: zinecker@fbm.vutbr.cz

Abstract: *For many years, a progressive globalization process has been observed, which translates into an increase in interdependencies between world economies. This growing level of interdependence affects the functioning of economies significantly. The greatest impact of mutual connections can be observed on the world capital markets. Therefore, the issue of the identification and measurement of market risk becomes an important problem related to the functioning of capital markets. Value at Risk is a metric that allows the risk of loss for selected assets to be assessed. The research objective of this article is to assess the quality of Value at Risk applied to measure the risk of the DJIA, DAX, and FTSE stock indices. The VaR estimation was carried out in the time period 2000-2012, where the DCC-GARCH model with the conditional Student's t-distribution was used. To evaluate VaR quality, the backtesting procedure was used, within which we used the Juc, Jind, and Jcc tests.*

Keywords: capital market, value-at-risk, backtesting, DCC-GARCH model, conditional variance

JEL codes: G15, C58

1 Introduction

A progressive globalization process has been observed since the 1990s. This translates into an increase in interdependence between world economies and their respective markets. This phenomenon is becoming a significant factor affecting the efficiency of financial and banking systems in providing capital for growth of real sphere (Meluzin et al., 2017; 2018a; 2018b; Kubiszewska, 2017; Balcerzak et al., 2017; *Gavurova* et al., 2017; Dusatkova et al., 2017, Dvorsky et al., 2017; Ivanová, 2017). Therefore, it translates into countries' competitiveness and socio-economic situation (Cheba and Szopik-Depczyńska, 2017; Zygmunt, 2017).

The potential instability of international financial markets, which can be the result of these interdependencies, can have especially strong and negative influence for lower developed economies, which can suffer from rapid capital flows even in the case of effective national governance, or prudent fiscal and monetary policy (Sanusi et al., 2017; Mihóková et al., 2017; Simionescu et al., 2017; 2018)

The most dynamic growth as well as the variability of mutual dependencies can be observed in the case of financial markets, which is confirmed by the empirical research (Heryan and Ziegelbauer, 2016; Cevik et al., 2017; Fałdziński et al., 2017; Pietrzak et al., 2017a; Vukovic et al., 2017). The identification and measurement of market risk resulting from the links between markets is an important indication for domestic decision-makers representing various financial institutions (Khan et al., 2016; Navid and Shabantaheri, 2017; Ahmed et al., 2018). Therefore, the issue of market risk management becomes a significant problem related to the functioning of capital markets. The greatest risk of loss relates to those assets that are listed on capital markets, where their capitalization is systematically increasing (Meluzin and Zinecker, 2016).

Value at Risk is a metric that allows the risk of loss for selected assets to be assessed. The major research objective of the proposed article is to assess the quality of Value at Risk applied to measure the risk of the DJIA, FTSE, and DAX stock indices. The VaR estimation was carried out in the time period 2000-2012, where the DCC-GARCH model with the conditional Student's t-distribution was used. To evaluate VaR quality, the backtesting procedure was used, within which we used the Juc, Jind, and Jcc tests.

2 Methodology and Data

The Value at Risk (VaR) metric is commonly used to assess risk for financial institutions (Smolović et al, 2017). The risk assessment concerns the financial assets held and, in accordance with the determined VaR, the institution must make appropriate reserves to secure potential losses. This means that Value at Risk belongs to the group of risk measures. VaR estimation is performed based on the knowledge of the distribution of returns of selected financial asset and allows determining the probability of loss occurrence. Determining the distribution parameters is a challenging task due to the volatility of the variance heteroscedasticity and due to the occurrence of interdependencies between markets and assets. Suitable modelling of returns distribution can be performed using the DCC-GARCH model (see Szumilo et al., 2018; Zinecker et al., 2016; 2017), which is defined by means of the following formulas:

$$\mathbf{Y_t} = \boldsymbol{\mu_t} + \boldsymbol{\eta_t},\ \boldsymbol{\eta_t}|F_{t-1} \sim t(0, \mathbf{H_t}), \mathbf{H_t} = \mathbf{D_t R_t D_t} \tag{1}$$

$$\mathbf{D_t^2} = diag\{\mathbf{H_t}\}, \tag{2}$$

$$H_{i,t} = \omega_i + \alpha_i \eta_{i,t-1}^2 + \beta_i H_{i,t-1} \tag{3}$$

$$\boldsymbol{\varepsilon_t} = \mathbf{D_t^{-1}} \boldsymbol{\eta_t} \tag{4}$$

$$\mathbf{R_t} = diag\{\mathbf{Q_t}\}^{-1/2} \mathbf{Q_t} diag\{\mathbf{Q_t}\}^{-1/2} \tag{5}$$

$$\mathbf{Q_t} = \boldsymbol{\Omega} + a\boldsymbol{\varepsilon_{t-1}}\boldsymbol{\varepsilon'_{t-1}} + b\mathbf{Q_{t-1}}, \boldsymbol{\Omega} = \bar{\mathbf{R}}(1-a-b), \tag{6}$$

$\mathbf{Y}_t$ - multivariate process of returns, t - conditional t-distribution with $\nu > 2$ degrees of freedom, $\boldsymbol{\mu}_t$ - the vector of conditional means of returns, $\mathbf{H}_t$ - the conditional covariance matrix, $\mu_{i,t}$ - *i*-th equation of the conditional mean, $h_{i,t}$ - the conditional variance equation for *i*-th returns, where $i = 1,\ldots,N$, $\omega_i, \alpha_i, \beta_i$ the parameters of the conditional variance equation, $\mathbf{R}_t$ - conditional correlation matrix, $\mathbf{Q}_t$ - quasi correlation matrix, $\bar{\mathbf{R}}$ - the unconditional covariance matrix of the standardize errors which can be estimated or set as $\bar{\mathbf{R}} = \frac{1}{T}\sum_{t=1}^{T} \boldsymbol{\varepsilon_t}\boldsymbol{\varepsilon'_t}$, a, b the parameters of the conditional correlation equation.

Aielli (2009) shows that the estimation of $\bar{\mathbf{R}}$ as the the empirical covariance matrix is inconsistent. So, we decided to estimate the unconditional covariance matrix.

Value-at-Risk (VaR) is a commonly used risk measurement technique. It can be applied to assess the probability of an asset loss, where different levels of probability and of the potential loss are assumed. Value at Risk can be defined as the amount of loss of an asset (portfolio) whose probability of reaching or exceeding it in a given time interval is equal to a given tolerance level. If the quantile of the distribution of the value of the asset (portfolio) $\mathbf{r_\alpha}$ is determined using the formula below:

$$\mathbf{P(C \leq C_\alpha) = \alpha} \tag{7}$$

then Value at Risk can be defined as follows:

$$\mathbf{VaR = -r_\alpha C_0}, \tag{8}$$

where r is the return, $\mathbf{C_0}$ is the initial value of the asset (portfolio), and $\boldsymbol{\alpha}$ is the tolerance level (see: Dowd, 2005).

Within the first step of the procedure of VaR estimation we need to assume the distribution of the asset returns. The decided to estimate the DCC-GARCH model, and then use the parameter estimates to compute VaR. The use of the DCC-GARCH model allows taking into account the autocorrelation of returns and the properties of the variance heterogeneity in the form of autocorrelation of returns squares, as well as conditional correlations. Based on the results of the parameter estimation of the DCC-GARCH class models, VaR is estimated by applying the following formula:

$$VaR_q^t = -\mu_{t+1} + h_{t+1} z_q \tag{9}$$

where μ_{t+1} is a one period ahead forecast of conditional mean, h_{t+1} is a one period ahead forecast of conditional variance and z_q is the q-quantile of conditional distribution.

The second step of the VaR determination procedure, requires evaluating the quality of its estimates. After Value at Risk estimation its quality should be assessed. The VaR measure is tested for two properties: unconditional coverage and independence property. The first one assumes that the expected number of hits (cases when returns are greater than estimated VaR) given the assumed coverage level. The second one states that the hit process is independent. For this purpose the VaR estimates are compared to the realizations of the asset returns. In the article, in order to perform backtesting, we used the unconditional coverage test Juc, the test of independence Jind, and the conditional coverage test Jcc (Candelon et al., 2011). Candelon et al. (2011) show that the statistical power of these tests are greater than standard test used for backtesting.

3 Results and Discussion

Following the determined research objective of this article regarding the assessment of the quality of Value at Risk, the study will be conducted based on three stock indices, *i.e.*, DJIA, FTSE and DAX. The selection of indices will allow us to solve the problem of assessing the risk measurement related to the functioning of the US, UK and German capital markets. The study was conducted in the time period 2000-2012. Logarithmic returns were used to estimate the DCC-GARCH model and VaR. Returns were calculated based on the levels of selected indices and data was obtained from the Yahoo Finance website.

In accordance with the presented procedure for VaR estimation, in the first step the distribution of returns of selected stock indices should be determined. For this purpose, the parameter of the DCC-GARCH model with conditional *t*-distribution was estimated. The initial analysis of individual DJIA, FTSE and DAX indices indicated the correctness of the GARCH(1,1) model estimation for each of them. This information was used to determine the model specification, where the DCC-GARCH(1,1) model was adopted. Therefore, estimation of the model parameters was carried out and the results obtained are presented in Table 1. The analysis of the parameters estimates of the model indicates a good fit to the empirical data, which means that this model should describe the distribution of returns correctly. All parameters related to the conditional variance and conditional correlation equations were found to be statistically significant at the 5% significance level. For each of the equations of the conditional variance, the sum of $\boldsymbol{\alpha_i + \beta_i}$ is less than 1. The estimates

of the parameter *v* of the *t*-distribution confirms the occurrence of thick tails in the distribution of the returns.

Table 1 The Results of the Estimation of the Multivariate DCC-GARCH Model Parameters

The conditional variance equations			
Parameter	**Estimate**	**Std. error**	**p-value**
ω_1 (DJIA)	0.0168	0.0037	0.0000
α_1 (DJIA)	0.0605	0.0060	0.0000
β_1 (DJIA)	0.9312	0.0064	0.0000
ω_2 (DAX)	0.0114	0.0027	0.0000
α_2 (DAX)	0.0704	0.0080	0.0000
β_2 (DAX)	0.9204	0.0084	0.0000
ω_3 (FTSE)	0.0124	0.0027	0.0000
α_3 (FTSE)	0.0696	0.0073	0.0000
β_3 (FTSE)	0.9213	0.0076	0.0000
v	8.9725	0.7264	0.0000
The conditional correlation equation			
Parameter	**Estimate**	**Std. error**	**p-value**
α	0.0198	0.0033	0.0000
β	0.9746	0.0054	0.0000
R_{12}	0.5242	0.0691	0.0000
R_{13}	0.8190	0.0304	0.0000
R_{23}	0.4784	0.0728	0.0000

Source: own calculations.

Therefore, it was decided to use DCC-GARCH model to estimate Value-at-Risk. The procedure consisted in estimating DCC-GARCH(1,1) model for last 2000 observations applying rolling window approach. The first model was estimated based on the initial 1000 observations, and each subsequent model was based on the data window, shifted one-day session forward. In this way 2000 one-day ahead VaR forecasts were obtained. Each forecast is a measure of the risk of incurring a particular loss at a given probability level. Thus, market risk forecasts were obtained for each of the three indices.

Then, in accordance with the assumed objective of the article, the quality of VaR obtained was evaluated on the basis of the backtesting procedure. The results of the binominal tests are presented in Table 2. The analysis of the results obtained based on the Juc, Jcc, and Jind tests indicates the correctness of VaR in terms of unconditional coverage and independence for all three indices. For most lags, there is no reason to reject the null hypothesis at the 5% significance level, which indicates that the VaR properties are appropriate for each of the tests. Only in two cases the null hypothesis is rejected, for DAX Jcc test and for DJIA Jind test.

Table 2 Results for Juc, Jcc, Jind Tests for 95% Confidence Level

Index	**Test**	**Statistic**	**Simulated p-value**	**Test**	**Statistic**	**Simulated p-value**
DJIA	Juc(p=1)	1.3534	0.2403	Jind(p=1)	0.0095	0.7993
	Jcc(p=2)	4.9370	0.0784	Jind(p=2)	4.7987	**0.0216**
	Jcc(p=3)	7.2218	0.0594	Jind(p=3)	6.5493	**0.0280**
	Jcc(p=4)	7.3700	0.0764	Jind(p=4)	6.5811	**0.0424**

	Jcc(p=5)	7.4074	0.0919	Jind(p=5)	6.7672	0.0519
	Jcc(p=6)	7.4083	0.1126	Jind(p=6)	6.8188	0.0672
FTSE	Juc(p=1)	3.8365	**0.0447**	Jind(p=1)	0.0088	0.8841
	Jcc(p=2)	4.8683	0.0817	Jind(p=2)	0.9527	0.2899
	Jcc(p=3)	6.4406	0.0748	Jind(p=3)	3.1778	0.1133
	Jcc(p=4)	8.1640	0.0631	Jind(p=4)	4.8119	0.0837
	Jcc(p=5)	9.5744	0.0547	Jind(p=5)	5.7938	0.0746
	Jcc(p=6)	10.5593	0.0552	Jind(p=6)	6.3225	0.0838
DAX	Juc(p=1)	4.8896	**0.0276**	Jind(p=1)	0.0086	0.8951
	Jcc(p=2)	6.5668	**0.0433**	Jind(p=2)	1.7289	0.1479
	Jcc(p=3)	8.3263	**0.0415**	Jind(p=3)	3.7312	0.0820
	Jcc(p=4)	9.4476	**0.0420**	Jind(p=4)	4.1612	0.1009
	Jcc(p=5)	9.8601	**0.0492**	Jind(p=5)	4.1717	0.1409
	Jcc(p=6)	9.9473	0.0596	Jind(p=6)	4.1787	0.1831

Bold values means rejection of the null hypothesis based on the 5% significance level.
Source: Source : own calculations.

4 Conclusions

The article addresses the issue of the identification and measurement of market risk of assets listed on capital markets. The increasing level of interdependence between economies affects the situation on capital markets significantly; therefore the problem of market risk becomes a major problem related to their functioning. A commonly used tool for assessing the risk of losses for selected assets is the Value at Risk measure. The research objective of the article was to estimate Value at Risk for selected DJIA, DAX and FTSE stock indices, as well as to assess the quality of the determined values of VaR. In order to verify the properties of VaR, the backtesting procedure was applied, in which the Juc test, Jind test and Jcc test were used. The results of the tests allowed us to determine good properties with regard to the tested capital markets of the United States, Great Britain, and Germany.

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Changes in Consumer Credit Market in Slovakia

Michal Mešťan[1], Maroš Malíček[2], Matej Žofaj[3], Ivan Králik[4]

[1] Matej Bel University
Faculty of Economics, Department of Finance and Accounting
Tajovskeho 10, 975 90 Banská Bystrica, Slovakia
E-mail: michal.mestan@umb.sk

[2,4] Matej Bel University
Faculty of Economics, Department of Public Economics and Regional Development
Tajovskeho 10, 975 90 Banská Bystrica, Slovakia
E-mail: maros.malicek@umb.sk[2], ivan.kralik@umb.sk[4]

[3] Matej Bel University
Faculty of Economics, Department of Tourism and Hospitality
Tajovskeho 10, 975 90 Banská Bystrica, Slovakia
E-mail: matej.zofaj@umb.sk[4]

Abstract: *Slovak households have been among the fastest-growing debtors of all EU countries in the past 10 years. Consumer credit regulation in Slovakia over the last 3 years has considerably tightened the terms of consumer credit provision not only for banks but especially for non-bank entities that have had to undergo relicensing. In this article, we focus on the analysis of consumer behavior and the structure of consumer credit granted to households by banks and non-bank entities, taking into account the volumes of new loans and their prices, expressed in interest rates and annual percentage rate of charge. At the same time, we evaluate the real effect of the tightened regulation on the consumer credit market for households in Slovakia.*

Keywords: banks, non-banks, annual percentage rate of charge, interest rates, consumer credit.

JEL codes: E51, P36, G21, G23, H31

1 Introduction

The consumer credit market is an integral part of the market economy. It allows economic entities with a shortage of capital to obtain the necessary resources to finance and satisfy their needs from economic subjects with surplus capital. The basic entity operating in the consumer credit market are banks. In addition to banks, non-bank entities are also active in this market. At present, the consumer credit market is also made up of other entities that do not have a banking license and are referred to as non-bank entities. According to Milne and Parboteeah (2016), due to the development of sharing economic industry the number of so-called Peer-to-peer lending platform increased in recent years. Those platforms apart from traditional regulation, combines demand and supply with consumer credit. Economic developments in recent years is coupled with lower interest rates and less strict regulation. It has enabled consumer credit to be extended to a wider range of people, leading to significant household indebtedness over the last nine years in Slovakia.

There are several academic contributions that deal with the credit market in Slovakia. Specific features of the Slovak banking sector can be studied in Horvátová (2014) and an impact of the crisis on the financial system of Visegrad countries is explored in Lawson and Zimková (2009). Majority of studies focused on a profitability, technical efficiency and copetiveness of the banks operating in Slovakia, e. g. Boďa and Zimková (2015), Boďa, Farkašovský and Zimková (2016), Palečková (2015), Zimková (2014), Horvátová (2017). Only some of them reflect also the quality of the banking services, e.g. Boďa and Zimková (2013), or Farkašovský and Pinter (2014). On the contrary, the papers on the financial services of non-banking sector are scare in the academic literature. The aim of our contribution is to fill this gap as we aim to research the structure of consumer credit granted to households by both, banks and non-bank entities.

In this article, we focus on the analysis of consumer behavior and the structure of consumer credit granted to households by banks and non-bank entities, taking into account the volumes of new loans and their prices, expressed in interest rates and annual percentage rate of charge. At the same time, we evaluate the real effect of the tightened regulation on the consumer credit market for households in Slovakia.

2 Regulation of Consumer Credits in Slovakia

Rights and obligations related to the provision of consumer credits on the basis of consumer credit agreements has been regulated in Slovakia via separate legislative act since 2010. The area of consumer credit has been regulated by the Act No 129/2010 Coll. on consumer credits and other credits and loans for consumers and amending certain laws.

The framework of the consumer credit regulation between the years 2010 and 2015 could be characterized as a soft approach towards the rights and obligations of market participants, where the providers has not been limited in entering the market or product design. However, this soft approach has turned out to be too liberal for providers and led to many complaints from the side of consumers on applied practices and unfair conditions. This market development has led to the demand for a new regulatory framework on consumer credit, which became effective since April 2015 (and some parts afterwards).

However, the Act on consumer credits is not the only legislative framework regulating the consumer credit market in Slovakia. Additional legislative acts that have significant impact on the consumer credit market, consumer credit products and additional conditions, rights and obligations could be summarized as follows:

- § 52 - § 54 of the Civil Code,
- Act No. 129/2010 Coll. on consumer credits and other credits and loans for consumers and amending certain laws,
- Act No. 266/2005 Coll. on the protection of consumers in respect of the distance marketing of financial services (and amending certain laws)
- Act No 250/2007 Coll. on consumer protection.

The Civil Code as well as Act on Consumer credits points at the Regulation No 87/1995 Coll. of the Government of the Slovak Republic implementing certain provisions of the Civil Code, where the price regulation of the consumer credit products is presented.

Thus, we can generalize, that the consumer credit regulatory framework consists from five main legislative acts, which form the basis for organization of the consumer credit market and product design, distribution, pricing and market participant behavior.

Regulatory changes in 2015

In order to explain the regulatory changes after the April 2015, we have structured the text into several areas defining the consumer credit market:

- authorization (licensing) of the consumer credit providers (non-banking providers),
- price regulation (ceiling),
- pre-contractual obligations of providers,
- evaluation of creditworthiness and ability to repay the consumer credit,
- details of the consumer credit agreement, • information obligations for the purpose of regulation and supervision.

Main regulatory changes in 2016

Main regulatory changes in 2016 have been focused on tackling the issue of increased speed of indebtedness of households. Legislative changes defined under the Act No. 90/2016 Z.z. on Mortgage loans have changed the definition of consumer credit where also credits used for financing real estate where no real estate collateral is required fall under the scope of consumer credit. At the same time, for these types of consumer credits there is no limit for repayment, while for other types of consumer credit a maximum of 10 years is defined as the maximum length for which consumer credit can be offered.

However, significant influence on the consumer credit market have had the Act No. 299/2016 Z.z., which changes the Act on Consumer Credit. The dominant part of the act focuses on the introduction of measures oriented on the obligation of a creditor to assess the creditworthiness of the consumer before the consumer credit is approved as well as during the whole contract duration. The creditworthiness assessment is based on simple formula comparing the net monthly income of a consumer ("A") and minimum standard living costs ("B"), costs of a credit provided to a consumer ("C") and other obligatory monthly payments ("D"). Thus, the consumer credit can be provided under the condition that

$$A \geq B + C + D \tag{1}$$

At the same time, creditor has to take into account the impact of interest increases and shall not take into account expected increase of future consumer´s income if this is not plausibly shown. The above mentioned Act also introduced the regulatory power for National Bank of Slovakia to issue detailed regulation on how to calculate all items A till D as well as the power to gather statistical data on provided consumer credit from credit providers on a regular basis and other oversight powers including the fines for consumer credit providers for breaching the obligations.

Main regulatory changes in 2017

Legislative changes in 2017 have been focusing on further tightening the introduced formula where the minimum living standard costs has been increased by a coefficient of 1,2 and thus increased the overall limit for consumer creditworthiness assessment. National Bank of Slovakia has issued its regulations which significantly influenced the ability to provide consumer credits. At the same time, National Bank of Slovakia has started preparing its regulation on overall limits implied on consumer credit providers. These regulations are expected to be effective starting July 2018.

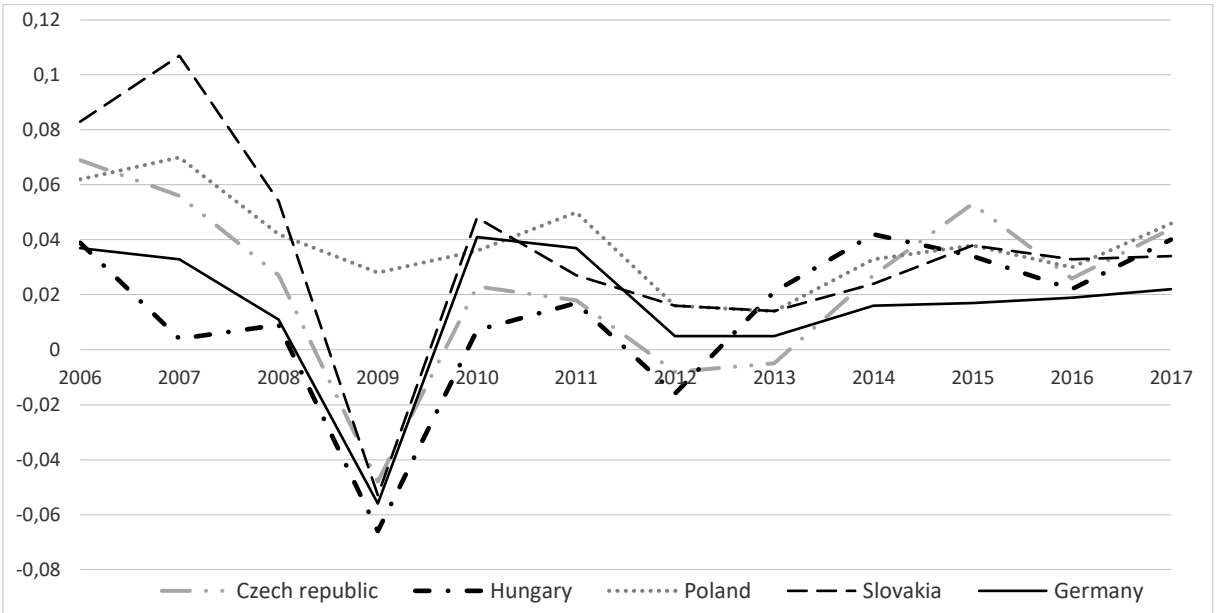
In the context of the above-mentioned legislative changes, we will look at the development of the consumer credit market in Slovakia in the context of banks and non-bank entities and the impact on the structure of the market.

3 Development and Changes in Consumer Credit Market in Slovakia

Economic development not only in Slovakia but also in the surrounding countries of the V4 region is characterized by a positive and stable growth rate since the outbreak of the financial and economic crisis in 2009. Information about real GDP growth rates in selected countries is shown in Figure 1. Positive Economic Growth is linked to the growth of economic activity, which is manifested by increased production of companies and household consumption. Economic developments in the last nine years have been coupled with the extensive fiscal stimulus of individual governments, supplemented by an expansionary monetary policy not only by the European Central Bank (ECB) but also by other central banks outside the Eurozone or in the world. Expansionary monetary policy has been associated with a reduction in key interest rates, which currently reach a zero level. The cost of credit has fallen and has become more accessible to consumers. The aim was to promote economic growth and increase consumption of households and companies.

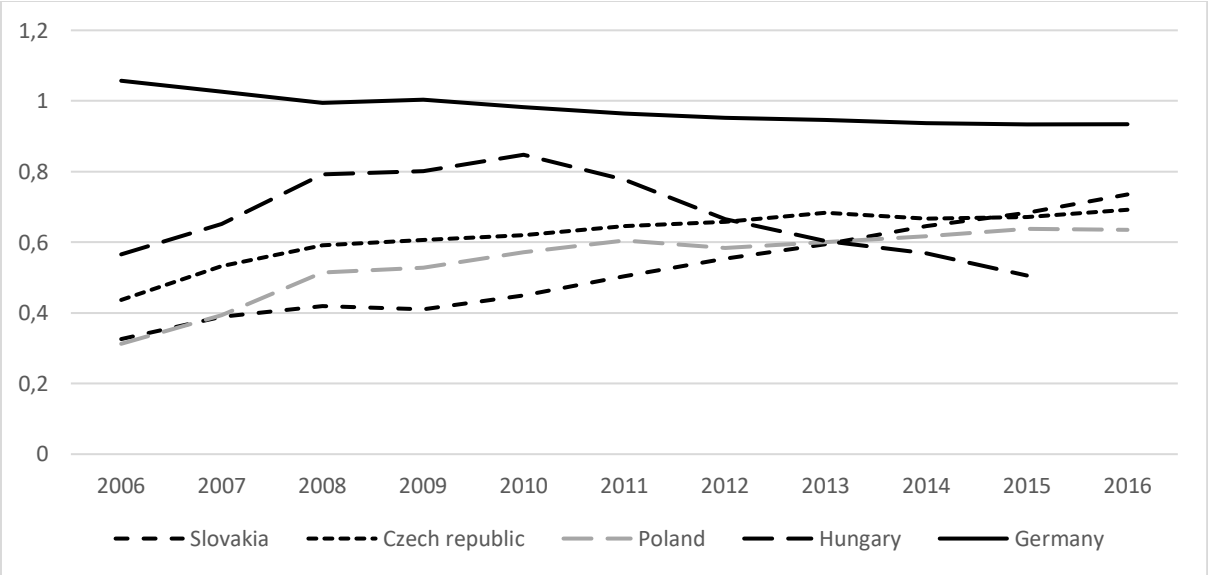
Household indebtedness can be characterized as the ratio of household debt to gross domestic product or as a ratio to their net disposable income. From our point of view, it is more appropriate to indicate household indebtedness as a ratio to the net disposable income of households. Figure 2 shows the evolution of indebtedness to household net disposable income between 2006 and 2016. Among the countries surveyed, Slovak households recorded the highest increase in indebtedness, which grew at 32,59 % in 2006 to 73,53 % in 2016. Higher the level of indebtedness has only the Germans among the countries surveyed. In 2016, it reached 93,41 %, a decrease of 12,31 pp compared to 2006.

Figure 1 Real GDP Growth in Selected Countries



Source: Eurostat, 2018

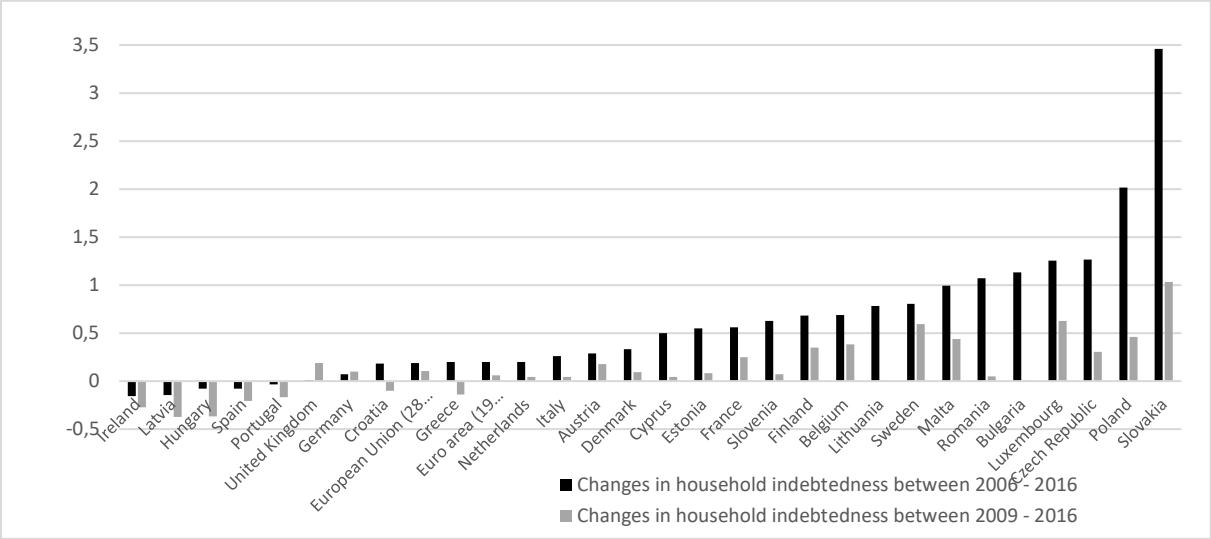
Figure 2 Household Total Debt of Net Disposable Income



Source: Eurostat, 2018

Figure 3 shows the change in household indebtedness of individual EU countries between 2006 and 2016 and 2009 to 2016. In both cases, Slovak households are among the countries with the highest growth. Between 2009 and 2016, household indebtedness grew by 103,45 %, up from 345,80 % between 2006 and 2016. The increase in household indebtedness in EU countries was only 19,04 % in the first case, and in the other 10,60 % and in the Eurozone countries it was 19,95 % respectively 5,85 %. The significant increase in household indebtedness in Slovakia was mainly due to its low level compared to the EU or Eurozone countries. Stable economic growth, disposable income growth, and low interest rates have created conditions for increasing households' lending capacity, which has also led to an increase in their indebtedness.

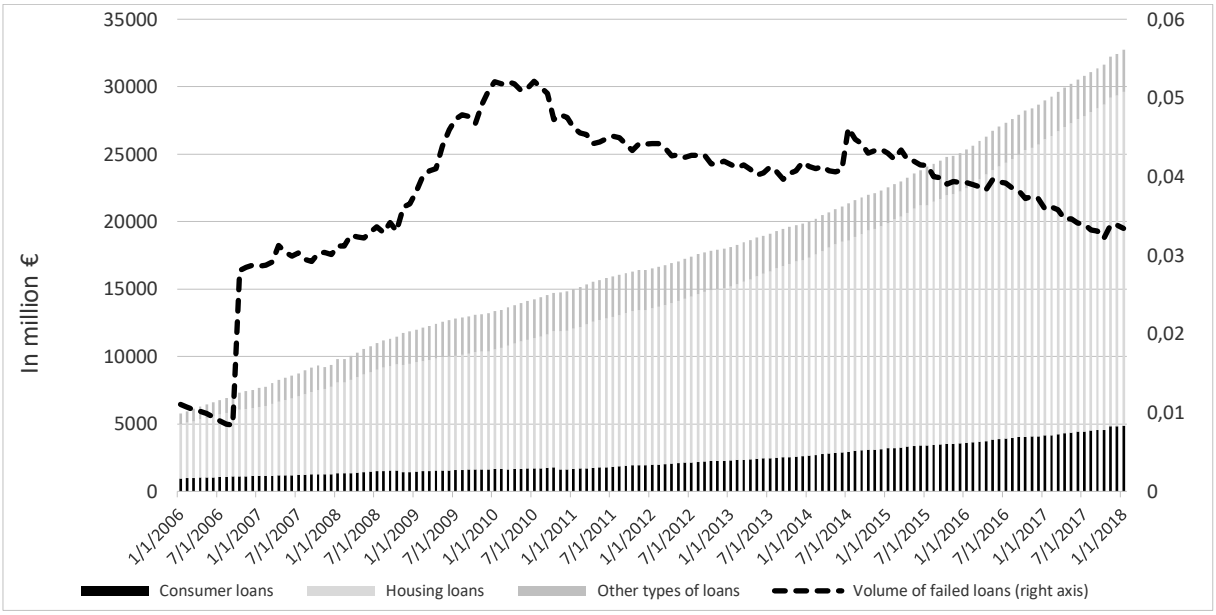
Figure 3 Changes in Household Indebtedness in EU Countries in Two Selected Tie Periods



Source: Eurostat, 2018.

Figure 4 shows an increase in the volume of loans granted to households, especially in the case of housing loans. Housing loans recorded an increase of 544,0 % over the monitored period, consumer credit 429,21 % increase and other types of loans 300,45 %. The growth of consumer credit provided mainly by banks is due to the growth of housing loans. Individuals very often, in the absence of their own savings, finance the purchase of real estate with consumer loans. Indeed, the rise in long-term indebtedness in the form of housing loans is problematic from the point of view of the regulator of the National Bank of Slovakia, especially in the period of low interest rates. At present, the limit for lending for housing has been reduced from 90 % to 80 % of the value of the property. Therefore, an individual need not the amount of 10 % but 20 % of the property price either in the form of own savings or by the drawing of consumer credit.

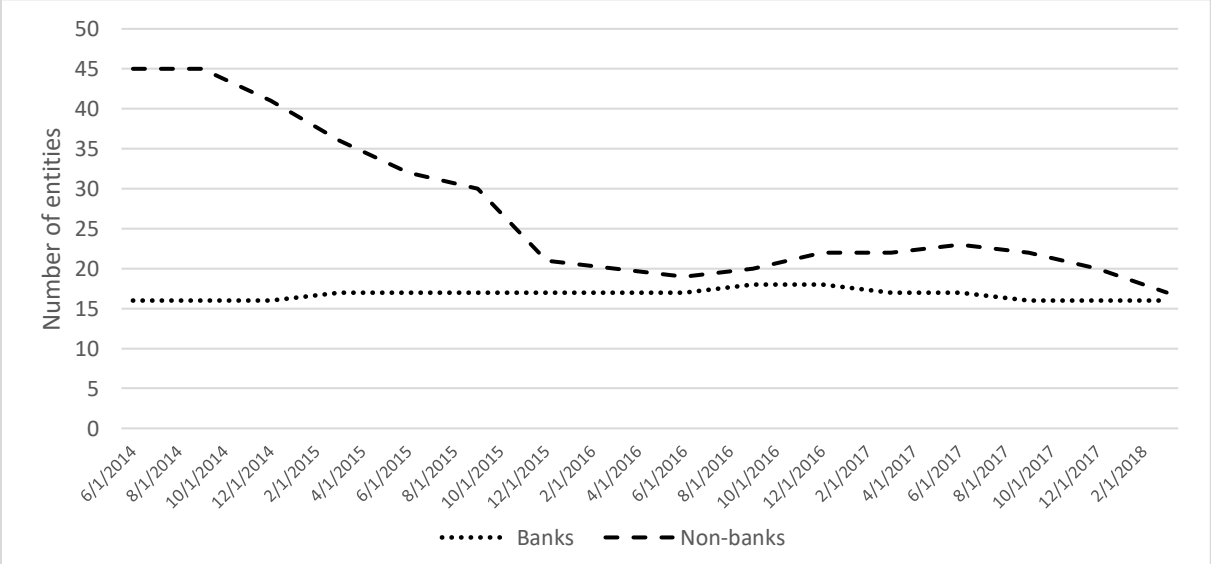
Figure 4 Structure of Loans Providing Household and Volume of Failed Loans in Slovakia in Monthly Bases from January 2006 to March 2018



Source: National bank of Slovakia, 2018.

The aim of the legislative changes mentioned in the second part of this article was to tighten the criteria for the provision of consumer credit by banks and non-bank entities. Figure 5 shows the development of the number of banks and non-bank entities providing consumer credit in Slovakia between 2014 and 2018 on a quarterly basis. Throughout the monitored period, we can see a slightly stable development in the number of banks that provided consumer credit. Their number oscillated between 16 and 18. In the case of non-bank entities, the development is more variable. We observe a stable number of non-bank entities in 2014, which began to decline from 1Q 2015. From the original 45 entities, this figure dropped to 30 in the 3Q 2015. In this period, the entities operating on this market had to go through licensing under the auspices of the National Bank Slovakia, if they wanted to stay on the consumer credit market. A more significant drop in 9 non-bank corporations is recorded in the 4Q 2015 when we can see that the consumer credit market has stabilized, and the market has remained subject to tighter consumer credit conditions. Between 1Q 2016 and 4Q 2017, the growth in the number of non-bank entities was stable and oscillated around 19-23 subjects. The new stricter conditions on the consumer credit market since 2018 have caused a further decline in the number of non-bank entities in the 1Q 2018 to 17 subjects.

Figure 5 Number of Entities Operating in Consumer Credit Market in Slovakia



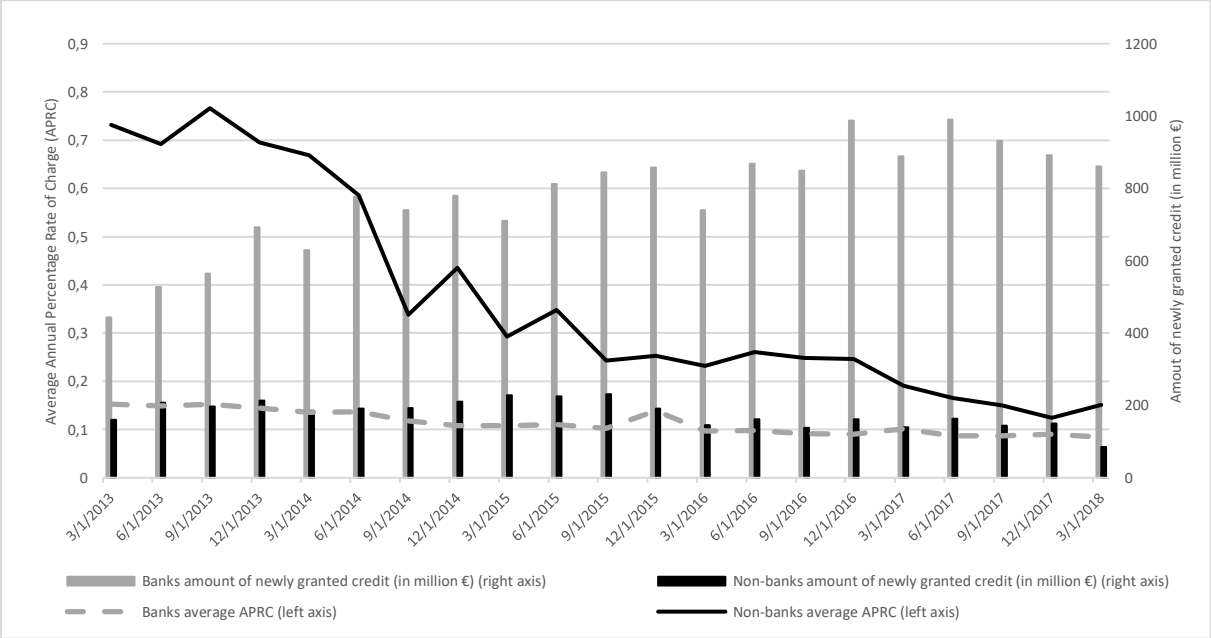
Source: National bank of Slovakia and Ministry of Finance Slovak republic, 2018.

In terms of the number of entities operating in the consumer credit market, the tightening of the terms of the consumer lending was reflected mainly in the decline of non-bank entities. Through Figure 6, we look at the volume of newly granted consumer credit by banks and non-bank entities from 1Q 2013 to 1Q 2018. Figure 6 also shows the average APRC average for consumer loans provided by banks and non-bank households in the reference period. This increase in household indebtedness is particularly noticeable for bank entities. The share of newly granted consumer credit by banks increased over the period under review compared to consumer credit provided by non-bank entities. In the case of non-bank entities, the decrease is visible especially since the 1Q 2015, when the number of non-bank entities in the Slovak market was significantly reduced and the conditions for the provision of consumer credit were tightened. The volume of newly provided consumer credit by non-bank loans decreased from the level of 231,05 mil. € in 3Q 2015 to the current 84,45 mil. € in 1Q 2018. In the case of banks, we see an increase from the level of 844,51 mil. € to 860,98 mil. €.

A diametrically different development is observed when looking at the average APRC. In the case of banks, we notice significantly lower levels of the average APRC throughout the reference period, which dropped from 15,26 % in 1Q 2013 to 8,43 % in 1Q 2018. In the case of non-bank entities, we see a significantly more volatile development of the average

APRC. In 2013 it oscillated between 69,19 % and 76,62 %. In 2014 it began to decline and ranged from 33,78 % to 66,88 %. In 2015, we see again the decrease in the average APRC, which in the following year 2016 shows values ranging from 23,22 % to 34,75 %. In 2017, the decline and convergence of the average APRC on consumer credit provided by non-banks to the average APRC covered by banks continued. For the 1Q 2018, the average APRC was 15,12 %, which is 6,69 % more for banks.

Figure 6 Development of Average APRC and Amount of Newly Granted Credit to Household (in million €) by Banks and Non-banks from 1Q 2013 to 1Q 2018



Source: authors' elaboration, 2018.

From the available public sources, it is not possible to obtain information on the number of clients who draw consumer loans in one year, so we do not discuss this area in the article.

4 Conclusions

In the article we analyze in detail developments in the consumer credit market in Slovakia with regard to a tightening regulation in the last three years. Slovak households have increased their indebtedness most significantly since the European Union. Narrow regulation of the consumer credit market has in recent years significantly reduced the number of non-bank entities operating in this market. The gap between consumer credit costs in APRC significantly decreased, which helped reduce the number of non-bank entities and clear the market from the so-called Predatory consumer credit providers. From the perspective of the client, we can talk about positive legislative changes between 2015 and 2017, which created the conditions for fair consumer credit provision. In our article, we could not fully evaluate the impact of the legislative changes affecting 2018, which lead to a more rigorous approach to assessing borrowers' credit capacity. That is why we want to continue in the field of research in this area. We would like to extend the survey with an analysis of the profitability of companies operating in the consumer credit market, supplement this list of companies with peer-to-peer lending companies, and map out the relationship between consumer credit growth, executions and personal bankruptcies.

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The Relationship between Debt and Equity in Social Economy Organizations – Polish Case

Grzegorz Michalski

Wroclaw University of Economics
Katedra Pracy i Kapitału
Komandorska 118, 53-345 Wroclaw, Poland
E-mail: Grzegorz.Michalski@ue.wroc.pl

Abstract: *In that paper is presented the model based on data about debt to equity relationship, collected from 5500 Polish social economy organizations in comparison to data from over 112000 European social economy organizations. Capital structure is an indicator that testify about level of financial risk. Polish social economy entities covered by Amadeus database, reports different debt to whole capital relationship customs. The levels of debt to whole capital reported in financial statements covered by Amadeus database in social economy entities in V4 and European countries were higher in the time financial risk 2007 - 2012 period than in Polish social economy entities. Polish social economy organizations are important part of general social policy in Polish economy. They realize important aims in healthcare, in education and many other socially important areas. Considering efficiency of social economy organizations, should be remembered that from the donor perspective, is important the way the managing team uses resources of the social economy organization and if it is used in the most effective way. The social economy organization efficiency should be considered in the context of the risk. The one from the most important way to be out from business is the debt to equity relation. In paper are considered relations between debt measures and efficiency measures. That relation is also illustrated for Polish social economy organizations data.*

Keywords: equity, capital structure, nonprofit organizations, efficiency of social economy organizations

JEL codes: G30, G31, G32

1 Introduction

Grizzle et. al. (2015) examine organizational factors that impact the level of operating reserves in social economy organizations and explore the relationship of operating reserves with organizational demographics and financial health variables (Grizzle et. al., 2015). T Kuo et. al. (2014) noticed that Magnus et al. (2003) and Yetman (2007) argued that debt financing would have a negative impact on the charitable donations of social economy entities (Kuo et. al., 2014). Kuo et. al. (2014) investigate the relationship between debt financing and donation levels and according to Kuo et. al. (2014) empirical results, was proved that debt financing has both a crowd-in effect and crowd-out effect on social economy entities donations. Kuo et. al. (2014) show that the crowd-in effect tends to exist in low debt ratio social economy entities, and the crowd-out effect is often found to exist in not-for-profit social economy entities with higher debt ratios (Kuo et. al., 2014). Tuckman and Chang (1993) analyses why social economy entities accrue debt and whether the funds they borrow are used productively. Work of Tuckman and Chang (1993) distinguishes between productive, problematic, and deferred debt. Tuckman and Chang (1993) examine the pervasiveness of social economy debt and the relation between this debt and social economy financial health and they find that over 70 percent of the social economy entities hold debt, the distribution of this debt is highly concentrated, and the level of debt and leverage varies with asset size and type of activity what is in one accord with findings of that paper (Tuckman, Chang, 1993). Social economy entities with higher debt levels are financially healthier than those with lower levels (Tuckman, Chang, 1993), (Gavurova et. al., 2018)

Prentice (2016a) explores the organizational and environmental factors that affect social economy financial health (Prentice, 2016a). Turner et. al. (2015) focused on the differential use of debt financing among forprofit and social economy entities. Forprofit entities use significantly and substantially more debt than social economy entities (Turner et. al., 2015). Calabrese (2011) analyzed the static trade-off and pecking order capital structure theories and applied to social economy organizations. Calabrese (2011) also considers how social economy entities adjust their debt to equity relation over time. Calabrese (2011) indicates that social economy capital structure choices are best explained using the pecking order theory, in which internal funds are preferred over external borrowing (Calabrese, 2011). Rosen and Sappington (2016) investigate the decisions of social economy entities to issue debt and they test whether the expected value and uncertainty of a social economy entity nonfinancial income affect its capital structure (Rosen, Sappington, 2016). Rosen and Sappington (2016) find that debt to equity increase is negatively related to both the expected value and the uncertainty (Rosen, Sappington, 2016).

Szymanska and Jegers (2016) theoretically describe social enterprises taking into consideration their main aims and they point out the direction which social enterprises should follow in order to obtain the highest value of their objective functions (Szymanska, Jegers, 2016). Wedig (1994) points that social economy entities are similar to proprietary firms except that their financial residual is expensed on a philanthropic activity which is similar to a dividend-in-kind for a donnors (Wedig, 1994). Wedig (1994) shows how the constraint against paying cash dividends affects the intertemporal paths of capital structure and argue that the social economy entities dividend-in-kind are similat to dividends in for-profit firms. Social economy entities are risk averse over cash flows and fund balance and behaves like a risk averse consumer rather than a risk neutral firm (Wedig, 1994). Wedig (1994) used a dynamic model to derive closed form expressions for the time paths of debt ant in comparison with empirical data Wedig (1994) confirms the hypothesis of risk aversion.

Long (1976) finds that debt to equity decisions must be based on many inputs—including financial valuation, which has not traditionally been applied in the social economy entities sector (Long, 1976). Reiter et. al. (2000) claims that in capital structure decisions of social economy entities play the same rules as in for profit entities (Zietlow, 1989).

Copeland and Smith (1978) make suggest that social economy entities that are donor funded have the primary objective of donor utility maximisation to ensure that the resources provided by the donor are utilised in the most efficient manner possible (Copeland, Smith, 1978), (Strydom, Stephen, 2014). Upadhyay et. al. (2015) studied the relationship between the social economy entity profitability and cash tied in operational activity (Upadhyay et. al., 2015; Blendinger, Michalski, 2018).

Rauscher and Wheeler (2012) claims that increased financial pressures on social economy entities have elevated the importance of working capital management. Efficient working capital management allows social economy entities to reduce their holdings of current assets and cash inflows can be used to reduce borrowing (Rauscher, Wheeler, 2012). Rauscher and Wheeler (2012) examine the relationship between social economy entities profitability and their performance at managing accounts payable (Rauscher, Wheeler, 2012). Singh and Wheeler (2012) investigate used data for 1,397 bond-issuing, not-for-profit US entities for 2000 to 2007, and Singh and Wheeler (2012) analyzed the relationship between social economy entities performance at managing the revenue cycle and their profitability and ability to build equity capital (Singh, Wheeler, 2012). Singh and Wheeler (2012) model four different measures of profitability and equity capital as functions of two key financial indicators and their results indicated that higher amounts of revenue in relation to a social economy entity assets were associated with statistically significant increases in equity capital ($p < 0.01$ for all four models). Singh and Wheeler (2012) claims that social economy entities that generated more revenue per assets invested reported improved financial performance (Singh, Wheeler, 2012). Statistically significant link existed between lower revenue collection periods and equity ($p < 0.01$ for three models; $p < 0.05$ for one model): social economy entities that collected faster on their revenue

reported larger equity values (Singh, Wheeler, 2012). Findings of Singh and Wheeler (2012) means that social economy organization can advance the financial viability by improving profitability and enabling equity growth (Singh, Wheeler, 2012).

Wheeler and Smith (1988) show that the appropriate discount rate for evaluation of capital expenditures depends on risk, leverage, cost-based reimbursement. Method presented by Wheeler and Smith (1988) can be used to account for these effects that is both practical and consistent with theory (Wheeler, Smith 1988). Wacht (1978) deals with the financial problem of integrating debt financing and fund-raising campaigns in social economy equities. Objective of Wacht (1978) findings is the model of the capital budgeting process for social economy entities. Social economy institutions, as claims Wacht (1978) cannot use orthodox cost-benefit tests because they are inappropriate and impractical because of the multi-dimensional character of the capital structure decision (Wacht, 1978), (Bem et. al., 2017).

Trussel (2012) claims that a capital structure used by social economy entities is an important determination of financial risk. Trussel (2012) indicates that there is no difference in the amount of leverage between the two institutional types od NGO's. Social economy and social economics entities have unique financing mechanisms which do not impact the relative amount of debt and equity in their capital structures (Trussel, 2012). Woronkowicz (2016) investigates social economy financial vulnerability metrics resulted from the effect of a capital facilities project. Woronkowicz (2016) uses data for a sample of social economy organizations and models the relationship between financial vulnerability indicators and facilities investments. The findings of Woronkowicz (2016) are evidence for fact that investments in facilities are associated with the costs of debt associated with facilities projects and influence social economy finances. The Woronkowicz (2016) findings have implications for the financial management of social economy organizations costs of capital (Woronkowicz, 2016).

Wacht (1984) claims that characteristics of social economy entities prevent the transfer and successful application of standard financial management solutions to financial management decisions in the social economy context (Wacht, 1984). Such characteristics include a dual management structure composed of professional and financial managers (Wacht, 1984), restrictions on the disposition of assets and earnings, and the constant threat of illiquidity as the result of the uncoupling of organizational goals and cash flows (Wacht, 1984). The theory of financial management separates the financial management goals from the professional goals (Wacht, 1978). A social economy entity can survive financially through time while its professional manager pursues utility-denominated goals delineated by the organization's tax-exempt status (Wacht, 1978).

Tuckman and Chang (1992) claims that social economy decisionmakers have an incentive to earn and accumulate surpluses. Tuckman and Chang (1992) developed a behavioral model and used to derive a demand function for equity. Tuckman and Chang (1992) applied such model to a national sample of 6168 charitable social economy entities and establish the hypothesis that social economy decisionmakers consciously plan to increase their organization's equity (Tuckman, Chang, 1992).

Prentice (2016b) claims that financial measures are used in social economy research to predict funding opportunities. The findings of Prentice (2016b) suggest that using debt to equity measures in social economy entities do not guarantee to find the searched answer (Prentice, 2016b).

Social economy organization may be defined as the entity that is concerned in its actions about realization of social value adding mission. Such mission is realized thanks to sources collected thru donations from donors (Michalski, 2016b). Donor is an individual (person, firm, other entity) who appreciate social value generated by realization of the mission realized by social economy organization. Such appreciation results in supporting social economy organization by donor’s donations. Donation is a supporting of social economy organization actions amount of money, other assets or volunteer work that donor delivers to supported social economy organization (Michalski, 2016a). Presented discussion

contributes in corporate finance theory in its narrower area concerned about social economy organizations model of financial management in financial liquidity with efficiency measures as the context. That context is seen by some as controversial, especially from technical point of view. Some claim that social economy finance and its managerial decisions in them, are not different from for-profit business decisions (Hansmann, 1987, Jegers, 2011; Michalski, 2016c, Gavurova, Korony, 2016). Such position is only partially correct. Sloan et al. and Wedig et al. use with modifications financial management portfolio theory to social economy organization financial management (Sloan et al., 1988; Wedig 1994, Wedig et al. 1996, Jegers, Verschueren, 2006; Soltes, Gavurova, 2015). In the paper is used the model of financial debt management in social economy organizations from the perspective that states the fundamental financial target of social economy organization is the best financially effective implementation of the mission that cause the donors support for the social economy organization (Leone, Van Horn, 2005; Eldenburg, 2011; Gavurová, Šoltés, 2014). Social economy organization financial debt management decisions need to take in account relation between future effects in the context of risk as debt financing is a specific form that increase financial risk (Soltes 2010, Bem, Michalski, 2015). That perspective is close to creation of for-profit firms value (Michalski, 2016a; Chapelle, 2010; Siedlecki, Bem, 2016).

2 Results and Discussion

Polish social economy entities covered by Amadeus database, reports different debt to whole capital relationship customs. Social economy organization managing team decision about the financial debt level policy, is a balance of gaining new opportunities to serve thru realization of the mission. That kind of decision shapes the level and quality of financial debt (Michalski, 2012). Paraphrasing Keith Smith and James A. Gentry observations, is possible to observe that Robichek et al. (Gentry, 1988; Robichek et al., 1965; Smith, 1973) tell about risk involved to financial debt level decisions, which must be accepted by financial institutions pledging of financial debt level of the nonprofit organization. Keith Smith (Smith, 1973; Gentry, 1988) predicted and Michalski (Michalski, 2008; Michalski, 2012) showed how portfolio theory may be used to decrease financial debt level risk. Debt to equity could be viewed in portfolio context as presented by Friedland (1966; Gentry, 1988). Pringle and Cohn (1974; Gentry, 1988) tried to adapt the CAPM theory to capital elements. Bierman and Hausman (1970; Gentry, 1988) discuss the granting policy of organization and shows that financial debt level policy requires balancing the future sales gains against possible losses. Lewellen, Johnson and Edmister (Lewellen, Johnson, 1972; Lewellen, Edmister, 1973) explain how and why traditional devices used for monitoring financial debt level should be changed by new and better ones. Freitas (Freitas, 1973) shows relation between debt and risk during financial debt level management. The question discussed in presented paper concerns the making decisions by nonprofit organizations in financial debt level area in connection with efficiency measures (Michalski 2016b).

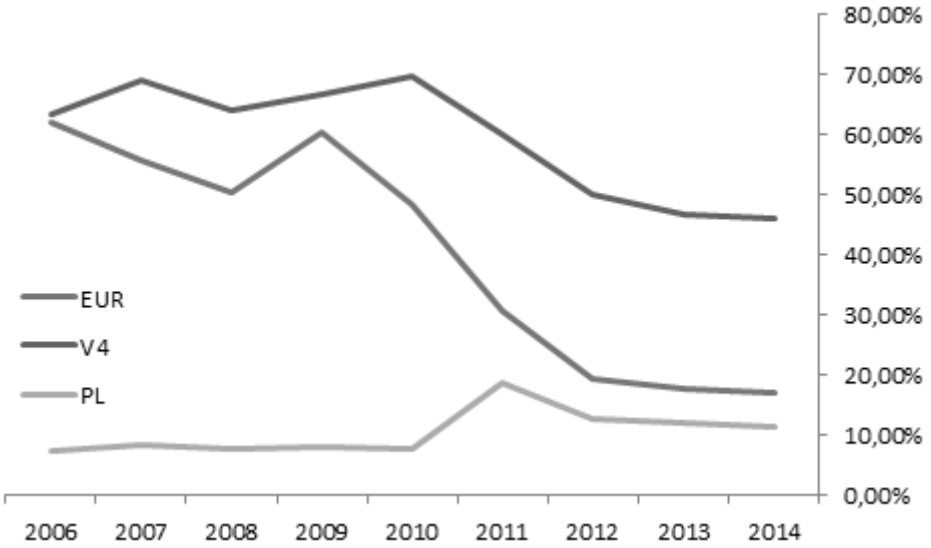
Table 1 The Relationships between Debt and Whole Capital in European, V4 and Polish Social Economy Entities

	2015	2014	2013	2012	2011	2010	2009	2008
EUR	36,20%	17,16%	17,75%	19,25%	30,66%	48,29%	60,39%	50,27%
V4	78,38%	45,92%	46,89%	50,17%	59,97%	69,66%	66,74%	64,24%
PL	17,82%	11,53%	11,99%	12,68%	18,56%	7,66%	8,07%	7,84%

Source: Database Amadeus product of Bureau van Dijk, [date: 2017 MAY 15]

As we can observe in Table 1. and Figure 1, the levels of debt to whole capital in social economy entities in V4 and European countries were higher in the time financial risk 2007 - 2012 period. That levels in Polish social economy entities looks different and that is an interesting observation, which illustrate general tendency of Polish social economy entities covered by Amadeus Database (probably also it is the truth also for whole population for Polish social economy entities).

Figure 1 DEBT to Capital Invested (Debt + Equity) Levels in Chosen European Social Economy Organizations



Source: own study based on data from 112000 social economy organizations reported in Database Amadeus product of Bureau van Dijk, [date: 2017 MAY 15]

There is difference in treating the entitlements of people who control organizations in prohibiting distribution of earnings and excess of revenues over expenses of organization: Equity type capital providers of for-profit firms can expect return money in case the business makes excess of revenues over expenses from operations. Social economy organizations do not have right to issue stock and equity of social economy organizations is issued by donors and persons who have no right to express control over the social economy organization. Equity type capital providers of social economy organizations in case the social economy organization generates money or excess of revenues over expenses from operations can consider additional support for organization but have no possibility to withdraw the money previously tied in organization. In social economy organizations, there is no equity capital but social economy organizations collect fund capital which is an equivalent of equity capital. Fund capital is collected in social economy organizations by earning excess of revenues over expenses, that are forced by regulation as money which should be retained within the social economy organization. Other source of fund capital is receiving contributions from individual persons or from private or public entities and from for profit businesses. The last possibility to collect fund capital are money from grants received by social economy organizations from governmental entities. Calabrese (2011) indicates that social economy capital structure choices are best explained using the pecking order theory. That means that in social economy organizations internal funds are used more likely than external borrowing.

Social economy organizations act because expected future advantages measured by realization of ideas and mission that are expression of donor's vision of the world. Both social economy and for-profit entities have an aim, which is a result of its owner preferences. For-profit organizations are active because of expected future advantages measured in money, non-profit organizations do their business because of expected future advantages measured by degree of realization of their mission.

Social economy organizations serve in each areas of social activities and depending on size can be registered or not in internal revenue authorities. Among social economy organizations can be listed: educational businesses like universities or schools, healthcare organizations like hospitals, charities working as religion institutions branches, etc.

Because of the benefits to the society generated by social economy organizations most governments allow tax exemptions both for donors and for the social economy organizations. Such tax exemptions are usually limited only to charitable social economy

organizations, which are listed on government records of such organizations that meet the condition for tax exemptions. Usually governments decide that according to their policy only the largest and the most useful for fixing society needs and most helpful for the people of society organizations have right for tax exemptions and of course the definitions and understanding of usefulness or helpfulness differ from country to country, and depends on dominating philosophy or religion of local societies (Michalski, 2016b). Tax exemption for the social economy organization could be for all money generated as profit in these organizations but more popular is solution where only profits that are effect of realization of programs or activities concerned on realization of the main mission of social economy organization are basis for tax exemption and other profits are subject of normal taxation. Such a solution helps to prevent situation when under social economy banner is hidden full for-profit activity not concerned on social needs and is not of help in leveling of disabilities of weaker participants of social interaction. Usually social economy organizations to keep tax exemption status are required to keep all excess revenues for the realization of the mission of social economy organization. There is not a custom among governments to allow social economy organizations to pay out money from excess of revenues over expenses to anyone who normally deserve it in for-profit entities. Board members, employees and clients of social economy organizations are excluded from receiving money that are larger than average expenses. Each amount of any money in social economy organizations should be directed to beneficiaries defined by the mission of social economy organization (Michalski, 2016b).

3 Conclusions

Polish social economy organizations are important part of general social policy in Polish economy. They realize important aims in healthcare, in education and many other socially important areas. Considering efficiency of social economy organizations, should be remembered that from the donor perspective, is important the way the managing team uses resources of the social economy organization and if it is used in the most effective way. The social economy organization efficiency should be considered in the context of the risk. The one from the most important way to be out from business is the lack of the money for realization of the aim of organization. In paper were considered relations between debt measures. That relation was also illustrated for Polish social economy organizations data.

Polish social economy entities covered by Amadeus database, reports different debt to whole capital relationship customs. Debt to whole capital levels in social economy entities in V4 and European countries were higher in the time financial risk 2007 - 2012 period. That levels in Polish social economy entities looks different and that is an interesting observation, which illustrate general tendency of Polish social economy entities covered by Amadeus Database (probably also it is the truth also for whole population for Polish social economy entities). After 2014 such tendency was changed in Polish social economy entities. Current policy of Polish **social economy** entities, that allows to use too much debt, is rather dangerous, and there is a need to increase level of understanding about risk and its destroying influence on possibilities of realization **social economy** organization mission.

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Determinants of Public Healthcare Units Indebtedness – the Case of Public Hospitals in Lodz

Katarzyna M. Miszczyńska

University of Lodz
Faculty of Economics and Sociology, Department of Public Finance
Narutowicza 68, 90-136 Lodz, Poland
E-mail: katarzyna.miszczynska@uni.lodz.pl

Abstract: *The performance of healthcare in Poland, compared with the EU countries, is far from satisfactory. The indebtedness of hospitals is one of the major problems to be solved by public administration. Hospitals as autonomous healthcare units are public units and are not subject to market mechanisms. Legal regulations widely determine their independence but limit responsibility for its implementation, which leads to their uncontrolled indebtedness. That indebtedness adversely affects not only the development of healthcare but also quality of provided medical services. Constant indebtedness of the units creates a need for finding its determinants. The aim of the research is an attempt to define some factors which determine indebtedness of public healthcare units (hospitals) in Poland. The study will cover units with a similar and thus comparable profile. The study was conducted between years 2007 – 2015 with help of econometric modeling. It should be stressed that the level of indebtedness of healthcare units, and at the same time, the efficiency of their performance vary. Based on preliminary research on determinants of indebtedness there should be mentioned the following most crucial factors: hiring medical personnel, average remuneration, bed occupancy, average stay in hospital, average number of patients per bed, days of treatment per person, founders.*

Keywords: health economics, indebtedness of hospitals, econometric modeling, healthcare in Poland

JEL codes: I11, I19, P46, C23

1 Introduction

Public hospitals in Poland are units of the public finance sector, and thus are obliged to manage the funds in a way that leads to achieving the best possible results at certain expenses. Therefore, it is decisive to justify the costs directly related to the actions undertaken in order to obtain the intended results.

The system of managing public funds is subject to constant transformations aimed at their most appropriate use. The necessity of effective spending of public funds is related to the need to ensure the financial security of public finance sector entities regardless of budget constraints or economic fluctuations. The changes taking place in recent years in the health care system have caused that health care units are in a new, sometimes quite difficult, financial and economic situation. An important role was played by the changes not only in the method of financing, but also the independence of public health care institutions, which in turn resulted in an increase in the responsibility of the management team for the results of the conducted activity. Constantly growing health needs, the changing demographic situation resulting in an often prolonging treatment process, technological progress in the field of highly specialized medical procedures and the associated increase in patients' awareness of the possibility of using them translates into an increase in the costs of health care facilities. All of this entails the need to use methods of rationing the costs of functioning of medical entities, and, as a consequence, improving the efficiency of managing the resources of public health care units. A prerequisite for effective functioning of health care institutions is the application of good management practices. The difficult financial and economic situation of public health care units, and in particular the problem of indebtedness, should be one of the most important problems to be solved by public administration. Hospitals that are public health entities are companies that are not subject to market laws. Legal regulation extensively determines their independence, and limits the

responsibility for using it, which results in generating costs that significantly exceed the revenues earned and, consequently, indebtedness. In some units this situation was not a one-time situation, which was caused by the conviction that due to the nature of the business and the existing situation, the situation will be repaired.

The lack of financial stability of hospitals impacts negatively on the quality of services provided and, consequently, on the development of health protection. Therefore, the aim of the article will be the identification of the factors causing the indebtedness of hospitals.

In the study, a research hypothesis was put forward that the growing indebtedness of hospitals is determined by appropriate management of the unit, referring to the financial and organizational sphere of the units.

In addition, the following detailed hypotheses have been put forward:

- H.1. Founding body has an impact on the debt of the hospital.
- H.2. Average length of stay affects the debt of the hospital.
- H.3. Changes in the current ratio affects the debt of the hospital.
- H.4. The amount of hospital beds has an impact on the debt of the hospital.

2 Literature review

Health sector, as a part of economy, is extremely important for economic development of the country. Problems concerning the performance of public healthcare units are widely analysed both by national centers [Jakimowicz 2011, Frączkiewicz-Wronka 2010] and foreign ones [Jena&Philipson 2013, Lupi et al. 2011]. Hence efficient, well organized performance of healthcare units is crucial not only from the perspective of patients' satisfaction but also from the perspective of managers (Opolski, Dykowska, Możdżonek 2009). The performance of healthcare in Poland, compared with the EU countries, is far from satisfactory, which was presented by Nojszewska's research (2011 b). Moreover, indebtedness of hospitals is one of the major problems to be solved by public administration. What is more, the indebtedness adversely affects not only the development of healthcare but also quality of medical services provided. The need for finding the determinants of their indebtedness is discussed nationwide (Skawińska 2009; Sowada 2012; Nojszewska 2011c i 2012; Ryć & Skrzypczak 2011; Misiąg et. al 2008; Rój&Sobiech 2006). Problems concerning the performance of public healthcare units are widely analysed both by national centres (Hass-Symotiuk 2011; Nojszewska 2011a; Golinowska 2006) and foreign ones (Alemi & Gustafson 2006; Martin & Smith 2012; Vanberkel et.al. 2012; Smith & Topol 2013; O'Neill L. et al. 2008; Carroll 2009).

The study presented herein contributes to the existing state of research by shedding light on a new set of determinants affecting the indebtedness of public general hospitals in Lodz, which may help in better management of these units.

3 Methodology and data

The aim of the study was to identify factors affecting the public hospitals' debt. The analysis was carried out on the basis of data regarding the operation of public general hospitals located in Lodz. The study was based on 12 public general hospitals differentiated by the founding body: poviat-commune, marshal's office and university. Due to the rejection of providing key financial and economic information for the analysis, the entities covered by the study do not constitute all such units in Lodz.

The data covers the period of 2007-2015 and was taken from hospitals' financial statements and Voivodeship Centre of Public Health.

The list of variables is presented in Table 1.

Table 1 List of Variables Used in the Model

Symbol	Description	Type
l_DEBT	Total debt ratio	Dependent variable
l_STAY	Mean length of hospitalization	Explanatory variable
l_CR	Informs about possibilities of repaying current liabilities	Explanatory variable
l_BEDS	Average number of hospital beds	Explanatory variable
l_UM	0-1 variable indicating a hospital whose founding body is the marshal's Office	Explanatory variable
l_PG	0-1 variable indicating a hospital whose founding body is the poviat or commune	Explanatory variable
l_UU	0-1 variable indicating a hospital whose founding body is the medical university	Explanatory variable

Source: own elaboration

The basic summary statistics are given in Table 2.

Table 2 Summary Statistics, Using the Observations 1:1 - 12:9

(missing values were skipped)

Variable	MEAN	MEDIAN	MIN	MAX
l_STAY	1,6816	1,7115	1,0607	2,2905
l_CR	-0,00611	0,10118	-3,0167	1,6789
l_DEBT	-0,3343	-0,49678	-1,8469	1,5424
l_BEDS	5,6279	5,7317	3,912	7,0049

Variable	S.D.	C.V.	SKEW	EXCSKURT
l_STAY	0,26534	0,15779	-0,32992	-0,54544
l_CR	0,91392	149,66	-0,77339	0,54842
l_DEBT	0,73553	2,2002	0,59709	0,27985
l_BEDS	0,69504	0,1235	-0,45139	0,24437

Source: own calculations in Gretl software

3 Results and discussion

For the purpose of identification of factors affecting public hospitals' debt econometric panel data modeling was conducted. The procedure was carried out on the basis of N=12 hospitals and T=9 observations over time period between 2007-2015 by means of fixed effects panel data model (FEM). The model that is subject to estimation can be written as:

$$l_DEBTt_{it} = \alpha_i + \beta 1\ l_STAY_{it} + \beta 2\ l_CR_{it} + \beta 3\ l_BEDS_{it} + \varepsilon_{it}, \quad (1)$$

where:
l_STAYit –debt ratio of *i* hospital in period *t*,

l_DEBTit –debt ratio of *i* hospital in period *t*,

l_CRit – current ratio *i* in period *t*,

l_BEDSit – average number of hospital beds *i* in period *t*,

β1, β2, β3, β4 – structural parameter of the model,

αi – fixe effect for hospital *i,*

εit – terror term.

The choice of a fixed effects model for hospitals can be argued in the following way. Uncontrolled differentiation of debt ratio between hospitals (i.e. intergroup differentiation characteristic for panel data) can be a cause for heteroscedasticity of a random element Controlling differences between units is possible thanks to using fixed or random effects panel models (Dańska-Borsiak 2011). Such models take into account occurrence of constant over time, unobservable differences between objects (units). In case when a number of objects is small (N < 20), and their specification indicates that they represent a finite set of unique and inimitable categories, it is preferable to use fixed effects (Łaszkiewicz 2016). In this study a need to introduce fixed effects for hospitals was additionally confirmed by the results of the Wald test on differing group intercepts (differing group intercepts).

Null and alternative test hypothesis can written as:

$$H0 : \alpha i = \alpha = const,\ i = 1,\ldots, N,\ t = 1,\ldots, T \quad (2)$$

$$H1 : \exists\, i, j:\ a_i \neq a_j. \quad (3)$$

In accordance with the null test hypothesis there is no need to introduce specific effects for hospitals. On the other hand, the alternative hypothesis stipulates that intercepts for objects are not equal.

The test statistic for differing group intercepts has reached the level of 17,3523, which proves that null hypothesis mentioning a lack of intergroup differences should be rejected (see Table 3).

Table 3 Test for Differing Group Intercepts

Test for differing group intercepts Null hypothesis: The groups have a common intercept Test statistic: F(11, 92) = 17,3523 with p-value = P(F(11, 92) > 17,3523) = 4,88332e-018

Source: own calculations in Gretl software

Therefore, the estimation of panel FEM model parameters was performed. Additionally, test for normality of residuals was conducted, according to which there were no reasons to reject the null hypothesis stating that a random element has a normal distribution. (see Table 4).

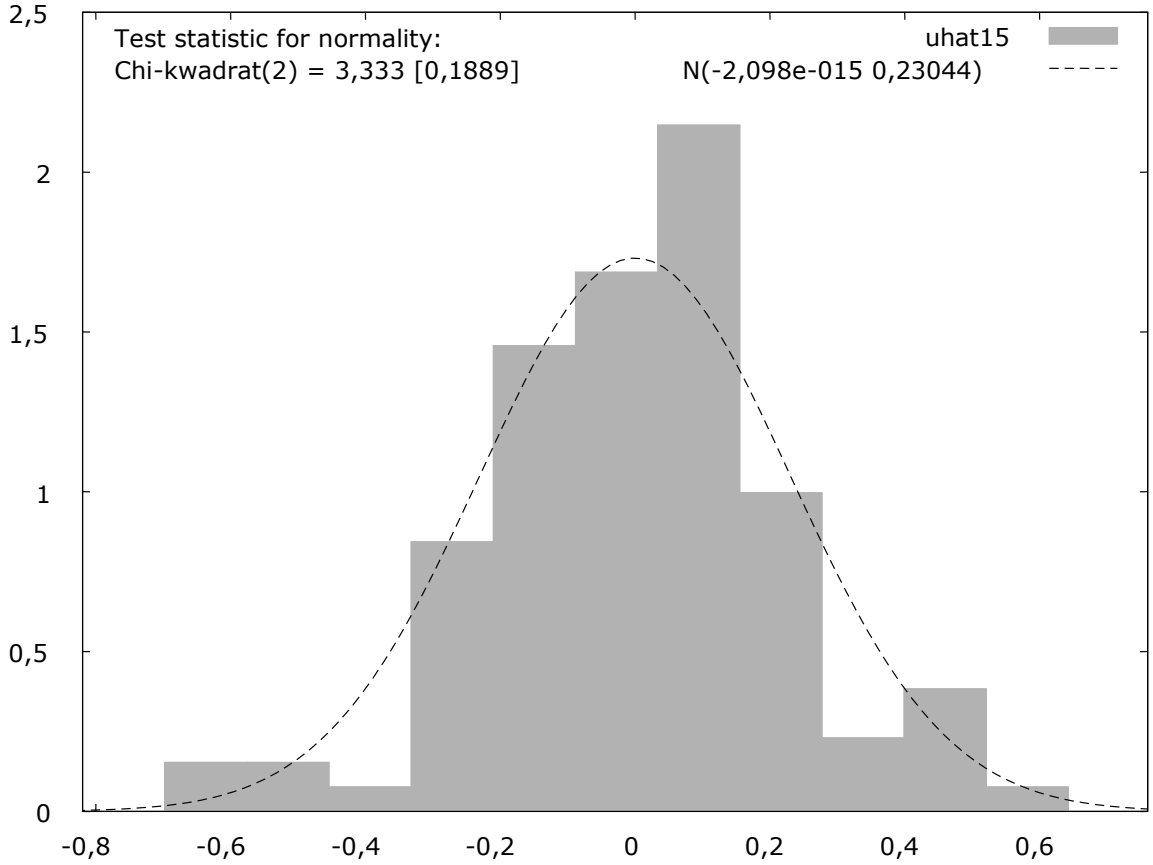
Table 4 Normality of Residuals – Test Results

Test for normality of residual - Null hypothesis: error is normally distributed Test statistic: Chi-square(2) = 3,333 with p-value = 0,1889

Source: own calculations in Gretl software

The graph below presents the results of normality of residuals test graphically (see Figure 1).

Figure 1 Normality Test



Source: own calculations in Gretl software

Results of calculations obtained by means of Gretl software on the basis of fixed effects panel model (FEM) using 107 observations are presented in the table below. The values t-Student statistics and p – values indicate that all variables are statistically significant. The model's fitting is satisfactory, with R-squared of approximately 90%. Results of estimation are presented in the table below.

Table 5 Results of Model Estimation.

Model: Estimation Fixed effects using 107 observations
12 units of cross-sectoral data were included
Time series of length: minimum 8, maximum 9
Dependent variable (Y): l_DEBT

	coefficient	**Std. error**	**t-ratio**	**p-value**	
const	-5,50015	1,19312	-4,610	1,30e- 05	***
l_STAY	0,728515	0,337706	2,157	0,0336	**
l_CR	-0,187038	0,0630249	-2,968	0,0038	***
l_BEDS	-0,701336	0,184723	3,797	0,0003	***

Source: own calculation in Gretl software

Based on estimations of model parameters it is clear that increase of a patient's stay in hospital by one unit causes, with other unaltered factors, increase in debt ratio by 0.72 unit. It is highly justified as a longer stay in hospital causes a decrease in bed occupancy rate, lowers capacity, which as a result contributes to an increase in costs and thus indebtedness.

Increase of the liquidity ratio by a unit causes a decrease in indebtedness by 0.18 unit ceteris paribus. Therefore, when the liquidity ratio grows, it translates into a decrease in debt ratio. Analysed hospitals are in a very bad financial condition. They often take new liabilities to repay the previous ones. In such a situation liquidity does not improve.

Moreover, the increase of a number of hospital beds by one unit causes, with other unaltered factors, decreases in debt ratio by 0.70 unit. Hence, if hospitals have more beds they can cure more patients and as a result they get more money from National Health Fund.

What is more, according to the results obtained from the model, the funding body does not have any impact on the level of hospital's indebtedness.

4 Conclusions

Efficient, well organized performance of healthcare units is crucial not only from the perspective of patients' satisfaction but also from the perspective of managers.

The conducted study has shown dependencies between financial and non-financial ratios as well as their impact on financial condition of hospitals measured by means of total debt ratio.

Presented results indicate that hospitals' indebtedness measured by the debt ratio is related to an average length of patient's stay in hospital, the current liquidity ratio as well as an average number of beds in hospital. Obtained results of estimations of model parameters are marked in line with expectations.

Based on the conducted study all detailed hypotheses have been verified. Hence:

H.1. Founding body does not have any impact on the debt of the hospital.
H.2. Average length of stay affects the debt of the hospital.
H.3. Changes in the current ratio affects the debt of the hospital.
H.4. The amount of hospital beds has an impact on the debt of the hospital.

All in all, it should be underlined that on the basis of conducted study the main hypothesis has been verified positively. Hence, the growing indebtedness of hospitals is determined by appropriate management of the unit, referring to the financial and organizational sphere of the units.

An attempt to identify factors that determine the process of units' indebtedness, which was presented in this paper, will be a starting point for further, more advanced studies in the area of financial management of public hospitals in Poland.

Acknowledgments

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Profitability Forecast for Assessment of Investment Project in Banking

Piotr Miszczyński

University of Lodz
Faculty of Economics and Sociology, Department of Operations Research
Rewolucji 39 , 90-214 Lodz, Poland
E-mail: piotr.miszczynski@uni.lodz.pl

Abstract: *The aim of this paper is to present the results of evaluation of a bank investment project. The main result of investment in a new banking project is the so-called a customer portfolio that has a suitable risk structure and profitability. Therefore it is important to estimate the profitability of current sales of currently developed banking products. Thanks to the fast and accurate ex ante profitability estimation tool, an ongoing assessment of the profitability of new banking products, especially loans, is possible. On this basis, price and risk pricing decisions allows to create a reasonably profitable portfolio that affects the value of the bank being built. In the paper there are the sample results of the metamodel profitability simulation tool presented and the accuracy measures of the obtained results.*

Keywords: simulation metamodel, profitability prognosis, investment valuation, bank project evaluation

JEL codes: C63, G17, G21, M10, M13

1 Introduction

The issue of evaluation of investment projects is widely and multi-faceted considered in the literature. In the classic approach, an investment can be defined as capital expenditure in order to achieve a positive financial effect in a given time. Organization in order to achieve the intended effect within the intended time is defined as a project that can be divided into stages: pre-investment, implementation and exploitation (effect). (Manikowski, 2010, pp. 7-17) In this paper, attention is focused on building the future value (effect) of investments in the quantitative assessment of investment projects. In projects concerning the generally understood financial sector, in particular in banking, considerations on value building and profitability assessment of projects are of key importance. Creating the value of a new banking project takes place, among others by building so-called loan portfolio (Marcinkowska, 2003). Each loan granted is characterized by a different risk and a different level of profitability (Krysiak, Staniszewska, Wiatr, 2015]. By appropriate classification of granted loans from the point of view of price parameters and risk assessment, one can estimate the potential revenues and costs associated with them. The ex ante forecasts of profitability for individual loan agreements resulting from such analysis are appropriately aggregated in order to assess the structure of the new bundle entering the portfolio. Thus, a tool is created thanks to which it is possible to manage the process of building the value of the loan portfolio on an ongoing basis, seen in this case as a result of a new investment project.

This paper presents the financial assessment tools for newly created credit products as well as the practical aspect of their use in making management decisions. The assumptions of the general model of single loan profitability estimation and its input and output parameters are described first. Next, the problems related to its practical application and the resulting need to apply the so-called metamodel to improve the process of providing management data. The concept of the metamodel's operation was described and the several variants of its construction were compared depending on the estimation methods used, i.e. decisional trees, random forests, linear regression, neural networks, interpolation. Due to the requirements for the metamodel, the measure of errors was used for the evaluation of variants.

2 Model, metamodel and criteria

In the original financial model under consideration, profitability for individual loan agreements is calculated. The model estimates ex-ante profitability both in whole and in individual sub-periods (months, years) of the duration of the contract. Loans starting in a given period (usually in a given month) form the so-called a bundle whose basic parameters (eg capital due to a bank under a loan agreement) are modeled in the following months until "expiration" (zeroing) in subsequent periods.

Assumptions

The original financial model is based on the forecast of future cash flows resulting from the repayment schedule, interest income, assumed commission income, estimated risk costs in particular periods and other factors resulting from the regulation of banking activity, eg the capital adequacy ratio. The described model is deterministic (lack of a random component causing repeatability of results with the same input parameters), while risk-related factors (eg risk related to delays in loan repayment) are estimated in another (external) model and inserted into the described model as average input parameters. The described model gives the possibility to calculate profitability for a single contract as well as for an aggregated beam. The model has been implemented in MS Excel due to the universality of this common tool.

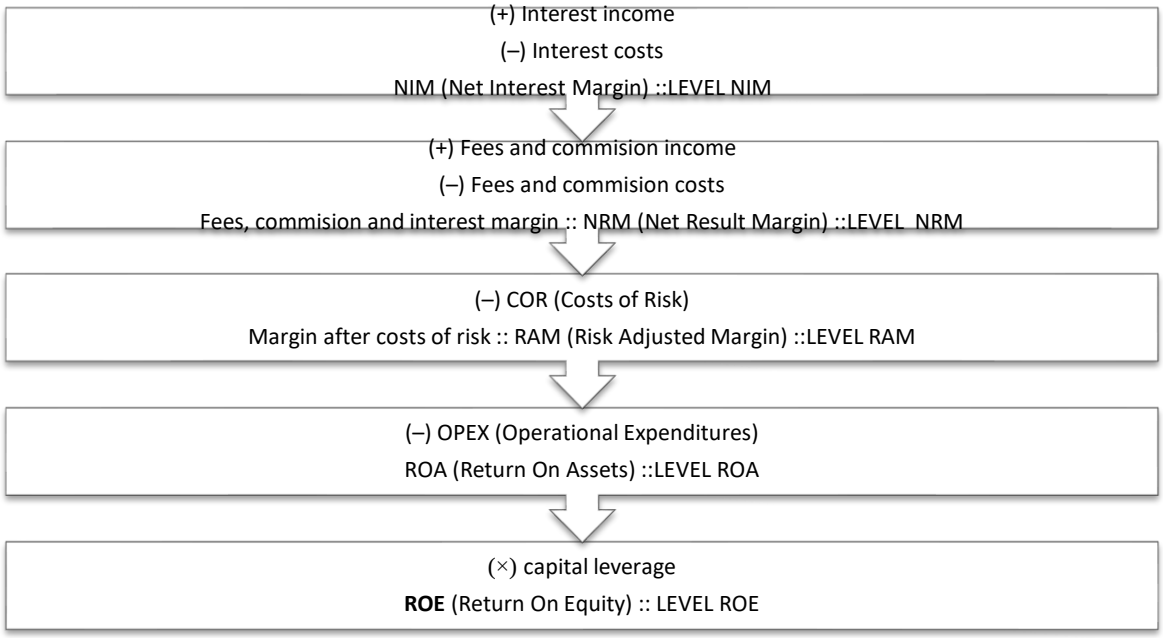
Inputs

The selection of input parameters to the model results both from the nature of banking operations, which is largely regulated in Poland, as well as from market conditions and policy in the scope of risk management (risk management aspect) and operating costs (the aspect of operating cost optimization). Generally, parameters can be divided into several groups, which may have different numbers depending on the level of detail of the adopted model. And so you can distinguish a group of parameters directly related to a given loan agreement, ie. the basic parameters regarding the loan agreement (amount, duration, interest rate, commission, additional commission components). The next group of parameters is mainly related to operating costs in the division, for example, into the sales channel. The next group are parameters related to risk assessment (eg customer score category, collateral). Despite the general classification, it should be mentioned that the model works in many aspects and parameters from a given group may affect many components of the model (eg. the scoring category given to the client in the application process will affect both the assessment of the risk costs and operational costs related to the service credit agreement).

Profitability ratio as a decision criterion

Profitability can be examined at various levels, depending on the information the decision maker wants to achieve. Each subsequent component taken into account when assessing profitability may unnecessarily distort the information. And so we can consider profitability at the first level, NIM (Net Interest Margin - net margin), i.e. the one resulting directly from interest and commission income and costs. The next level includes COR costs (Costs of Risk) resulting from national regulations and the risk management policy adopted by the bank. The next level, ROA (Return on Assets), allows you to assess profitability after taking into account the operating costs of the so-called OPEX (Operational Expenditures). The last ROE (Return on Equity) expresses profitability after taking into account all of the listed components and the capital requirement resulting directly from the bank's internal regulations and policies. It is worth mentioning here that the capital requirement varies depending on the purpose of the loan and possible collateral. The diagram below (Diagram 1) illustrates the successive levels of the loan profitability test.

Figure 1 Profitability Levels



Source: own study based on (Marcinkowska, 2003 pp.119-130)

Estimating profitability using a metamodel

The concept of a metamodel in a nutshell consists in creating an alternative model to the original model, which is based on the same batch data used in the original model, and will generate very similar results to those generated by the original model. To estimate metamodel parameters, the input and output data from the original model should be used (Kaminski B., 2015a; Barton R., State P., 2010) The process of calculating profitability without using the metamodel concept can be described by four steps: 1. The appearance of new contracts in the database system; 2. Collection and preparation of data from a given period (month) to calculations (semi-automated process); 3. Conversion of the profitability of new contracts or the whole aggregate bundle (semi-automated process); 4. Aggregation of results and report generation (semi-automated process).

The reasons for the use of the metamodel

The main reasons for the use of the metamodel concept is the significant acceleration of the computational process and the automation of the calculation process at the database level. The calculation process using the "large" primary model is a labor-intensive process that involves the analyst's work. In addition, due to the constraints of MS Excel, in which the original model is implemented, it is difficult to automate at the database level. The scheme of the profitability calculation process, which can be much more efficient thanks to the use of the metamodel, can be described by 3 steps: 1. The appearance of a new contract in the system; 2. Automatic conversion of the profitability of a new contract using a metamodel; 3. Aggregation of results and generating a report at any time based on a "dump" from a data warehouse (Automatic process in any BI-Business Inteligence system)

Different approaches to building a metamodel

The metamodel concept does not impose either the form or estimation methods in its creation. In the course of work on the implementation of the metamodel concept, different approaches were considered (described below). Due to the basic purpose of this work, which is to indicate a new application for the metamodel concept, the calculations have been made as simple as possible. Therefore, for the purposes of this work, an exhaustive description of the methods has been abandoned, assuming that the most common and classic variants of the proposed methods have been applied to well-known and described in the literature.

At the beginning of the research on finding the best form of the metamodel, a regressive approach was used to analyze profitability in banking. This approach has been called the "magic formula", because it was supposed to be based on a simple equation / equations for calculating the output parameters. A multiple regression method and a neural network method were used to implement this approach. Testing different forms and variants of the proposed methods, the simplest single equation regression model was finally used, whose parameters were estimated using the classical method of least squares. However, when testing different variants of neural networks, ultimately, a multi-layered one-way network with a linear activation function was chosen (Gajda, 2001, pp.215-244, Ripley, 2016)

The second approach has been dubbed the "classification" table understood as a set of rules by which single loan agreements can be classified to a given profitability range based on the value of input parameters. The classification tree method was used to implement this approach (Therneau, Atkinson, Ripley, 2017) and the developed method of random forests (Liaw, Wiener, 2015). The random forest method, which de facto generated several hundred decision trees based on randomly selected subsamples and input parameters, could be applied due to the large sample size and a large number of input parameters (Williams, 2009, p.50).

Another interesting way to solve the problem of accuracy was to use the kriging proposed eg in the work of Bogumił Kamiński (Kamiński, 2015a). Therefore, the scope of the tested methods was extended to include interpolation methods, in particular the kriging method.

Criteria for estimating the results of the estimation

Another extremely important stage in the implementation of the metamodel concept was the development of appropriate methods for assessing the practical applicability of the various approaches. For this purpose, apart from the classic methods of evaluating particular models, additional comparative criteria were developed for the results of models obtained using various methods. In the end, following assessment criteria were used:

- Minimization of the maximum deviation for a single case

$$K_1 \to \min, \qquad K_1 = \max\left|y_n - \hat{y}_n\right| \tag{1}$$

where: $\hat{y}_n$ - the resulting value for the metamodelu; y_n - the result value for the original model

- Minimization of the number of outliers for a set deviation threshold δ (Kamiński B., 2015b)

$$K_2 \to \min, \qquad K_2 = \sum_n f(y_n), \qquad f(y_n, \hat{y}_n) = \begin{cases} 1 & dla \quad \left|y_n - \hat{y}_n\right| \geq \delta \\ 0 & dla \quad \left|y_n - \hat{y}_n\right| < \delta \end{cases} \tag{2}$$

- Minimization of mean average absolute error - MAPE (Gajda J., 2004)

$$K_3 \to \min, \qquad K_3 = \frac{1}{N}\sum_n \left|y_n - \hat{y}_n\right| \tag{3}$$

- Observation of outliers of rest modules (Gajda J., 2002, s.234-237)
- Observation of the forecast-implementation graph(Gajda J., 2002, s.235, Hussain et al., 2002)

The application of the criterion of minimizing the maximum deviation for a single case results from the nature and purpose of the calculations. It is important that the metamodel gives comparable results to the original model for each individual case. For the purposes of decision-making analyzes, the results of the estimation can be aggregated in many areas and to a different extent, therefore, possible too large discrepancies for a single case may distort the image significantly. It is equally important that too many cases do not deviate from the indicated acceptable deviation value, hence the criterion of minimizing the number of outliers. The application of the other two criteria is of a control nature.

3 Results and Discussion

Calculation for individual methods were made in the R program on a sample of loan agreements launched in a new bank. Calculations for the metamodel constructed using the kriging method were used in the 'DiceKriging' library. (Roustant et al., 2015). The calculations for the remaining methods were made using the 'Rattle' supplement (Williams GJ, 2009) and the R program libraries implemented in this appendix: ia: Package 'rpart' (Therneau T., Atkinson B., Ripley B., 2017), Package 'randomForest' (Liaw A., Wiener M., 2015), Package 'nnet' (Ripley B., Venables W., 2016). The results of the estimation were also transferred to Excel and the results obtained using different methods were compared.

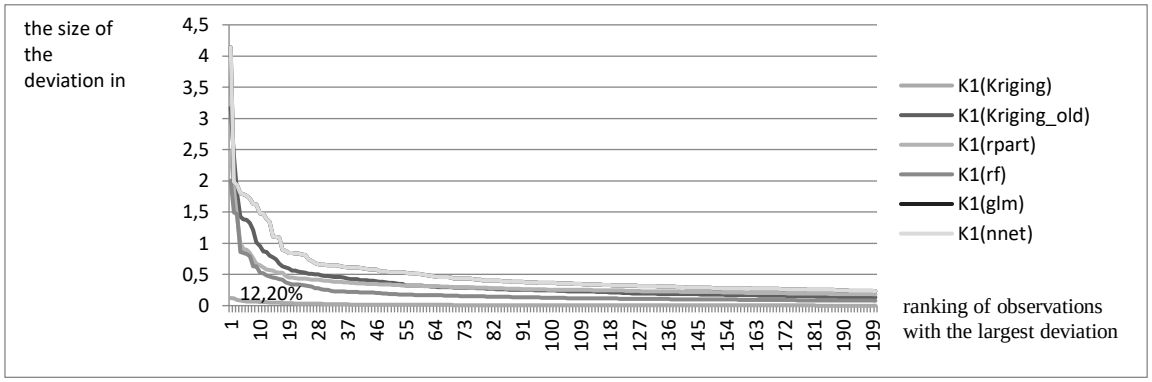
Comparisons of metamodel construction methods were made using the five criteria described above. In particular, criteria 1-4 (K1, K2, K3, K4) are based on the deviation between the value obtained by means of metamodel and the original model (financial model implemented in Excel). Because metamodel and primary model results are tested for the ROE expressed as a percentage (%), deviations will be measured in percentage points (pp.). The fifth criterion is based on the observation of the "forecast - execution" graph where the "forecast" is the result obtained with the help of the metamodel and the "execution" result obtained with the help of the primary model.

Comparison by means of five criteria indicates that the best accuracy was obtained by means of the kriging method (after applying the selection procedure of the learinig sample). Among other results, classification methods (classical classification tree and random forests) obtained better accuracy than regression methods, neural networks and kriging without applying the selection procedure of the learning sample (in the charts described as kriging_old).

Chart 1 shows deviations of results for individual observations arranged in descending order according to the first criterion of evaluation (criterion K1). Chart 1 shows that the largest deviation for the kriging method is 12.2 pp for the tested sample. which is definitely a better result than for other methods.

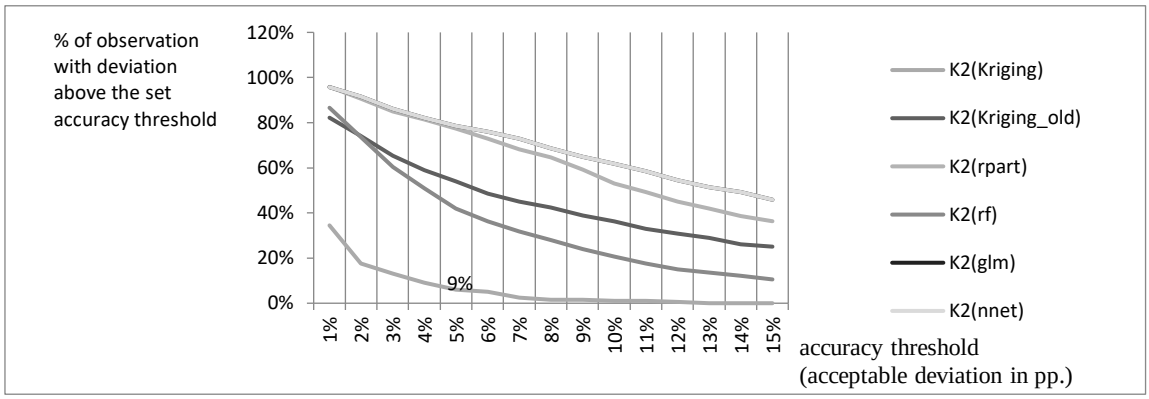
Chart 2 shows how many percent of the sample exceeds the set threshold for the deviation amount, according to the second evaluation criterion (criterion K2). Chart 2 shows that only 9% of results obtained using the kriging method deviate more than 5 pp. from values obtained using the original model (financial model implemented in Excel)

Figure 2 Comparison Using the Criteria for Minimizing the Maximum Deviation for a Single Case and Minimizing the Number of Outliers



Source: own calculations.

Figure 3 Comparison Using the Criteria for Minimizing the Maximum Deviation for a Single Case and Minimizing the Number of Outliers

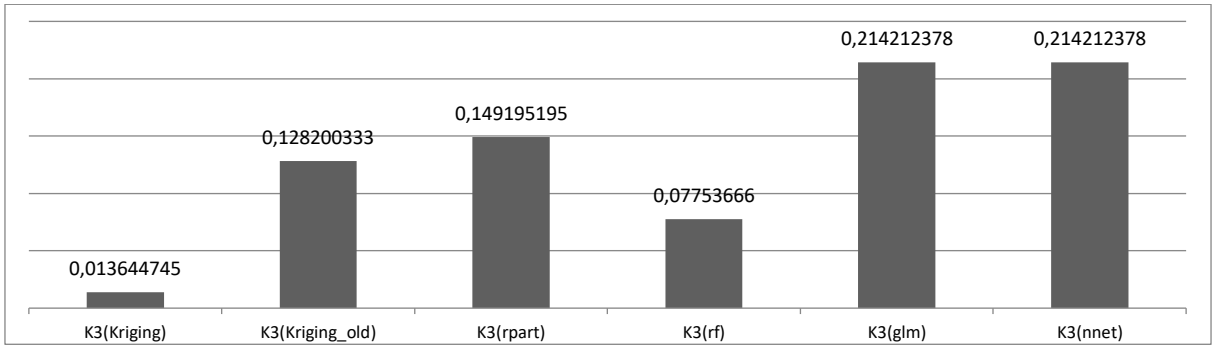


Source: own calculations.

The general observation resulting from the observation of graphs 1 and 2 indicates a significantly lower position of the curve for the kriging method, which proves the greater accuracy of this method than the others.

Comparison with the mean average absolute error criterion indicates the best indicator value for the kriging method (Figure 3). Indication with this criterion coincides with the previous results, which suggests the correctness of the first two criteria.

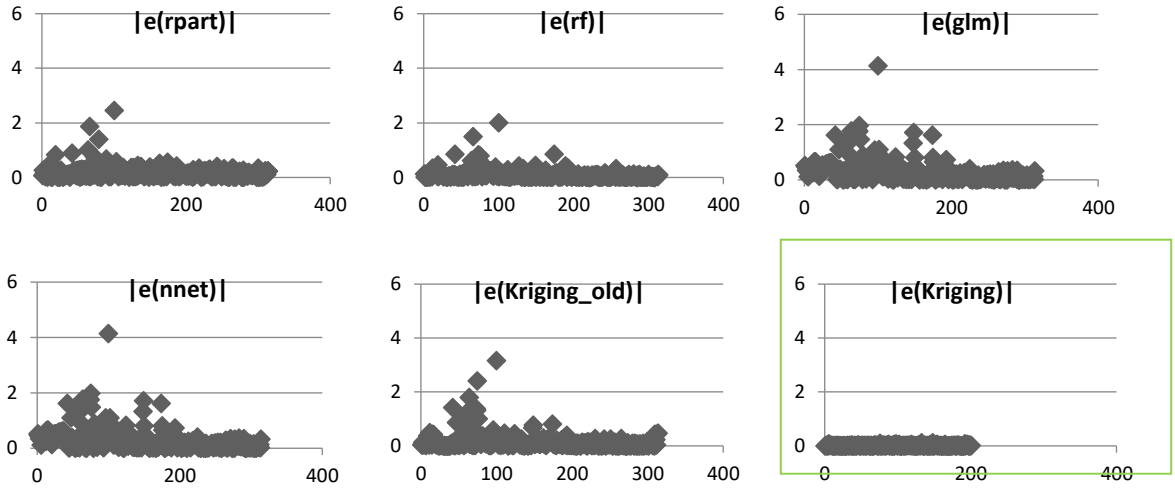
Figure 4 Comparison with the MAPE indicator.



Source: own calculations

Residual module charts also indicate the highest accuracy of the kriging method. In the graphs below (graphs 4-9), a smaller number of outliers and smaller deviations for the kriging method are clearly visible.

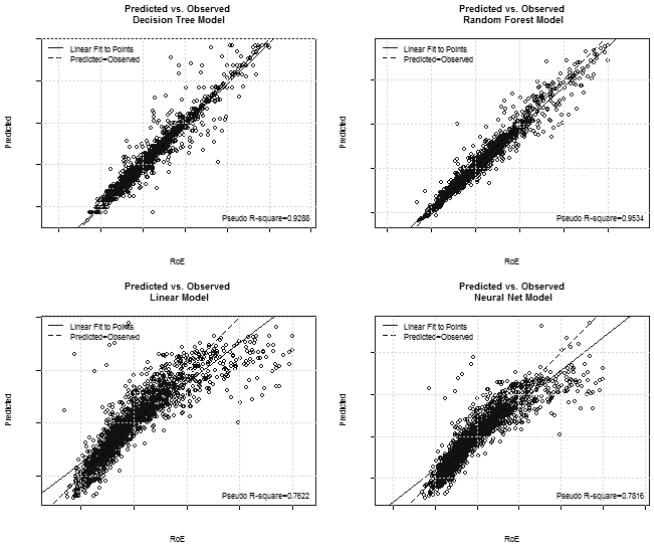
Figure 5 Deviation Modules for the Methods Being Compared.



Source: own calculations.

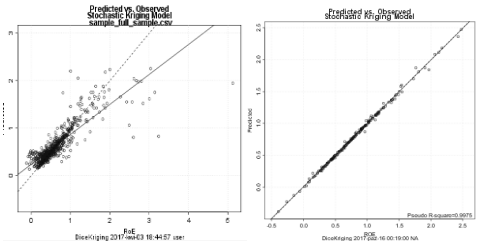
In order to better illustrate the accuracy of the methods, the "forecast- execution " charts of the results of the primary model and the metamodel obtained using the tested methods are presented. The graphs below clearly show that the results obtained using the kriging method are much better than the results obtained using other methods. Particularly visible is the relatively small dispersion of kriging results beyond the line that determines the coverage of the results of the metamodel and the main model. In turn, the linear regression model and the neural network tend to give forecasts overestimated at the center of the distribution and at the underestimated at its extremes. In addition, the kriging method does not generate outliers, which is its special advantage.

Figure 6 Graphs Matching Data from Metamodel and the Original Model



Source: own calculations in R, Rattle package

Figure 7 Graphs Matching Data from Metamodel and the Original Model for Kriging



Source: own calculations in R

4 Conclusions and future research

The metamodel concept has been successfully implemented, significantly accelerating the process of calculating profitability for individual credit agreements. The subsequent aggregation of results allows for detailed and multifaceted analysis of the effect of an investment project which is the construction of a profitable loan portfolio. The results obtained should be considered satisfactory. There is need to improve the metamodel's accuracy, the results of metamodel analyzes should have similar accuracy to the results of the original model. As part of the work, it was assumed that for practical applications a maximum of 5% difference between the results of the metamodel and the original model is required. Of course, this is not a strictly defined limit of acceptability and can be interpreted differently due to the specificity of the evaluation criterion.

This work focuses on presenting the concept of solving the problem. The challenge is to achieve satisfactory accuracy at all levels of the profitability ratios tested. The challenges also include the need for efficient recalibration of metamodel parameters in the case of changes in the original model that involve a change in the value of the resulting variables.

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Effects of Financial Accounting Harmonization on Agribusiness

Lukáš Moravec[1], Jana Hinke[2], Gabriela Kukalová[3], Zuzana Tichá[4]

[1,3] Czech University of Life Sciences
Faculty of Economics and Management, Department of Trade and Finance
Kamýcká 129, 165 21, Praha 6
E-mail: LukasGM@gmail.com, kukalova@pef.czu.cz

[2,4] University of West Bohemia
Faculty of Economics, Department of Finance and Accounting
Univerzitní 22, 306 14, Plzeň
E-mail: hinke@kfu.zcu.cz, susann.t@seznam.cz

Abstract: *Financial accounting is the most important tool for determining the financial position and performance of agricultural business. However, this is increasingly subject to the harmonization process. The first effort to harmonize financial accounting in Europe took place in the 1950s after the signing of the Treaty of Rome, and has been ongoing since then. Harmonization is currently being promoted through EU directives that are changing national legislation. The aim of this contribution is to quantify the impact of important changes (in financial accounting between 2004 and 2017) on the financial position and performance of agricultural business.The impact of the changes was quantified using the average values of a sample of 100 selected entities across the Czech Republic (i.e., joint stock companies, limited liability companies and cooperatives with primary agricultural activity). Average values are presented in the tables so that the effect of the change on the balance sheet and profit can be demonstrated. The data wereobtained from the collection of commercial register documents. Important changes (specific for agriculture) have been found: valuation of assets, reporting of preferential limits, depreciation of permanent crops on foreign land and valuation of inventories of own production, reporting a change in their amount.*

Keywords: accounting, agriculture, changes, harmonization.

JEL codes: M16, M21, M41

1 Introduction

For the past several decades, the world economy has been strongly influenced by the globalization processes. The process of globalization lies in a significant increase incross-border activities, particularly the movement of goods, capital and the workforce. Businesses have the chance to operate in international markets and investors also invest money in farawaycountries. For these investors, it is essential to gain relevant economic data, on which their investment decision making is based. The relevant sources of economic information include accounting data, mainly financial statements and extensive commentary (Vallišová, Dvořáková, 2012). In the past, national accounting regulations were laid downby the legislation of the particular country, which resulted in major divergences. However, in a globalized environment, accounting regulations defined within national legal frameworks are insufficient (Strouhal, Horak, Boksova, 2017). It is important that all existing (internal and external) as well as potential users get data about the financial position and performance of a company in a format that they will understand.

For that reason, the objective of this article is to describe significant changes to the Czech legislation pertaining to financial accounting in the Czech Republic in 2004 – 2016, define the changes that occurred as a result of harmonization, i.e., the application of Directive 2013/34/EU of the European Parliament and of the Council, and also quantify the impact of the most significant changes on the financial position and performance of agricultural businesses.

2 Methodology and Data

The Desk Research method, based on acomparative analysis of the primary data in Czech legislation, was used in compiling the description of the year-over-year changes. A sample of 100 agricultural businesses using the system of double-entry bookkeeping according to Czech legislation was used to quantify the impact of the said changes on the financial position, performance (or turnover) and financial analysis indicators. The analysis was based on the companies' data available in the Albertina database.

The authors first determined whatscientific research in the area of the harmonization of accounting data and its impact on national accounting regulations has been conducted so far. The following table details the comparison of resources published in the Web of Science and Scopus databases.

Table 1 Research Studies on the Harmonization of Accounting Data and the Impact on National Accounting Regulations

Author	Focus of the study	Type of research	Goal
Procházka, D. (2017)	Consequences of Accounting Harmonization in a Transition Country	Logistic regression model	To provide evidence that subsidiaries under foreign control steadily integrate IFRS
Carneiro, J., Rodrigues, L., Craig, R. (2017)	Assessing international accounting harmonization in Latin America	Interviews with key informants to assess accounting harmonization in the 13 countries	To confirm or rebut the theory: it will be difficult to achieve material harmonization in GLASS countries
Sforza, V.,Cimini, R. (2017)	Central government accounting harmonization in EU member states	Six variables from the World Bank database, correlate with the quality mechanisms	To confirm or rebut the hypothesis:independent of the basis for accounting the WB, the quality of enforcement mechanisms will affect the magnitude of adjustments
Agasisti, T. (2016) + Marion, B. S. (2016)	Public Sector Accounting and Auditing in Europe. The Challenge of Harmonization	comparative analyses	Estimation about the "readiness to change" of the current public administrations in all the 14 countries
Černý, V. (2016)	State subsidies in the Czech Republic and in accordance with IAS/IFRS	comparative analyses	To quantify of the impact of reporting subsidies on enterprises
Habanec, P., Bohušová, H. (2017)	Deferred tax materiality reporting in accordance with Czech national legislation and with IFRS	Comparative analyses, time series analysis	To determine the effect of the financial reporting system on deferred tax reporting
Karwowski, M. (2017)	Role of accounting in supplying information relative to the trend toward convergence	Review of publications	To identify a possible use of accounting in studying the business models of companies operating in the selected industry

Source: own processing (2018)

3 Results and Discussion

The first step towards achieving the set goal is to describe the year-over-year changes in Czech regulations pertaining to financial accounting in 2004 – 2016, which was done by way of a comparison table summarizing the significant changes that have an impact onthe financial position (balance sheet), performance (profit and loss statement), and at the same time the quality of the companies' financial reporting. The last column in the table contains anassessment of whether these changes are primarily associated with companies conducting agricultural activity. This specification is important for the next step – quantification of the impact of the changes on the financial position and performance of agricultural businesses.

Printed in bold in the table below are the changes that occurred due to harmonization, or the application of Directive 2013/34/EU of the European Parliament and of the Council.

Table 2 Comparison Table of Year-over-year Changes in Legislation

Change/Impact on:	Balance sheet	Income statement	Quality of reporting	Agribusiness companies
Year-over-year changes in 2003 - 2004				
Determining the valuation method for a set of assets	x	x	x	x
Change in the method of valuation of short-term securities, derivatives, and receivables for trading	x	x	x	
The possibility of depreciation of capital improvements	x	x	x	
The obligation for certain entities to account for deferred tax	x	x	x	
Year-over-year changes in 2004 - 2005				
Emission allowances and preferential limits – reporting, accounting and valuation	x	x	x	x
New requirements for the contents of the notes to a financial statement			x	
Year-over-year changes in 2005 - 2006				
Statement of available-for-sale securities valuation		x	x	
Reporting exchange rate differences	x	x	x	
Year-over-year changes in 2006 - 2007				
Deferred obligation to transition from single-entry bookkeeping to double-entry bookkeeping	x	x		
Year-over-year changes in 2007 - 2008				
The possibility of reporting in the order of millions of CZK in financial statements			x	
Livestock reporting – changes in terminology			x	

Business and company share valuation in dissolved entities	x		x	
Depreciation of permanent crops grown on leased land	x	x	x	x
Specification of the accounting procedure related to subsidies	x	x		x
Year-over-year changes in 2008 - 2009				
Valuation of CZK 1 for certain types of assets	x		x	
Component spare parts accounted for in stock	x			
Accounting for capital funds in the event of company transformation	x			
New requirements for the contents of the notes to a financial statement			x	
Component depreciation method	x	x	x	
Year-over-year changes in 2010 - 2011				
Method of foreign currency conversion	x	x	x	
Depreciation period of goodwill and valuation differences on acquired assets	x	x		
Year-over-year changes in 2011 - 2012				
Specification of the stocktaking procedure			x	
Creating reserves for the purpose of income tax	x	x	x	
Year-over-year changes in 2015 – 2016				
Determining own costs incurred	**x**	**x**	**x**	**x**
A new definition of reserves			**x**	
Change in inventory level and activation as costs correction		**x**	**x**	**x**
Valuation of own costs in connection with inventory of own products		**x**		**x**

Source: own processing in accordance with legislation valid in the particular year (2018)

According to the table, it is clear that the largest number of changes since 2003 took effect on January 1, 2016, as a result of the incorporation of the EU Directive into the national legislation of the Czech Republic. On the other hand, the years 2013 and 2014 brought no substantial changes in accounting or financial reporting.

From the aforementioned information it can be inferred that the specific aspects of accounting in agriculture are:

1) the valuation method for a set of assets – change from 2004,
2) reporting of preferential limits – change from 2005,

3) depreciation of permanent crops on leased land – change from 2008,
4) valuation of inventory of the company's own products and reporting changes therein – change from 2016.

The effect of these changes on the financial position, performance (or turnover) and financial analysis ratio indicators of agricultural businesses will also be quantified.

Valuation of a set of assets

In agriculture, it is rather common to purchase multiple assets at the same time, without knowing the price of each asset individually. A typical example is the purchase of an orchard, which can be subdivided into the real estate and the individual trees or bushes,which can be accounted for as a long-term asset under "Permanent crops". Until the end of 2003, the law mandated these assets to be valued as a set of assets, using the methods applicable at the time. However, the relevant regulation did not specify a clear procedure on how this set of assets should be valued. It was up to the individual accounting unit how it would valuate this set of assets. In practice, the common practice was to use the method of breaking down the purchase price based on the accounting unit's estimate. In 2004, this method was incorporated into the Act on Accounting, which introduced the principle of proportional breakdown of the purchase price based on expert appraisal of individual components. However, should the costs of procuring an expert appraisal be disproportionate to the significance of the particular item, the accounting unit can valuate this asset based on its own estimate. Among their long-term assets, accounting units report only perennial plants – permanent crop of trees and bushes, vineyards and hop fields. For fruit trees and bushes, the Czech legislation contains the condition that they must be planted on a continuous plot of land of a minimum area of 0.25 hectares and with aminimum density of 90 trees or 1,000 bushes per hectare. If this criterion is not met, the plants are reported directly as costs. For vineyards and hop fields, there is no additional restriction. Purchased fruit orchards are immediately included in long-term assets, even if they do not bear fruit yet, i.e., they do not generate any revenue. Fruit-bearing age is crucial for the commencement of tax depreciation. According to tax regulations, only perennial crops that have reached fruit-bearing age and will generate revenue for a minimum period of 3 years are eligible for depreciation. Permanent crops fall under depreciation category 3 with a 10-year depreciation period. The fruit-bearing age of plants is not determined by law. It is defined by the accounting entity itself in its internal policies, based on agrotechnological parameters. This results in a time discrepancy between the increase in the item "perennial crops" and the beginning of their depreciation.

Fruit orchards are owned only by 5 of the total number of 100 accounting entities that made up the sample. According to the analysis of the notes to the financial statement, in three cases the valuation methodology did not change due to the insignificance of this item. The change in the remaining two cases is shown in the following table:

Table 3 Impact of the Change in the Valuation Method for a Set of Assets on the Financial Position and Performance

Item	Values (in K CZK)		Impact (in K CZK)	
	Average 2003	Adjusted 2003	Balance sheet total	Financial result
Perennial crops	1,696	1,648.2	↓o 47.8	↑o 4.78
Land	764	811.8	↑o 47.8	No impact
Ratio	69:31	67:33	-	-

Source: own processing based on data from the Albertina database (2018)

The table above contains the average valuation of assets in 2003 according to the original methodology (ratio) and according to the new ratio. The table shows a decrease in the value of perennial crops by CZK 47.8 thousand. On the other hand, the item "Land" saw an increase by this value. The value of the balance sheet total thus remained unchanged.

Given the depreciation period for perennial crops (10 years), the depreciation amount decreased by CZK 4.78 thousand, which had a positive impact on the financial result.

The change in the valuation methodology also impacted certain financial analysis indicators. The formula for calculating theprofitability indicator uses the financial result as the numerator, and as the value of the financial result increased, so did the value of this indicator.

Reportingpreferential limits

The amendment to the Act on Accounting for the year 2005 made it mandatory for accounting units to report preferential limits in their balance sheet (statement of financial position). Before that, preferential limits were reported only in off-balance sheet accounts and in the notes to the financial statement. According to the new system, preferential limits at the first holder are reported as long-term intangible assets (item B.I.6. Other intangible fixed assets) in the amount equivalent to the replacement cost and also as subsidies received (short-term payables). An increase in short-term payables also has certain negative aspects in the form of lower liquidity of the company. The new system of reporting concerns only preferential limitsgained in 2005 or later. The quotas from before then are recorded using the original methodology. Gaining information about the replacement cost of this asset is very complicated. This is due to the fact that there is no registered market for preferential limits. Therefore, it was established by a decree that should the costs of determining the replacement cost exceed the significance of this information, the accounting unit is exempt from recording it in the balance sheet and the data on preferential limits are to be published only in the notes to the financial statement.

From the sample of 100 accounting units of agricultural enterprises selected for the purpose of this article, only 10 reported preferential limits. Following an analysis of the companies' financial statements, it was discovered that only one company included this asset in their balance sheet. The other accounting units continued to post their allocated milk quotas only in the notes to the financial statement, mainly because they had received no new quota in 2005.

The company that posted itspreferential limits reported in its balance sheet for 2005 a production quota in the value of CZK 148 thousand, which it received free of charge that year. Preferential limits in the total value of CZK 2,173 thousand, assigned before 2005, were posted by this accounting unit only in the notes to the financial statement. The obligation to post its preferential limits in the balance sheet resulted in an increase in the balance sheet total of this accounting unit ofCZK 148 thousand. However, the balance between the assets and liabilities remained zero. There was an increase in the value of long-term intangible assets and also short-term liabilities.

The increase in assets and short-term liabilities also impacted certain financial analysis indicators. The change in the value of short-term liabilities impacts mainly the indicator of the company's liquidity, in which this figure represents the denominator. The increase in the value of short-term liabilities thus caused a decrease in the value of these indicators. The following table shows the changes in the results of the liquidity indicators of the said agricultural business:

Table 4 Changes in the Results of the Liquidity Ratio Indicators of the Agricultural Business

Item	Values in 2005	
	Before the change	Following recalculation
Current ratio	6.37	5.33
Quick ratio	2.02	1.97
Cash position ratio	0.51	0.42

Source: own processing (2018)

An increase in the value of long-term intangible assets impacted mainly the asset turnover ratio and return on assets ratios, in which total assets represent the denominator. An increase in the value of long-term intangible assets thus also resulted in a decrease in the value of these two ratios.

Depreciation of perennial crops

As of 2008, accounting units can also depreciate perennial crops that the accounting unit manages on another owner's land. In the notes to the financial statement, accounting units do not post any information on the amount of land of other entities that they manage, so for the purpose of quantification of the impact of the change it was necessary to use estimates of the value gained by way of expert discussions with the five main economists of the agricultural businesses. According to their expert estimates, they manage approximately 1/3 of their perennial crops on leased land. The quantification of the change in depreciation is shown in the following table:

Table 5 Quantification of the Impact of Changes in the Depreciation of Perennial Crops on Leased Land

Item	Value (in KCZK)	Impact of change (in K CZK)	
	ø in 2007	Balance sheet total	Financial result
Total perennial crops	2 789	-	-
- of which is on leased land	930	-	Decrease by 93

Source: own processing based on data from the Albertina database (2018)

An increase in depreciation affects the financial result; however, it also means a decrease in the tax base and tax liability due to the effect of the tax shield. The change has no effect on the balance sheet total, though it affects all the ratio indicators calculated based on the financial result – particularly the profitability indicators.

Valuation of inventory of the company's own products and reporting changes in its size

Valuation of livestock and plants procured by the company's own activity is a major issue in agriculture. The Act on Accounting defines the valuation of inventory or long-term assets as equivalent to the company's own costs. The original provisions valid until the end of 2015 gave accounting units the option to choose between the valuation of inventory of the company's own products solely based on direct costs, or including justifiable overheads. Accounting units thus could choose from various valuation methods and could to a certain extent affect their financial result and, as a result, their tax liability. The 2016 amendment to the Act on Accounting did away with these options and stated that valuation must contain all eligible and attributable costs. This new provision contributed to the harmonization of the valuation methodology in Czech legislation and the standard IAS 2 – Inventory. There are two ways to valuate inventory by the company's own costs. The valuation is either based on the actual costs incurred, or costs determined by calculation. The research has shown that 100% of the selected accounting units in the research sample useplan calculation to determine their costs for the purpose of valuation of inventory created by the company's own activity. This calculation only expresses the average production conditions, and thus also the average unit cost in a particular period. Plan calculations are usually carried out on an annual basis. If any significant changes occur, these calculations can be updated during the year. As accounting units do not publish the exact structure of their calculations, this change cannot be quantified.

Another change occurred in the way changes in the inventory of the company's own products are posted. For a number of years, goods produced to stock were considered to be revenue without being sold. Revenue was thus adjusted in relation to costs. The new provision effective from January 1, 2016 defined the way of posting this item as costs adjustment. This change should ensure an increase in the validity of the financial statement

and better alignment with IFRS. This change does not affect the company's financial result, but it does affect its turnover. For the purpose of quantification of the impact on turnover, the item "change in inventory of own products" was analyzed in the companies' financial statements.

Table 6 Value of the Item "Change in Inventory of Own Products" in the Selected Sample

Value type	Values (in K CZK)			
	2013	2014	2015	2016
Maximum	3,073	3,817	4,007	3,945
Minimum	1,256	1,090	1,332	1,298
Median	2,383	2,589	2,274	2,477
Average	2,481	2,623	2,516	2,719

Source: own processingbased on data from the Albertina database (2018)

The table above displays the values of the item "change in inventory of own products" in the past four years for which there weredata available. The table implies that the transfer of the item from revenue to cost correction resulted in agricultural companies posting CZK 2,719 thousand less in revenue in 2016. It has already been statedthat this fact does not affect the companies' financial results, as it is irrelevant whether the item is considered as an increase in revenue or cost correction; however, in terms of financial analysis it will affect all ratio indicators that are based on the value of costs or revenue (e.g., return on costs, return on revenue, etc.).

4 Conclusions

The changes in legislation pertaining to financial accounting resulting from the harmonization of accounting systems contribute to creating a true and accurate image of the economic performance and financial position of all companies. Despite the major gaps in the legislation concerning accounting in agricultural companies in the Czech Republic, it is being harmonized with the internationally recognized accounting principles.

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Financial Market Implied Industry Classification

László Nagy[1], Mihály Ormos[2,3]

[1] Department of Finance
Budapest University of Technology and Economics
Magyar tudósok körútja 2, Budapest H-1117, Hungary
E-mail: nagyl@finance.bme.hu

[2] Department of Finance and Accounting
Institute of Business Economics, Eötvös Loránd University
Szép utca 2. H-1052 Budapest, Hungary
E-mail: ormos@gti.elte.hu

[3] Department of Economics
J. Selye University
Bratislavská cesta 3322, SK-94501 Komárno, Slovakia
E-mail: ormosm@ujs.sk

Abstract: *This paper introduces the financial market implied industry classification standard. Besides current industry classifications we propose a spectral clustering based quantitative methodology. The main drawback of current standards come from their qualitative classification techniques which can be eliminated in this purely mathematical concept. Calculating the market implied clusters and compering them with global industry classification explores that market implied classification provides better statistical results. However it also turns out that different clustering techniques provide similar classifications, moreover, both methods determine "Real Estate" as a cluster.*

Keywords: Cluster analysis, market classification, GICS, machine learning

JEL codes: G12; G15; C38

1 Introduction

Practitioners are using Global Industry Classification Standards (GICS) to keep track of sector based moves. It is widely accepted that firms with similar business activities have similar macro and micro factor sensitivities. Thus, building portfolios with names from the same industry lets us to eliminate specific risk. Sector based bundling gives the opportunity to tailor the macro factor exposure, understand the contamination of macro level shocks and determine regulatory standards. Moreover, it also helps to identify firms which under or outperform the industry hence it helps to separate systematic and non-systematic risks.

Asset managers use industry classification standards for their asset allocation and risk management strategies. Moreover, industry classification is also important for regulators, governments and labour economists to have a deeper understanding of the given state of the economy and be able to implement policies.

GICS is the mainly used classification. The methodology was developed by Morgan Stanley Capital International Inc. (MSCI) and Standard and Poor's (S&P). The categorization combines quantitative and qualitative techniques (MSCI 2015.) to obtain a market oriented economically thoughtful classification standard.

In this article we introduce a spectral clustering based (Nagy and Ormos 2016.) purely quantitative model to unveil the Financial Market Implied Classification (FMIC). Using daily closing prices, we show that the normalized modularity cut (Bolla 2011.) implied clusters and GICS are highly comparable. Moreover, standard Capital Asset Pricing Model based regressions give further evidences for using spectral clustering. The results show that GICS can be looked on as an approximation of the spectral clustering based classification. In addition, the clusters support the latest review of GICS in which Real Estate was added as distinct asset class.

The article structured as follows: Section 2 is a brief overview of industry classification standards. In Section 3 we introduce our spectral clustering based concept. In Section 4 we present the market implied clusters, compare them with groups given by GICS and carry out regression analysis to investigate the risk explanation power of FMIC. Section 5. summarizes the article.

Industry Clasification Standards

Investors are using different classification techniques from long ago to identify industries and characterize their specific behaviour. In 19th century all the market participants had their own classifications which were mainly used to evaluate risk, understand the macro factor sensitivities and build investment strategies (Vose 1916). However, there was no officially accepted framework. Hence, it was unmanageable to aggregate sector level sensitivities and implement economic policies.

Standard Industrial Classification

After the Great Depression in 1937, the US Central Statistical Board (Kolesnikoff 1940.) unified the different industry classifications and established the Standard Industry Classification. SIC was the main guideline of the Federal Government, banks and investors during the 20th century, in addition, the U.S. Securities and Exchange Commission (SEC) still uses it to its industry classification. The system had to be revised several times, in 1958, 1963, 1967, 1972, 1977 and 1987, but it still had several limitations. The main drawbacks of SIC are that it is designed for the economy of early 20th century, it is hard to identify new groups and follow the changes of global economy.

North American Industrial Classification System

NAICS is and industry classification standard which was designed to response to the increasing criticism of SIC (Executive Office of the President Office of Management and Budget. 2017). In 1980s the rapid changes of world economy forced the Office of Management and Budget (OMB) to overhaul SIC. Thus in 1997 the Economic Classification Policy Committee (ECPC) in Nacional the cooperation with Mexico's Instituto de Estadística, Geografía e Informática (now the Instituto Nacional de Estadística y Geografía, INEGI) and Statistics Canada suggested a new industry classification system which supplanted SIC. They agreed in that NAICS should be reviewed in every five years to reflect economic changes. The current form of NAICS defines 20 sectors and 1,057 industries. The classification standard is used for various administrative, regulatory, and taxation purposes.

Global Industry Classification Standards

Besides the SIC and NAICS in 1999 Morgan Stanley Capital International Inc. and Standard and Poor's created the widely used Global Industry Classification Standard. The primary goal of S&P was to enhance its business with introducing sector indices of S&P 500 index. In order to achieve this ambition an adequate industry categorization rule was needed. The classification has a market oriented nature, which incorporates quantitative and qualitative techniques. As GICS is used in the sub-index decomposition of S&P 500 thus it should follow all the changes of the market, hence it has to be reviewed at least annually. At first GICS introduced 10 sectors, 23 industry groups, 59 industries and 123 sub-industries. The classification was revised several times, currently it stands from 11 sectors, 24 industry groups, 68 industries and 157 sub-industries. Each sector, namely Consumer Discretionary, Consumer Staples, Energy, Financials, Health Care, Industrials, Information Technology, Materials, Real Estate, Telecommunication Services and Utilities represents an economically understandable market segment which is the key of the popularity of the classification. GICS is the most famous actively used standard which is assiduously reviewed by the financial market. Because, almost all U. S. market participants benchmark their positions against the performance of GICS sector indices. Moreover, the most liquid products in the world are the Standard & Poor's Depositary Receipts (SPDR) ETFs which

tracks the S&P 500 index and sub-indices. Thus, the behaviour of GICS must be in line with the market because like a stock it is continuously reviewed by the market and like earning season at least annually revised by MSCI and S&P.

In this article we propose a purely quantitative technique (FMIC) to analyse the connections between financial market and GICS and study the efficiency of Global Industry Classification Standards.

Spectral Clustering

The original concept of classifying the market, defining sub-groups, distinguishing sectors raises the fundamental question: Who can judge the market?

If we do not want to make any a priori assumptions then we have to look at the data and dismiss other subjective classification guidelines. Mathematically it is possible to represent a datasets as a graph, hence, we can construct an abstract network of stocks. The most straightforward method would be representing stocks with nodes, connection strengths with weights. Thus, we can define the network with $\mathrm{G}(V,W)$ graph where V represents the set of stocks and W contains the connection information. It is widely used that the adjacency matrix W represents the graph, thus all the structure information is embedded in the matrix. Note that if we normalize the sum of each row to one, then we get the transition matrix of the random walk on the graph (Luxburg 2007.);

$$P = D^{-1}W \tag{1}$$

where D represents the diagonal matrix of the sums of rows. Studying stopping times of random walks on graphs sheds some light on the structure of the graph, because, if it takes a long time to reach a subgraph of the graph from a given node then it would mean that the node and the subgraph are well separated. Moreover, the largest eigenvalue of the submatrix of P which belongs to the subgraph controls the distribution of the stopping time;

$$\mathrm{Prob}(\tau \geq n) = 1 - \pi_0 \sum_{i=1}^{n} Q^{i-1} R \cdot 1 \tag{2}$$

where τ represents the stopping time, π_0 the initial distribution, Q the submatrix of transient points, R defines the transition probabilities from transient to recurrent points.

Using symmetricity and spectral theorem

$$\mathrm{Prob}(\tau \geq n) = 1 - \pi_0 V \sum_{i=1}^{n} \Lambda^{i-1} V^T R \cdot 1 \tag{3}$$

Equation 3. shows that the spectrum of adjacency matrix, stopping times and clustering properties are strongly connected.

In addition, the problem can be looked at from an analytical point of view. Fourier analysis is a widely used tool in pattern recognition theory (Shi and Malik 2000). Considering an arbitrary real valued function on the vertexes and defining the below incidence matrix led some colour to the connections between Laplace operator and graph theory (Chung 1997.);

$$B_{ev} = \begin{cases} 1 & \text{if v is the initial vertex of e} \\ -1 & \text{if v is the terminal vertex of e} \\ 0 & \text{otherwise} \end{cases} \tag{4}$$

then $B^T B$ would be exactly the negative discrete Laplace operator because:

$$B^T B f(v_i) = \sum_{v_i \sim v_j} f(v_i) - f(v_j) \tag{5}$$

Notice that if we subtract the adjacency matrix from the diagonal matrix of row-sums then we get the same operator. Thus Laplace matrix can be defined as follows;

$$L = D - W \tag{6}$$

If we think of the adjacency matrix as a noisy matrix and would like to maximize the information content, then we get the modularity matrix;

$$M = W - dd^T \tag{7}$$

where d represents the vector of row-sums. Normalizing the matrix gives as the normalized modularity matrix which helps us to cluster tightly connected networks (Bolla 2011.).

$$M_D = D^{-\frac{1}{2}}(W - dd^T)D^{-1/2} \tag{8}$$

Equation 5. shows that L is the negative discrete Laplace operator hence its eigenvectors would be sine and cosine functions. Analogously to noise filtering techniques we can calculate a Fourier approximation. However, we would like to optimize the normalized modularity cut thus we have to use the normalized modularity matrix. The optimal representation of the original vertices are the rows of that matrix which contains its columns the eigenvectors of in absolute sense largest eigenvalues of the normalized modularity matrix (Bolla 2013.);

$$\left(D^{-\frac{1}{2}}u_1, \dots, D^{-\frac{1}{2}}u_k\right) \tag{9}$$

where $u_1, \dots, u_2$ are the corresponding eigenvectors of $|\lambda_1(M_D)| \geq \cdots \geq |\lambda_k(M_D)| \gg |\lambda_{k+1}(M_D)|$.

To unveil the market implied classification we should calculate the similarity matrix, then determine the normalized modularity, identify the spectral gap in the spectrum of the normalized modularity matrix and finally clustering the optimal representation with k-mean algorithm.

The only hurdle is the calibration of edge weights. Note that a spectral clustering method is effective if and only if in absolute sense decreasing sequence of eigenvalues goes to zero and gap appears in the spectrum. Otherwise, spectral based methods cannot give appropriate classification. Hence, we should test different similarity measures thus we have to calculate the spectrum of different similarity measures implied normalized modularity and Laplace matrices and choose that which provides the best spectral properties. Ormos and Nagy showed tightly connected financial dataset can be analysed with Gaussian square distances.

$$W_{ij} = e^{-||s^i - s^j||^2} \tag{10}$$

Combining Fourier analysis, pattern recognition techniques, random walk and graph theory provides us the optimal cluster property, thus spectral clustering gives us the opportunity to find an approximation of the market implied classification.

Financial Market Implied Classification

Spectral clustering can be used to unveil the hidden market structure of stock indices. The purely quantitative approach needs only closing prices so that the market segments are formed by stock prices. The fundamental assumption behind the model is that at least the weak form of market efficiency holds on a daily scale. This assumption allows intra-day inefficiencies, but accepts that the daily closing auction forces the market into the equilibrium.

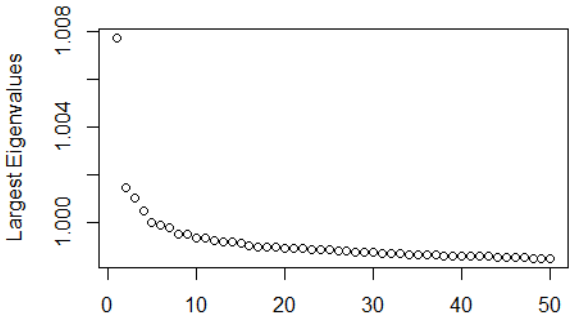
Data

The current study identifies FMIC based on stock splits and dividends adjusted daily closing prices between 01/01/2007 and 01/03/2017 of current S&P 500 constituents. The data is provided by Yahoo! Finance.

FMIC and GICS

Calculating the spectrum of normalized Laplace and modularity matrices of Gaussian based similarities shed some light on the structure of the network. Bolla showed that if a graph is dense then the normalized Laplacian matrix cannot be used because the norm of eigenvalues slowly converge to zero. Normalized modularity matrix, however, provides better spectrum properties.

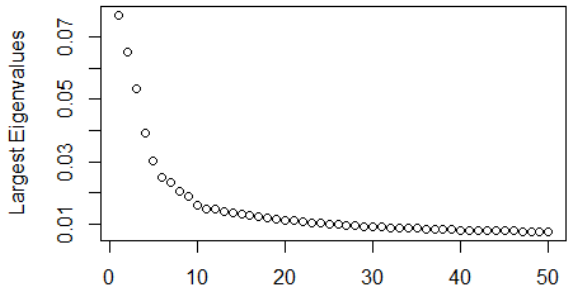
Figure 1 Spectrum of Gaussian Based Normalized Laplace Matrix



Source: own processing

Calculating the spectrum of normalized Laplace matrix displays that the eigenvalues converge slowly to zero thus Fourier based approximation techniques cannot be used (Figure 1.). It also suggests that the network structure is not scarce, different clusters should be connected. Hence, we should optimize the information theory based Newman Girvan cut thus we have to calculate the spectrum of normalized modularity matrix.

Figure 2 Spectrum of Gaussian Based Normalized Modularity Matrix



Source: own processing

The spectrum of normalized modularity matrix provides appropriate spectral properties. Figure 2. shows that it has several large eigenvalues and the decreasing sequence of them converges to zero. Nevertheless, the normalized Laplacian cannot be used for clustering. All these implies that the equity index network is dense, most of the stocks are connected.

Identifying spectral gaps highlights that the optimal number of market implied clusters would be 5, 7, 9 or 12.

Note that GICS distinguishes 11 sectors. If we calculate FIMC with 11 clusters then we get controversial results. Moreover, GICS and FIMC 11 classifications are fundamentally different. However, spectral clustering based methodology proposes to use 12 clusters. If we calculate FMIC 12 then we could see that GICS is in line with market implied classification, see Table 1.

Table 1 Frequency Table of GICS and FMIC 12

GICS/FMIC12												
	1	2	3	4	5	6	7	8	9	10	11	12
C	0	8	33	3	0	0	0	0	0	42	0	0
S	0	0	5	1	0	0	0	0	0	4	0	26
E	31	2	2	0	0	0	0	0	0	0	0	0
F	0	5	9	0	0	50	0	0	0	0	0	0
H	0	0	5	0	0	0	0	39	0	0	16	0
I	0	5	55	0	0	0	0	0	6	0	0	0
IT	0	6	15	47	0	0	0	0	0	0	0	0
M	4	1	19	0	0	0	0	0	0	1	0	0
R	0	1	5	1	23	0	0	0	0	0	0	0

T	0	1	4	0	0	0	0	0	0	0	0	0
U	1	0	1	0	0	0	26	0	0	0	0	0

Notes: This table is the contingency table of GICS and FMIC 12; D denotes Consumer Discretionary, C: Consumer Staples, E: Energy, F: Financials, H: Health Care, I: Industrials, IT: Information Technology, M: Materials, R: Real Estate, T: Telecommunications Services and U: Utilities.

Source: own processing

Clusters 1, 4, 5, 6, 7 and 12 cover Energy, Information Technology, Real Estate, Financials, Utilities and Consumer Staples respectively.

The first cluster is dominated by Energy companies. It also contains four Utilities and NRG Energy. These firms are closely related to energy business. Thus, we could say that GICS Energy sector can be quantitatively supported.

Information Technology names are put into Cluster 4. Checking non Information Technology names in Cluster 4 we see that the most of them are highly technological. The three Consumer Discretionary companies are Amazon Inc., Expedia Inc. and Garmin Ltd. that all carry out strongly technology based business. Equinix specialized in data and cloud business thus putting it to a technological cluster is also in line with economic thinking. Monster Beverage could be surprising, however, if we compare it with its peers we could see that Monster Beverage differs from them.

Cluster 5 gives mathematical evidence to handle Real Estate as a different sector. Moreover, Financials, Utilities and Consumer Staples are also separated in Cluster 6, 7 and 12 respectively.

Clusters 8, 9, 10 and 11 incorporates Health Care, Industrials and Consumer Discretionary firms. Table 1 shows that these clusters split GICS sectors into two parts. Scrutinizing the results we could see that names are divided along GICS sub industries (Appendix 1).

Cluster 9 is the smallest cluster which encompasses 6 Industrial firms. Studying the sub industry classification we see that 5 companies out of 6 are Airlines and the outlier is Fortive Corporation which has large exposure to aviation business.

In conclusion, we can say that FIMC 12 is in line with GICS sectors and sub-industries, however it gives us a purely quantitative technique to identify clusters.

The spirit of CAPM

Understanding systematic risk is essential part of asset allocation because prices can be scrutinized only within an equilibrium model. Researchers, investors, regulators and banks are seeking models which could distinguish systematic and non-systematic risk.

Following a purely market oriented prospect leads to the Capital Asset Pricing Model (CAPM) which incorporates the systematic risk into the market portfolio. Several empirical studies concluded that CAPM can be used as a benchmark, but has to be made it more precise.

Analysing risk and reward in different frameworks explores different aspects of risk. Note that while standard deviation counts all the moves, β takes into account only that moves which can be explained linearly with the fluctuation of market portfolio. However, investors are sensitive to losses, filtering out therefore gains leads to Expected Downside Risk (Ormos and Timotity 2016.), in addition, various information theory based measures (Ormos and Zibriczky 2014.) can be defined which are strongly connected to log-optimal portfolio theory (Urban and Ormos 2013.).

$$\left(\ln \frac{S_t}{S_{t-1}}\right) = r^f + \beta \cdot SRM + \varepsilon \tag{11}$$

All the linear models explain different aspects of systematic risk (SRM) but they can be compared with regression statistics. Correspondingly, if we add GICS and FMIC 12 to the regressions then we could compare them.

$$\begin{cases} \left(\ln\frac{S_t}{S_{t-1}}\right) = r^f + \beta_1 SRM + \beta_2 GICS + \epsilon \\ \left(\ln\frac{S_t}{S_{t-1}}\right) = r^f + \beta_1 SRM + \beta_2 FMIC12 + \theta \end{cases} \quad (12)$$

Table 2 shows that the FMIC 12 outperforms GICS, except when risk is characterized by entropy and semi-variance.

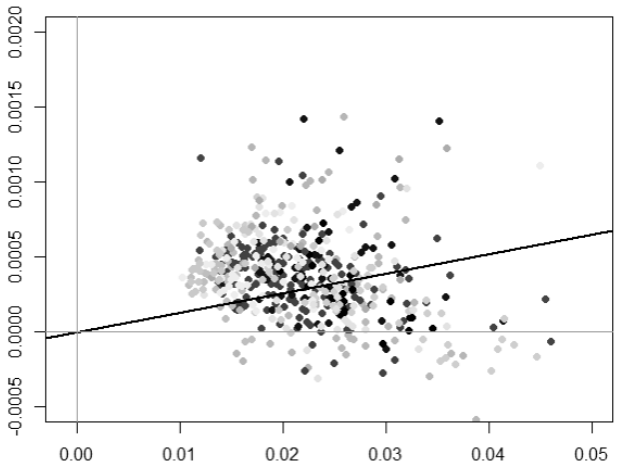
Table 2 Regression Statistics of GICS and FMIC 12

	p-value risk	R2	p-value GICS	R2	p-value FMIC 12	R2
Var	0.000	0.110	0.000	0.173	0.000	0.185
Sig	0.000	0.104	0.000	0.169	0.000	0.179
Semi-var	0.151	0.004	0.000	0.111	0.000	0.106
CAPM	0.000	0.187	0.002	0.232	0.002	0.234
EDR	0.000	0.143	0.000	0.210	0.000	0.227
H	0.000	0.026	0.000	0.122	0.000	0.117

Notes: Table 2 contains the regression statistics of different systematic risk models with GICS and FIMC 12.
Source: own processing

Notice that semi-variance is not significant and entropy could explain only 2.6% of total variance. Hence, we could say that risk measures with high R^2 values can be used with cluster-variable like FIMC or GICS. Otherwise, there is no need adding cluster-variable to regression, because linear terms are not explained, thus the risk measure captures the same non-linear effect.

Figure 3 Standard Deviation, Mean Return Plot of FMIC 12 with Zero Interception



Source: own processing

Setting the constant coefficient zero and calculating the regressions gives Table 3 which is in line with the 2007-2017 market conditions.

Table 3 Regression Statistics of GICS and FMIC 12 with Zero Interception

	p-value risk	R2	p-value GICS	R2	p-value FMIC 12	R2
Var	0.000	0.203	0.000	0.595	0.000	0.601
Sigm	0.000	0.374	0.000	0.593	0.000	0.598
Semi-var	0.000	0.253	0.000	0.565	0.000	0.562
CAPM	0.000	0.277	0.000	0.624	0.000	0.625
EDR	0.000	0.375	0.000	0.613	0.000	0.622
H	0.000	0.522	0.000	0.571	0.000	0.568

Notes: This table contains the regression statistics of Equation 12.
Source: own processing

It also can be seen that different linear based risk factors explain 20%-52% of the total variance, but adding cluster-variables the explanatory power of the model jumps to 60%. This means that cluster specific and linear risks explains 60% of the fluctuation.

If we generalize the baseline linear model we could specify the following regression;

$$\mathbf{E}\left(\ln\frac{S_t}{S_{t-1}}\right) = \sum_{i=1}^{10}\beta_i \cdot (SRM)^i + \varepsilon \tag{13}$$

Expanding the linear model with higher order terms could shed more light on non-linear dependencies, see Table 4.

Table 4 Estimated R2 Statistics of Polynomial

Risk / R2 of n-th order	1st	2nd	3rd	4th	5th	10th
Var	0.203	0.365	0.495	0.537	0.567	0.582
Sig	0.374	0.547	0.568	0.568	0.569	0.581
Semi-var	0.253	0.348	0.411	0.454	0.477	0.518
CAPM	0.277	0.559	0.574	0.575	0.591	0.626
EDR	0.375	0.587	0.593	0.594	0.595	0.598
H	0.522	0.524	0.526	0.527	0.532	0.535

Notes: Table 4 highlights the non-linear connections between returns and systematic risk factors.
Source: own processing

The results are in line with our expectations, because, adding higher order terms of linearly inspired risk metrics to the regression increases the explanatory power, while entropy shows different behavior.

Generalizing Equation (11) we could get the following models;

$$\begin{cases}\left(\ln\frac{S_t}{S_{t-1}}\right) = \beta_1 SRM + \beta_2 GICS + \varepsilon \\ \left(\ln\frac{S_t}{S_{t-1}}\right) = \beta_1 SRM + \beta_2 FMIC\ 12 + \theta\end{cases} \tag{14}$$

Equation (13) lets us to distinguish cluster and non-cluster specific higher order connections. The results (Table 5) show that polynomial terms explain similar effects like GICS and FMIC 12.

Table 5 Estimated R2 Statistics of Polynomial Regressions with FMIC 12

Risk/ R2 of n-th order model with FMIC 12						
	1st	2nd	3rd	4th	5th	10th
Var	0.601	0.602	0.605	0.606	0.609	0.616
Sig	0.598	0.601	0.604	0.605	0.608	0.614
Semi-var	0.562	0.563	0.564	0.565	0.566	0.569
CAPM	0.625	0.636	0.637	0.640	0.640	0.652
EDR	0.622	0.634	0.634	0.634	0.635	0.636
H	0.568	0.569	0.569	0.573	0.573	0.577

Notes: This table summarizes the non-linear filter behaviour of the cluster variable (FMIC 12).
Source: own processing

Tables 4 and 5 show that higher order terms do not increase the explanatory power of the regressions. Thus, the remaining 30% part of the variance cannot be explained by liner-based risk factors and clusters. Analysing returns with linear and polynomial regressions show that FMIC 12 outperforms GICS, however, cluster variables explain similar non-linear connections.

Conclusions

Spectral clustering is an adequate technique to unveil the embedded market structure, filter out non-linear effects and make CAPM more precise. The purely quantitative method

gives us the opportunity to categorize firms based on their stock market returns, in addition, it lends some colour to Global Industry Classification Standards.

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The Role of Corporate Income Tax Differences on the Profit Shifting Behavior: Evidence from the Czech Republic

Danuse Nerudova[1], Veronika Solilova[2], Marian Dobranschi[3], Marek Litzman[4]

[1,2,3,4] Mendel University of Brno
Faculty of Business and Economics,
Department of Accounting and Taxation
Zemědělská 1, 61300, Brno, Czech Republic
E-mail:danuse.nerudova@mendelu.cz;
veronika.solilova@mendelu.cz;
marian.dobranschi@mendelu.cz
marek.litzman@mendelu.cz

Abstract: *The aim of this paper is to investigate the profit shifting behavior of Czech subsidiaries owned by parent companies placed in top five EU investor countries in the Czech Republic. We analyze the sensitivity of profit before taxation to the corporate tax differences between Czech subsidiaries and other subsidiaries owned by the same Multinational Enterprise. We expect that the profit shifting behavior of the Czech subsidiaries to be less significant compared to the existent estimates by the literature. This hypothesis arises from the particular tax advantageous position of the Czech Republic relative to the top five EU investor countries high corporate tax rates. We adopt the Hines-Rice approach to analyze the semi-elasticity of profits before taxation to the corporate income tax differences.*

Keywords: profit shifting, tax differential, semi-elasticity, effective CIT rate, tax avoidance

JEL codes: H25, H26, H32

1 Introduction

Profit shifting issue represents a current topic due to increased globalization and mobility of the capital across the world countries. The Multinational Enterprises (hereinafter as MNE's) can exploit different tax rules regarding the corporate income tax rates and avoid paying taxes on profits. Our objective is to assess the sensitivity of profits before taxation to different tax regimes. The aim of this paper is to identify if profit shifting occurs in case of Czech subsidiaries and what are the potential channel of shifting profits. We choose to analyze the pre-tax profits sensitivity of Czech subsidiaries owned by MNE's placed in the top five EU investors countries in the Czech Republic. We restrict our sample data to profitable Czech subsidiaries that are involved in manufacturing. We use Ordinary Least Squares (hereinafter as OLS) regression to estimate the impact of corporate income tax (hereinafter as CIT) rate on the pre-tax profits reported by selected Czech subsidiaries. Moreover, using OLS procedure we estimate the impact of tax differential between Czech subsidiaries and the average CIT rate of their affiliates from the same MNE group as well as firm-specific input factors and other control variables. The adoption of Hine-Rice approach to estimate the sensitivity of pre-tax profits to tax differential seeks to investigate whether Czech subsidiaries report less pre-tax income when their "sisters" companies based elsewhere in the EU face a lower CIT rate. The paper is organized as follows. In the first section we present a short literature review regarding the empirical literature that analyses profit shifting; in the second section we present the data used and the methodology of our empirical analysis; the third section presents the results obtained and the paper ends with concluding remarks.

2 Literature Review

The concept of profit shifting behavior has been defined as the strategic action of the Multinational Enterprises (hereinafter as MNE) to intentionally moving profits from high-tax jurisdictions to low- or no-tax countries (Dyreng, 2015; Markle, 2015). The main triggering factors of profit shifting according to Dharmapala (2014) and Markle (2015) are the tax rate differences between countries, loop-holes in tax laws regarding corporate

income taxation, increased mobility of capital and intangible assets, political and social instability.

OECD (2013) points that profit shifting and base erosion phenomenon is affecting three distinct groups: public budgets (due to the low corporate income tax revenues), domestic companies due to comparative advantages of the MNE's in moving profits abroad and overall tax compliance if there is a broad perception that MNE's can legally avoid taxation.

The dominant approach in analyzing profit shifting behavior has been founded by Grubert and Mutti (1991) and Hines and Rice (1994). Hines and Rice (1994) analyzed the sensitivity of US MNE's profitability rates to the international tax rates differences. The model proposed by Hines and Rice (1994) considers that the reported profitability of the US foreign subsidiaries is a function of pre-tax earnings and local tax rates. Consequently, the central role of the Hines-Rice approach is the tax difference between the affiliate and parent company, which can estimate the sensitivity of profits to tax incentives of different jurisdictions. Hines and Rice (1994) find that the pre-tax income is inversely related to the corporate income tax rates differences between countries where the affiliates are based.

Clausing (2009) analyses the sensitivity of profit shifting due tax differences between countries. The author found that the decrease of the CIT rate by 1% by a host country where a US-owned subsidiary is based, will lead to an increase by 0.5% increase of declared profit as response to lower tax burden. Clausing (2009) found that in 2004 the financial techniques to shift profits used by US MNE's have lowered the US CIT revenues by 35% or 180 billion USD. The real movements of assets and employment in order to avoid high CIT rates have decreased the US CIT revenues by 18% or 80 billion USD. Huizinga and Laeven (2008) analyze the profit shifting behavior adopting an innovative approach. The authors research the sensitivity of profits before taxation to the international tax differences including also the tax differences between affiliates that are hosted in other countries and are owned by the same parent company. Using firm-level data for the European MNE's and their subsidiaries, Huizinga and Laeven (2008) found that the semi-elasticity of pre-tax profits to top statutory tax rate is 1.43.

Dischinger and Riedel (2011) analyze the impact of corporate tax differences on location of intangible assets within the MNE's. The independent variable is the difference between corporate tax rate of the analyzed subsidiaries to the unweighted tax rate average other affiliates from the same MNE group. The authors found a semi-elasticity of 1.7. Buettner and Wamser (2013) use the micro-level database of all German multinationals from the German Central Bank to analyze the size of profit shifting done by German MNE's using the strategic intra-company loans. The author uses the internal loans between subsidiaries owned by the German MNE's and tax differentials between multinational groups. The results obtained show that internal loans tend to react significantly to tax differentials between subsidiaries placed in low-tax countries.

Beer and Loeprick (2015) use the ORBIS database to analyze the main drivers of transfer pricing and potential counter measures in the EU. Beer and Loeprick (2015) found that if the subsidiaries have a greater ratio of intangible to total assets tend to report less profits if the tax rate increases compared with subsidiaries with no intangibles.

Jansky and Kokes (2015) analyses the financial and ownership data of companies operating in the Czech Republic aiming to find evidence of profit shifting. The authors also use data regarding 4124 multinational companies that operate in Czech Republic. Jansky and Kokes (2015) found that the MNE's with links to tax haven countries have a positive impact on the debt to equity ratio of the subsidiaries. Moreover, Jansky and Kokes (2016) research the ability of MNE's to shift profits from Czech Republic to three European tax havens, namely the Netherlands, Switzerland and Luxembourg. The authors found that companies linked to the above stated countries show a higher debt to equity ratio, which indicates profit shifting through strategic use of debt.

Markle (2016) researches the profit shifting behavior of the MNE's which are subject to territorial and worldwide system of taxation. Markle (2006) finds that the MNE's that are subject to territorial tax regime are more prone to shift profits than the MNE's under the

worldwide tax regime. The results obtained by Markle (2016) show that the profits before taxation are inversely related to the international tax differences by a coefficient of - 1.23 in case of territorial tax regime and -0.62 in case of MNE's under the worldwide tax regime. Heckemeyer and Overech (2017) perform an extensive meta-analyze to provide a consensus estimate regarding the profits sensitivity to tax rate elasticity. The authors base their research on 25 most important primary studies, from where they conclude that a 1% increase into the tax rate differential between affiliates and other sister subsidiaries from the same MNE group leads to an overall 0.8% decrease in the declared pre-tax profits.

3 Data and Methodology

Data

The empirical analysis is based on data derived from Amadeus Database. We use firm-level data regarding the Czech subsidiaries owned by parent companies based in top five EU investor countries in the Czech Republic, namely: Austria, Germany, France, Luxembourg and Netherlands. The period on which observations are available is between 2006 – 2015. We impose several restrictions when extracting the data from Amadeus. Firstly we choose to analyze only the Czech subsidiaries owned by parent companies based in top five EU investors which own at least 51% of their shares and have at least another subsidiary elsewhere in the EU. The second condition for our data set is that we collect data only for Czech subsidiaries involved in manufacturing. In the third step we collect data only for those subsidiaries that have reported profit at least one year in the analyzed time period. We exclude the non-profitable Czech subsidiaries or those subsidiaries that have no recent financial data. In order to preserve the strongly balanced panel data, we do not eliminate the years where the Czech subsidiaries report losses. In this situation we replace the negative observations with zero, since our interest is to investigate how does profitability reacts to tax differences between Czech subsidiaries and their "sister" companies based in other EU countries.

The dependent variable used in our model is profit before taxation (*Pbt*) and the core independent variables are: statutory corporate income tax rate (*CITcz*), effective corporate income tax rate (*ETRcz*) in the Czech Republic and the tax differential (*difftaxcz* and *diffetrcz*). Following the Hines-Rice approach we also include in our model the capital and labor variables as a method to estimate the level of "true" profit. Consequently we use the fixed assets as a representative of capital and number of employees for labor costs. Beside these independent variables we choose to add interest payments in order to test whether the indebtedness of Czech subsidiaries plays a role in reporting profitability. We also include into our model country specific factors such as GDP per capita (gdpcappp) expressed in Purchase Power Parity as a representative for degree of economic development; unemployment rate (unempl) as a proxy of economic conditions and Corruption Perception Index (hereinafter as CPI) as a representative of the quality of legal system. The first two control variables are extracted from Eurostat Database and the CPI is derived from Schneider (2012, 2015). After all restrictions are imposed we were able to collect data for only 300 Czech subsidiaries that fulfill our conditions.

The tax differential is constructed as the difference between corporate income tax rate of the subsidiary (i.e. CIT rate in the Czech Republic) and the unweighted average corporate income tax rate of affiliates from the same MNE group (i.e., the average corporate income tax rate of "sister" companies and parent company). We build two distinct tax differentials where we use statutory corporate income tax rates (*difftaxcz*) and effective corporate income tax rates (*diffetrcz*). For the analyzed Czech subsidiaries we obtain the effective tax rate by dividing taxation payments to profits before taxation and for the average effective tax rates of affiliates from the same MNE group we use the data provided by Spengel et al. (2015).

The Econometric Approach

The empirical analysis follows the traditional Hines-Rice approach which was later improved by Huizinga and Laeven (2008), Dischinger and Riedel (2011), Beer and Loeprick (2015)

and Markle (2016). The occurrence of profit shifting behavior can be indirectly estimated by regressing profits before taxation to the tax differentials between the subsidiaries and affiliates from the same MNE group coupled with other independent variables. The tax incentives to shift profits from subsidiaries hosted in high tax countries to affiliates hosted low-tax jurisdictions can be captured by using tax differentials while controlling for input factors (i.e., fixed assets and number of employees). Moreover, the profit shifting activities can react differently to statutory corporate income tax rate than to effective tax rate. Therefore, we intend to test whether there are differences in the sensitivity of profits before taxation to statutory and effective corporate taxation. The regression equations are as following:

$$logPbt_{i,t} = \beta_0 + \beta_1(CITcz_{i,t}) + \beta_2(logfix_{i,t}) + \beta_3(logempl_{i,t}) + \beta_4(loginterest_{i,t}) + \beta_5(X_{i,t}) + \rho_t + \epsilon_{i,t} \quad (1)$$

$$logPbt_{i,t} = \beta_0 + \beta_1(ETRcz_{i,t}) + \beta_2(logfix_{i,t}) + \beta_3(logempl_{i,t}) + \beta_4(loginterest_{i,t}) + \beta_5(X_{i,t}) + \rho_t + \epsilon_{i,t} \quad (2)$$

$$logPbt_{i,t} = \beta_0 + \beta_1(difftaxcz_{i,t}) + \beta_2(logfix_{i,t}) + \beta_3(logempl_{i,t}) + \beta_4(loginterest_{i,t}) + \beta_5(X_{i,t}) + \rho_t + \epsilon_{i,t} \quad (3)$$

$$logPbt_{i,t} = \beta_0 + \beta_1(diffetrcz_{i,t}) + \beta_2(logfix_{i,t}) + \beta_3(logempl_{i,t}) + \beta_4(loginterest_{i,t}) + \beta_5(X_{i,t}) + \rho_t + \epsilon_{i,t} \quad (4)$$

In the Eq. 1 the dependent variable is profit before taxation (l*ogPbt*) expressed in natural logarithms. The core explanatory variable is the corporate income tax rate (*logCITcz*) imposed to the Czech subsidiaries expressed in natural logarithms. The *logfix* and *logempl* represent the capital and labor proxies for input factors. The country specific control variables (X) are represented by GDP per capita, unemployment rate and CPI, all expressed in natural logarithms. ρ_t represents the time effects and ϵ represents the error term. The subscript *i* represent the observation for each Czech subsidiary, where i=1…n and *t* represent time period in yearly observations between 2006 – 2015.

In the Eq. 2 we change the main independent variable from statutory corporate income tax rate (*logCITcz*) to effective corporate income tax rate (*logETRcz*), calculated as the taxation payments by each Czech subsidiary divided to their profits before taxation. The rest of variables remain as defined in Eq. 1.

In Eq. 3 we regress the profits before taxation (*logPbt*) to the tax differential (*difftaxcz*) between Czech subsidiaries and their affiliates from the same MNE group using the statutory corporate income tax rates. The rest of variables remain as defined in Eq. 1.

In Eq. 4 we regress the profits before taxation (*logPbt*) to the tax differential (*diffetrcz*) between Czech subsidiaries and their affiliates from the same MNE group using the effective corporate income tax rates. The rest of variables remain as defined in Eq. 1. We transform the dependent and independent variables to their natural logarithm equivalents in order to eliminate outliers and obtain stationary time series. When logarithms are used for both dependent and explanatory variables in a regression equation, the obtained estimates can be interpreted as elasticities. This rationale can be applied to the first two equations (i.e., Eq. 1 and Eq. 2). In Eq. 3 and 4 we estimate a log-level regression equation, therefore the obtained estimates are interpreted as semi-elasticity results.

We expect that the core explanatory variables included in Eq. 1-2, namely the statutory and effective CIT rate, will have a negative impact on the pre-tax profits reported by the Czech subsidiaries. The tax differential included in Eq. 3-4 as main independent variable is expected to have a negative impact on pre-tax income. However, considering the tax advantageous position of the Czech Republic in comparison with the other EU countries in terms of corporate income taxation, we expect that the tax differential will have a lower impact on profits before taxation than the estimates obtained by previous studies.

4 Results and Discussion

Before running the models proposed in Eq. 1-4, we test the stationarity of time series using the Levin-Lin-Chu test and Fisher-type tests for panel data in STATA15 (i.e., Augmented Dickey-Fuller test and Phillips-Perron unit-root test). All three unit root test prove that our time series are stationary.

The results obtained from running our four regression equations are presented in Table no. 1. We used Hausman test to decide whether Fixed-effects or Random-effects model is more appropriate for our multi-variate regression. The Hausman test showed that there are no significant differences present between fixed or random effects assumption. Consequently we choose to estimate our model using Random-effects assumption due to the fact that is more efficient than fixed-effect model.

Table 1 The Estimation Results of Generalized Least Squares Regression

GLS Random-effects				
Dependent variable: Profit before taxation (*logPbt*)				
Equation	(1)	(2)	(3)	(4)
Independent Variables				
logCITcz	-2.588***			
	(0.559)			
logETRcz		-0.319***		
		(0.0837)		
difftaxcz			0.190	
			(2.067)	
diffetrcz				-0.0806***
				(0.0172)
logfix	0.318***	0.282***	0.320***	0.319***
	(0.0515)	(0.0484)	(0.0516)	(0.0512)
logempl	0.436***	0.418***	0.435***	0.429***
	(0.0632)	(0.0626)	(0.0635)	(0.0624)
loginterest	-0.0535**	-0.0524**	-0.0542**	-0.0531**
	(0.0185)	(0.0181)	(0.0186)	(0.0186)
loggdpcappp	-1.041	1.115	1.840*	1.897**
	(1.192)	(0.768)	(0.747)	(0.734)
logunempl	-0.571*	-0.197	-0.0412	-0.0337
	(0.223)	(0.246)	(0.249)	(0.246)
logCPI	6.819*	2.654	3.967*	3.589*
	(3.288)	(1.906)	(1.784)	(1.739)
Time-fixed effects	YES	YES	YES	YES
N	1585	1429	1585	1585
R2	0.475	0.494	0.475	0.485

Note: Standard errors in parentheses;* p < 0.05, ** p < 0.01, ***, p < 0.001.

Source: Authors calculations

The results obtained by estimating the Eq. 1 show that profits before taxation are highly sensitive to the evolution of statutory corporate income tax rate. Since the Eq. 1 is a log-log regression, the results can be interpreted as elasticities. Therefore if Czech Republic increases CIT rate by 1% then the profits before taxation of Czech subsidiaries owned by top five EU investor countries will decrease by 2.58%. Looking at the firm-specific input factors, such as capital and labor, we find that both variables are statistically significant and have a positive impact on profits before taxation. Number of employees has a higher impact on profitability than fixed assets. These estimates show that Czech subsidiaries involved in manufacturing industry tend to be more labor intensive and rely less on capital.

Another interesting result is shown by the estimates regarding the impact of interest payments on profits before taxation.

Interest payments have a negative and statistically significant impact on profitability. This can be interpreted that the strategic use of debt can represent a possible technique of profit shifting. Regarding the economic development, we found that is not statistically significant in Eq. 1. On contrary, the unemployment rate plays a rather weak negative impact on profitability. A 10% increase in unemployment rate would decrease the profitability by 0.57 %. The decrease of corruption plays also a relative weak role in reporting profitability, where a 10% decrease in CPI would increase the profits before taxation by 6.8%.

The estimates obtained from second regression equation show that the sensitivity of profits before taxation to the effective corporate income tax rate is significantly lower in comparison to the statutory corporate income tax rate. A 1% increase in effective CIT rate would decrease the profits reported before taxation only by -0.32%. The rest of the independent variables hold the same impact on profitability as in Eq. 1, with exception of economic development (*loggdpcappp*), unemployment rate (*logunempl*) and corruption (*logCPI*) which prove to be statistically insignificant.

The results obtained by estimating Eq. 3 show that the tax differential based on statutory CIT rate is statistically insignificant. The company-specific input factors hold positive impact on profitability, while the interest payments have a negative impact on profits before taxation. The economic development is statistically significant and has a positive impact on profitability, where a 10% increase in GDP per capita will increase the profitability by 1.8%. We found that unemployment is statistically insignificant and corruption decrease plays a positive role, where a 10% decrease of corruption will lead to a 3.9% increase in reported profits before taxation.

The estimates obtained from running Eq. 4 show that the tax differential based on effective CIT rate between Czech subsidiaries and average effective CIT rate of the affiliates from the same MNE group is statistically significant. Since Eq. 4 represents log-level estimation the interpretation for *diffetrcz* coefficient is different. The coefficient obtained represents the indirect or semi-elastic effect of tax differential on profits before taxation. Therefore a 1 unit change (e.g., 1 unit increase or decrease in tax differential) will produce $\beta_1 \, x100\%$ change in profits before taxation. The tax differential is constructed as the difference between effective CIT rate of the Czech subsidiaries and the average effective CIT rate of their "sisters" and parent. In this context the resulted independent variable *diffetrcz* has negative values due to the fact that the effective CIT rate faced by Czech subsidiaries is smaller than the average effective CIT rate imposed on parent and sister affiliates elsewhere in the EU. Therefore the interpretation of our estimates should be done as follows. A 1 unit increase in tax differential (i.e., which translates in tax differential decrease because is negative in its' absolute form) will lead to 8% decrease of pre-tax profits reported by Czech subsidiaries. Because the effective CIT rate is used to compute tax differential (*diffetrcz*) the interpretation should take into account the changes made in tax credits by the EU countries where the parent and "sister" affiliates of the Czech subsidiaries are based. Consequently, if the EU countries will increase tax credits or implement new tax credits which will in turn decrease the effective tax rate faced by the "sister" companies will lead to less profits declared before taxation in the Czech Republic. It is important to specify that the estimates obtained by our model are significantly lower than the estimates obtained by previous studies, such as Huizinga and Laeven (2008), Beer and Loeprick (2015) and Markle (2015). This is due to the fact that the Czech Republic corporate income taxation is considerable lower than the other EU countries. Therefore the reaction of pre-tax income reported by the Czech subsidiaries to the tax differential is still negative but smaller compared with primary estimates.

The input factors capital (*logfix*) and labor (*logempl*) have a positive impact and statistically significant as found in previous equations. The interest payments hold a negative impact where a 5% increase in interest payments will decrease the pre-tax income by 0.05%. An opposite impact shows the economic development, where a 5% increase of GDP per capita

leads to 1.9% increase in pre-tax income. Unemployment rate shows a statistically insignificant effect on profits before taxation in Eq. 4 and a 10% decrease of corruption level will increase the before tax profits by 3.5%.

5 Concluding remarks

In this paper we analyze the sensitivity of pre-tax income to the tax differential between Czech subsidiaries and average CIT rate of the affiliates in the same MNE group. We use the firm-level data for the Czech subsidiaries owned by top five EU investor countries in the Czech Republic. Taking into consideration that profit shifting behavior depends significantly on the tax incentives, we run four different models to estimate the sensitivity of pre-tax profits to corporate income taxation. In the first two models we estimate the impact of statutory and effective CIT rate on profits before taxation. We found that the pre-tax income of Czech subsidiaries is highly sensitive to changes in statutory than to effective CIT rate changes. Overall the profits before taxation are inversely related to the evolution of CIT rates. In addition to the first two models we also estimate a semi-elastic model, where the core exogenous factor is the tax differential between Czech subsidiaries and the average tax rate of affiliates based in other EU countries. We found that if the tax differential is based on statutory CIT rate the results obtained are not statistically significant. When the tax differential is based on effective CIT rate, the explanatory variable becomes statistically significant and has a negative impact on the pre-tax income reported by Czech subsidiaries. The results from fourth model can be interpreted as the tax differential decreases, due to decrease of average effective CIT rate to which the affiliates from the same MNE group are liable, then Czech subsidiaries will report less pre-tax income. Consequently, this negative reaction of pre-tax profits represents a proof of profit shifting. Moreover, we identify that the strategic use of debt represents a potential method of profit shifting in order to avoid corporate income taxation.

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Monetary Policy Normalization of the European Central Bank

Aleksandra Nocoń

University of Economics in Katowice
Faculty of Finance and Insurance, Department of Banking and Financial Markets
ul. 1 Maja 50, 40-287 Katowice, Poland
E-mail: aleksandra.nocon@ue.katowice.pl

Abstract: *Monetary policy normalization of modern central banks is the process of ending non-standard monetary policy initiatives and its return to the pre-global financial crisis framework. On the other hand, it may mean a transformation of monetary policy towards a new quality, a new monetary architecture, hitherto unknown to central banks - referred as "new normal". The lack of previous experience of central banks in implementation of normalizing activities is undoubtedly a factor hindering their realization. Literature studies indicate a small number of scientific studies and publications in this research area. Therefore, appropriate definition and implementation of the exit strategies' assumptions is extremely difficult in the lack of theoretical framework. In turn, normalization without clearly formulated assumptions, implemented ad hoc, may destabilize banking sector, and finally the whole financial system. Detailed guidelines are also crucial for the effectiveness of the process. Appropriate identification of the normalization process, undertaken early enough - even during unconventional policy, will avoid the negative effects of the "exit" and support positive results, generated during the implementation of non-standard monetary policy. The main aim of the study is identification of possibilities of monetary policy normalization of the European Central Bank. The central bank of the Eurozone still implements extraordinary instruments (enter strategy) - in the form of quantitative easing and zero interest rate policy, while the major central banks of the global economy have developed detailed exit strategies assumptions. Thus, the article attempts to specify detailed guidelines of the ECB normalization process, paying particular attention to balance sheet normalization.*

Keywords: monetary policy normalization, exit strategies, European Central Bank, tapering

JEL codes: E52, E58

1 Introduction

Normalization - in general terms - is a process of returning to traditional monetary policy. Most often, it is identified with the restoration of monetary policy to pre-global financial crisis framework. On the other hand, it can mean a transformation of monetary policy towards a new quality, so far unknown to central banks - *new normal*. Therefore, monetary policy normalization is the process of implementation of the *exit strategies* assumptions, precisely set by central banks. It is an attempt how to "*exit*" from non-standard monetary policy and return to pre-global financial crisis framework. In a broader perspective, it is a process related to withdrawal of unconventional instruments and stabilization of banking sector conditions. The assumptions of normalization process of monetary policy are therefore defined by monetary authorities in their *exit strategies*. They include determinants of selected economy, as well as banking sector and a central bank, indicating necessary actions, that have to be taken to restore the previous monetary policy framework.

Monetary policy normalization is a long-term process and - in assumptions – includes several simple operations, relating to (Yamaoka and Syed, 2010, p. 6; Pyka and Nocoń, 2017, p. 177):

- halting extraordinary interventions,
- downsizing and normalizing central bank's balance sheet,
- selling purchased assets, if necessary,
- raising short-term interest rates.

Expansionary monetary policy of central banks, conducted during the global financial crisis, based on low interest rates and a high degree of *Quantitative Easing*, has caused that it is very difficult for central banks to return to *steady state* and to plan the "*exit*" path from extraordinary monetary policy. Moreover, they are also concerned about the consequences of normalizing activities.

According to J. C. Trichet (Trichet, 2009), appropriate preparation for the *exit* from non-standard monetary policy is a very important part of the normalization process. Central banks must ensure that unconventional operations will be quickly withdrawn and excess liquidity will be absorbed, when macroeconomic conditions improve. Thus, in the case of extraordinary refinancing operations, conducted by central banks, their maturity has been fixed in advance, while in the case of outright purchases additional decisions are required. It should be determined whether purchased securities will be held till maturity or they will be resold in a specific date.

Modern central banks are now faced many challenges in the area of new monetary policy objectives and tools. It is extremely important to precisely define assumptions of the normalization process of modern monetary policy, in particular setting aims to be achieved. So, the normalization process is much more difficult for central banks than the enter strategy, i.e. implementation of unconventional instruments. The lack of previous experience of monetary authorities in realization of normalizing actions is also a kind of a barrier, or a fear of smooth implementation of the *exit* assumptions. Central banks can hardly imagine the consequences of normalization, which additionally slows down their practical actions. In the literature, in the context of normalization process, the concept of "*new normal*" appears several times, as a new post-crisis monetary architecture in which central banks will return to conventional monetary policy. However, will the *new normal* be the same as the *old normal*? So it will be the same situation like before the outbreak of the global financial crisis, or will be totally new quality in monetary policy, far from the previous paradigm of central banking.

2 Theoretical framework of normalization process of modern central banks

In principle, normalization of modern monetary policy includes two main aspects:

- increase of a level of main interest rates (*normalization of interest rate policy*) and
- restoration of central bank's balance sheet to pre-global financial crisis framework (*normalization of balance sheet policy*).

However, it is important to properly define sequencing, according to which above actions should be implemented. Thus, except specifying timing and pace of the normalization process, sequencing of its implementation should also be identified. It means whether an increase of main interest rates should be made before or after the change in size and structure of central bank's balance sheet. This is particularly important when central banks decide to raise interest rates from a very low level, seeking to tighten credit conditions when forecasts indicate that inflation will rise above the inflation target.

In theory, balance sheet policy can be conducted independently of interest rate policy. C. Borio and P. Diysatat (Borio and Disyatat, 2009) indicate that decisions about main interest rates can be made regardless of the size and structure of balance sheet. According to the doctrine of severability, a level of key interest rates is independent from a level of bank reserves. Therefore, decisions on a level of interest rates should not be determined by changes in central bank's balance sheet. However in practice, monetary authorities subordinate decisions on rising interest rates to forecasts of conversion of their assets and liabilities.

When it comes to normalization of interest rates it seems quite easy and base on gradual and reasonable increases of central banks' main interest rates. While normalization of balance sheet might be more difficult challenge for modern central banks. The following

potential paths of normalization of central bank's balance sheet can be identified (Borio and Disyatat, 2009, p. 155):

1. *Selling Securities outright – active approach* – Central banks can actively sell assets purchased during QEs. This will be the most effective in settings of high inflation and future unanchored expectations indicating rise for higher inflation than the central bank's target, or growth overheating than central bank's forecasts. For both FED and Bank of England, this approach seems unrealistic. Selling securities will not only raise yields, but will also put downward pressure on asset prices i.e. both banks are targeting low yields while supporting price stability so exercising this option has the least probability.
2. *Maturing assets not re-invested – Passive (Gradual) approach* – Central banks can also take the approach not to re-invest maturing assets back into the central bank's expanded balance sheets. This process will allow a gradual wind down as assets come due. Bank of England and FED, both have indicated indirectly to follow this path as long as there is an output gap and threat of deflations remains.
3. *Reinvesting maturing assets into duration for gradual equally paced long term wind down – Passive (Snail pace) approach* - This approach allows central banks to keep reinvesting maturing assets into new assets, however, with a plan to invest in assets, which when come due, smooth the assets maturity gaps in the long run. This will gradually wind down the balance sheet on a longer horizon in a consistent and orderly manner. Also, it does not put pressure in any sector of the duration.
4. *Keeping expanded balance sheet as a "new normal"* - Central banks may accept the new role of having expanded balance sheet forever. Not the best of choices as many central bankers have openly stated that this is not their priority nor role, however, if circumstances of weak global economy consistently exists and inflation constantly undershoots banks target, both FED and Bank of England will look for alternatives and this may become a new norm.

In practice, sequencing of specific stages in monetary policy normalization might be modified as a result of dynamic changes of macroeconomic, market or monetary conditions. That is why central banks' flexibility in adjusting operations, by quick response to changing conditions, is so important. Changes may follow sequencing of normalizing actions, some may be abandoned, and other initiatives - not included in the initial normalization plan - may be *ad hoc* implemented.

3 Towards normalization of the European Central Bank

Late implementation of *quantitative easing* policy (QE), public debt crisis and the prolonged period of returning to the growth path of the Eurozone countries, caused that the European Central Bank still continues its non-standard monetary policy. At the same time, the assumptions of the normalization of its monetary policy have not been explicitly defined so far. However, there are some signs towards completion of non-standard instruments implementation and restoration of pre-global financial crisis monetary policy operational framework in the Eurozone. In March 2017, the ECB reduced the volume of asset purchases under the QE policy from 80 to 60 billion EUR per month. Further reduction of the asset purchase program covered the period from January to September 2018, when the central bank purchased 30 billion EUR of securities per month. At the same time, the ECB assured that capital from maturing instruments will be still reinvested, also after withdrawal of asset purchase programs. In turn, the low (zero) interest rate policy will be maintained until total termination of QE policy.

Completion of the non-standard and unconventional initiatives implementation means a move towards normalization of the ECB monetary policy. If the central bank of euro area adopted the order of monetary policy normalization process defined by the Federal Reserve System, this would mean:

- first of all, increasing the level of main interest rates (*interest rate normalization*),
- and then reducing the size of balance sheet (*balance sheet normalization*), by cessation of re-investment of capital from maturing assets and by gradually

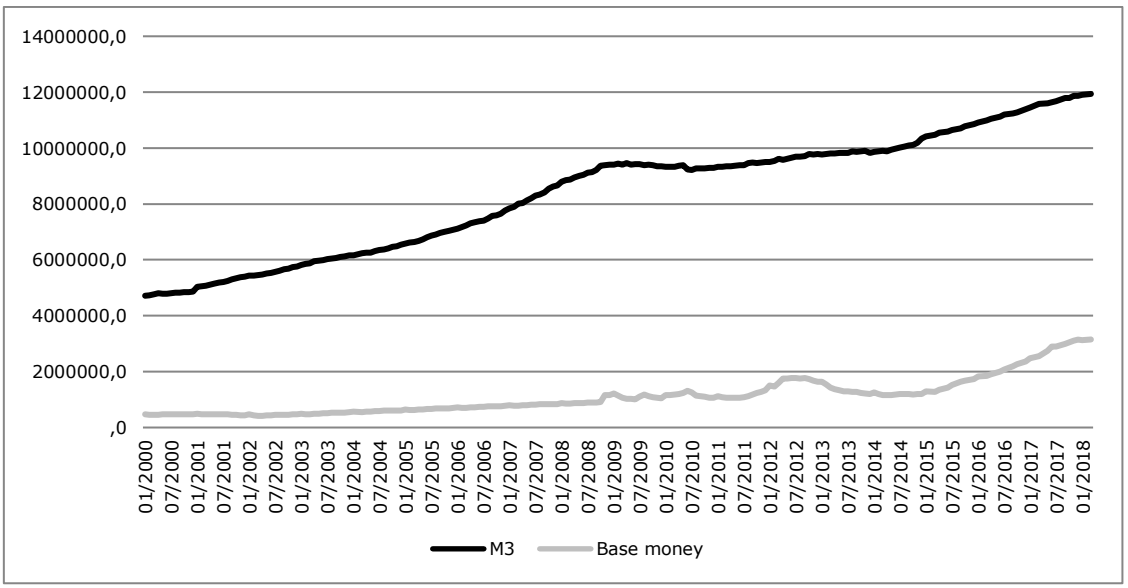
withdrawal of maturing instruments, purchased under the *quantitative easing* policy.

So far, the ECB has determined that it will first gradually reduce asset purchase volumes until the QE policy will be completely withdrawn, and only then will begin to raise main interest rates and cease to reinvest capital on maturing instruments. If it is assumed that in the case of the ECB, normalization will mean a return to the pre-crisis policy - the so-called *old normal*, it is expected:

- to raise the level of key interest rate (*refinancing rate*) to approximately 3%,
- to reduce size of the central bank's balance sheet to pre-crisis level, namely to around 10% of the GDP of the euro area,
- to restore pre-crisis structure of central bank's balance sheet, so that on the asset side - short-term refinancing operations with banks will have the main share, while on the liabilities side money in circulation and reserve requirement will be dominant,
- to go back to its pre-crisis operational framework to conduct monetary policy, i.e. with a central role for MRO and corridor rates, an aggregate deficit of liquidity of the banking sector relative to the ECB and variable-rate fixed-quantity liquidity tenders.

An important issue in the aspect of ECB monetary policy normalization seems to be determining the optimal size of central bank's balance sheet. This point still remains unresolved in the scale of the whole global economy. Economists and policymakers indicate arguments for the need to "shrink" balance sheet totals to pre-crisis levels and identify the potential areas of risk, resulting from maintaining a high level of balance sheet. The first one is the classical monetarist argument. A high level of liquidity may in fact cause a rapid creation of credit money, an accelerator of inflation above the inflation target, which would threaten price stability - and thus achievement of the most important central bank's objective (Asness et al., 2010). In theory, according to the money multiplier principle, a relation between monetary base (M0 aggregate) and the broad money aggregate (M3) should be relatively constant, because maintaining a higher value of reserves should enable banks to increase lending. However, after the outbreak of the financial crisis, programs providing liquidity to banks (through non-standard refinancing operations and asset purchase programs (Nocoń, 2016, pp. 141-143)) caused an increased of monetary base, but banks did not use an additional source of capital to expand their lending, which resulted in a disproportionately smaller increase of M3 (see Figure 1).

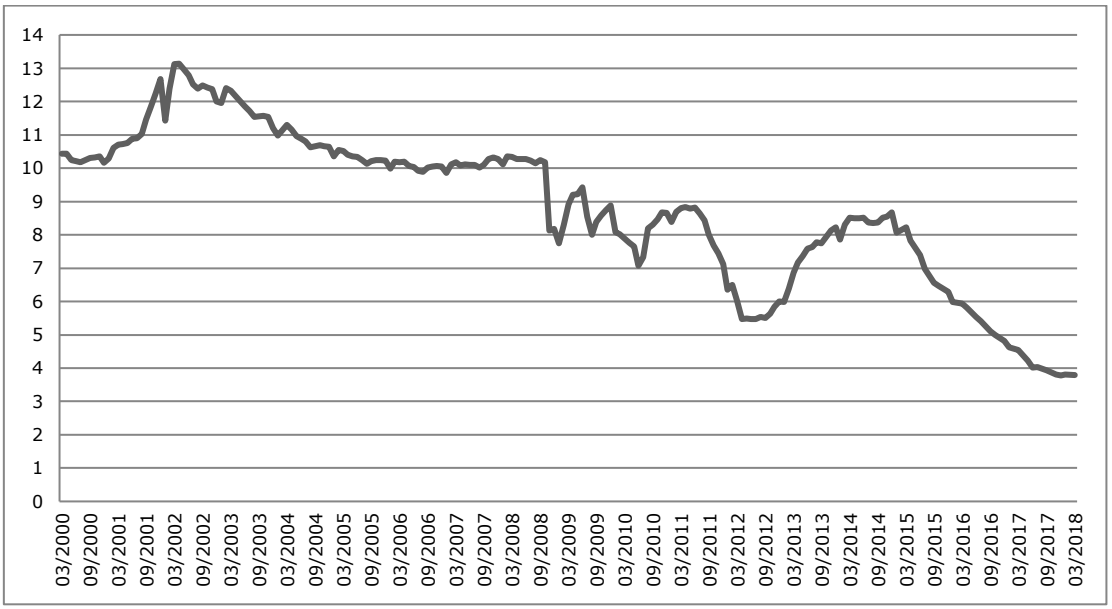
Figure 1 Base Money and M3 Aggregate (in mln EUR)



Source: own work based on ECB data

Thus, the M3/M0 multiplier in the euro area has significantly decreased (see Figure 2). This effect was not even compensate by the ECB decision from 2012 to reduce the reserve requirement rate from 2% to 1%.

Figure 2 Money Multiplier M3/M0



Source: own work based on ECB data

In the years of 2007-2012, the growth of the monetary base (M0) resulted from the growing banks' demand for reserves in refinancing operations, not because they wanted to increase the volume of loans. On the contrary, they tried to secure against possible liquidity shortage when the short-term money markets were dysfunctional. In turn in 2015, after implementation of the asset purchase programs, the growth of monetary base was supply-driven. The central bank of euro area increased a level of excessive reserves to finance asset purchases. Therefore in this case, by increasing the M0 aggregate, there was no direct increase of banks' lending.

The second argument is that a large balance sheet of central bank and a high surplus of reserves in the banking sector may reduce commercial banks' incentives for prudent liquidity management and allow them to rely on a central bank as a Lender of Last Resort too much (Bindseil, 2016). If a liquidity level on the banking market is high, commercial banks tend low willingness to finance each other on an interbank market, and therefore mutual monitoring and assessment of other banks' financial condition.

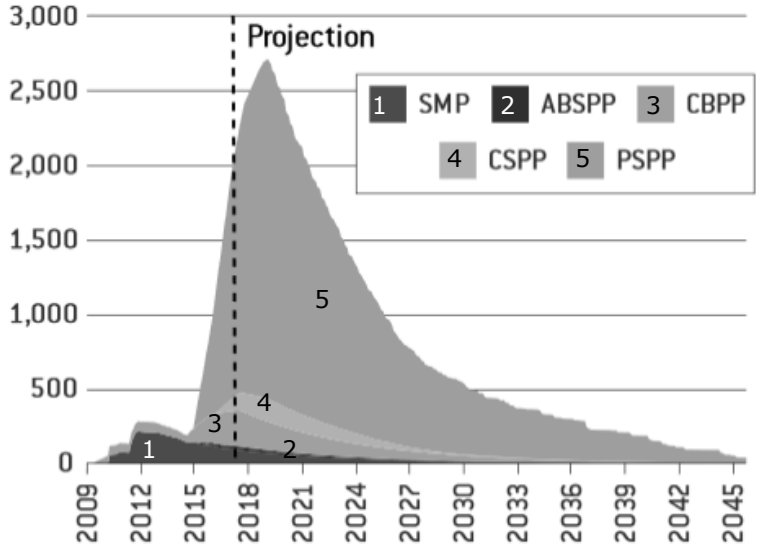
Finally, another side effect of having large balance sheet and a significant excess of liquidity is the risk of lower income and increased financial losses of central banks. This is due to the fact that a significant part of the portfolio of previously acquired assets of monetary authorities are long-term instruments with low profitability, while liabilities are short-term, and their interest may increase along with the normalization of central bank's key interest rates. Despite the fact that central banks are not institutions which main objective is to maximize profits, positive financial results guarantee their financial and operational independence. Possible losses should be only a temporary problem in the period of interest rate normalization, because in the long term if they decide to reinvest profits from maturing assets, new investments during rising interest rates will have higher rate of return. Thus, the spread between financial instruments on the assets side and short-term reserves on the liabilities side will increase. However, an increase of a level of reserve requirement and abolition of an interest rate on its funds may be one of the methods of reducing losses in the transition period.

Analyzing the direction of central bank's balance sheet normalization, it should also be emphasized the arguments for maintaining a large balance sheet. Greenwood et al. indicate

that monetary authorities may strive to maintain a high level of their balance sheet due to the financial stability objective. Maintaining high value of balance sheet total, a central bank would provide, in the form of reserves, much needed financing for financial sector and the real economy (Greenwood et al., 2016). At the same time, through providing higher liquidity than before the crisis in the form of reserves, central banks will be able to displace private capital providers - debt securities issuers, in particular from the shadow banking market. On the other hand, it should be noted that a main role of the central bank's market operations department is not to care for stability of the whole financial system, but to form a level of short-term interest rates that affect the shape of the yield curve. All in all, in order to determine the optimal size of balance sheet, the ECB should not seek to return to its pre-crisis value and structure, but carefully consider advantages and disadvantages of maintaining a large level of assets and liabilities, taking into account the current situation and possible scenarios in the medium and long term.

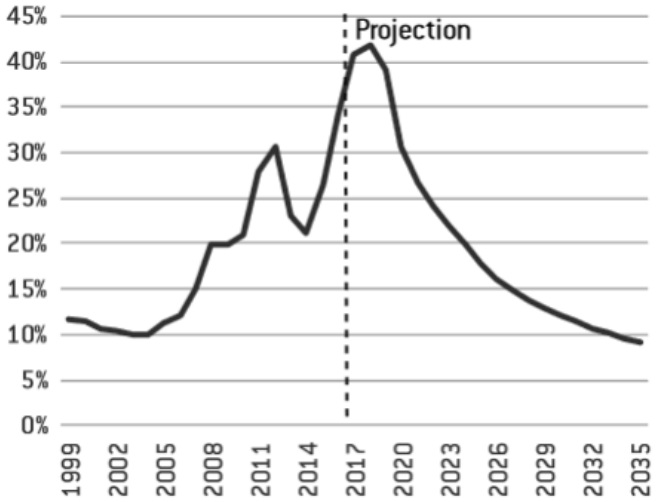
Therefore, it is very important to assess how long it will take for the ECB to reduce its balance sheet to pre-crisis level. If the central bank of euro area decides on a passive approach to its normalization, and resigns from re-investment of capital from maturing assets as well as maintains previously acquired instruments until maturity, it will last about 30 years since the expected completion of the asset purchase programs (i.e. from March 2019) to remove them completely from the ECB's balance sheet (see Figure 3). At the same time, it will take about 5 years to reduce the balance sheet by half, while to reduce it by 80% - will take about 10 years.

Figure 3 ECB Asset Holdings (in bln EUR)



Source: G. Claeus, M. Demertzis (2017). How should the European Central Bank 'normalise' its monetary policy? *Policy Contribution*, Issue No. 21, November 2017, p. 10

Figure 4 ECB Total Balance Sheet Size as a Percent of Euro Area GDP



Source: G. Claeus, M. Demertzis: How should the European Central Bank 'normalise' its monetary policy?, op. cit., p. 10

On the other hand, restoring the size of ECB's balance sheet in relation to euro area GDP, taking into account the natural tendency to increase central banks' balance sheet along with an increase of nominal GDP, requires about 14 years (see Figure 4)[13].

4 Conclusions

The ECB, in reaction to the global financial crisis, implemented a set of standard and non-standard monetary policy instruments that caused a four-fold increase of its balance sheet total, changed the operational framework and the line of conducting monetary policy. Entering the path of growth and return of inflation in direction of the target seems to favor actions towards normalization of its monetary policy. This process should take into account the following issues:

- ensuring predictability of future monetary policy, by defining a schedule of normalizing activities, even before fully completion of asset purchase programs; sequencing and pace of normalization do not have to be very precisely defined, but this information seems to be extremely important to reduce the uncertainty of market participants and avoid possible distortions;
- significant central bank's flexibility with regard to time and sequencing of normalizing activities; the ECB should not rush with the exit from non-standard monetary policy and reducing the size of its balance sheet; the normalization process can be supported by:
    - an increase of a level of main interest rates in the conditions of maintaining a large balance sheet,
    - an increase of reserve requirement rate,
    - *reverse repo* operations,
    - the issuance of ECB's securities to absorb excessive liquidity.
- a passive approach to the normalization of balance sheet by maintaining assets to their maturity.

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[13] At the same time assuming 2% growth of GDP and inflation rate per year, as well as the fact that short- and long-term refinancing operations (MROs and LTROs) will return to pre-crisis level.

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Determinants of Non-Life Insurance Consumption

Tomáš Ondruška[1], Zuzana Brokešová[2], Erika Pastoráková[3]

University of Economics in Bratislava
Faculty of National Economy, Department of Insurance
Dolnozemská cesta 1, 852 35 Bratislava, Slovak Republic
[1] E-mail: tomas.ondruska@euba.sk
[2] E-mail: zuzana.brokesova@euba.sk
[3] E-mail: erika.pastorakova@euba.sk

Abstract: *The paper examines various personal, demographic and economic factors and their impact on the non-life insurance consumption in the Slovak Republic. Non-life insurance is complex and abstract service that has become an increasingly important part of the protection of individual's property by providing a wide range of policies for consumers. What are the key determinants associated with the non-life insurance consumption? Our results have identified most robust predictors of the non-life insurance consumption that could be used in predictions of consumer's consumption of property insurance. These results can help insurers to better understand their potential consumers and to improve their acquisition and segmentation techniques.*

Keywords: consumer, insurance market, insurance consumption, determinants

JEL codes: G22

1 Introduction

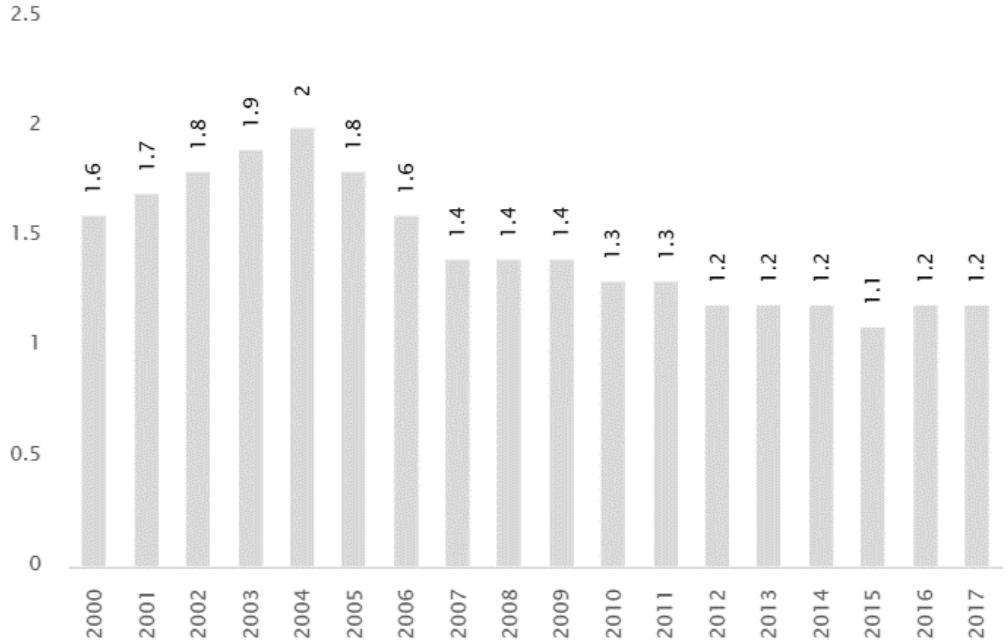
Undoubtedly, insurance plays an important role in the modern world. However, overall understanding of the insurance demand is limited contrary to individual's common sense. Although insurance demand research is largely focused on life insurance, given the increasing volume of assets owned by individuals or households and emerging risks that threaten these assets is necessary to study also demand for non-life insurance.

In particular, due to the lack of household-level data of insurance[14], there are very few existing empirical works on non-life insurance demand. As a result, most existing studies only use macro data. The motivation of the paper is to contribute to the understanding of consumer behavior in the purchase of non-life insurance from the microeconomic perspective. Main aim of the paper is to identify key determinants associated with the property insurance consumption, which could help insurers to better understand their potential consumers. We do not focus on legal entities in the paper, but we will limit our research to research of the determinants of demand for non-life insurance from the point of view of individuals. However, in our research we only focus on the property insurance, abstaining from various liability and compulsory insurance policies.

The outlook of the general performance of the non-life market in Slovak Republic allows better understanding of the specifics of this market. The performance of insurance market is usually analyzed through three indicators: (1) volume of written premium, (2) insurance penetration ratio (gross written premiums to GDP), and (3) insurance density ratio (gross written premium per capita). Generally, the insurance density and penetration ratios (Figure 1 and Figure 2) indicate that indicators are not improving over time. The persistence of such a trend will cause that the assets of households in the Slovak Republic will be less protected against the effects of random events.

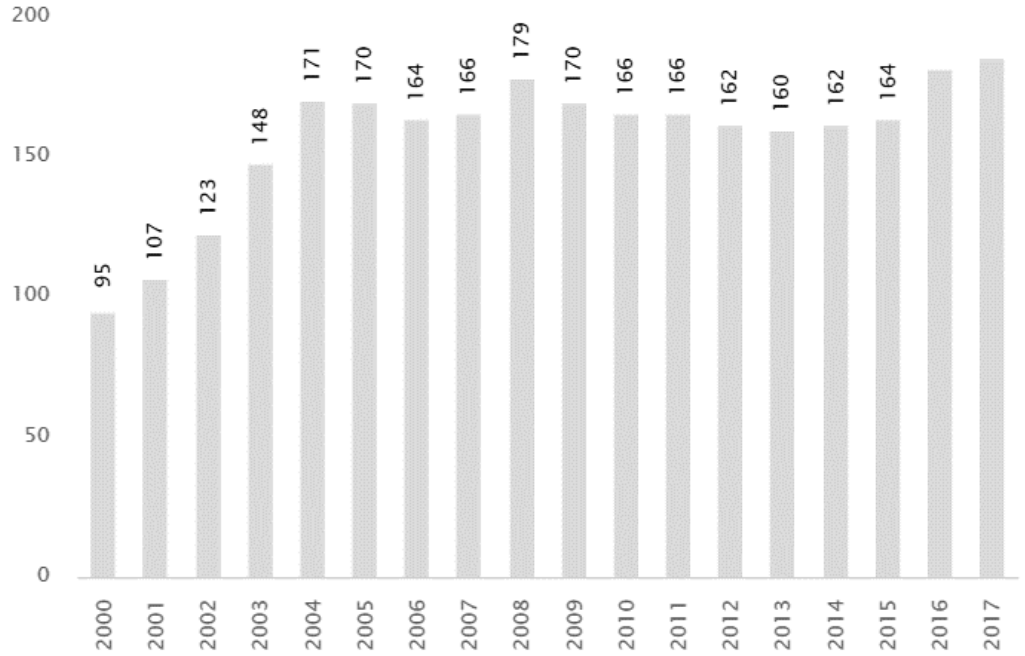
[14] The reason for this may be the demand side represented not only by households and individuals but also by companies as well as the obligation to buy some non-life insurance products.

Figure 1 Non-Life Insurance Penetration in Slovak Republic – GWP as a percent of GDP



Source: AXCO & Allianz Research

Figure 2 Non-Life Insurance Density in Slovak Republic – GWP per capita in EUR



Source: AXCO & Allianz Research

Figures indicate that insurance premium remained stable over time and the variance of the ratio was driven mainly by the changes of GDP. It signalizes that the growing GDP was not bringing substantial growth in insurance coverage demand. The insurance density index in Slovakia was associated with a significantly lower value of assets that can be insured in the commercial entities and households, as well as property insurance distant priority in the hierarchy of needs. Unfavorable indicators point to the need for research in this area to find answers to the question of how to stimulate demand for non-life insurance.

2 Literature Review

Determinants that influence insurance purchases have been the focus of insurance research for many years. Studies define numerous variables that might be significant in explaining the demand for insurance (Zietz, 2003). Most of the researches analyze solely life insurance products because of the specific character of the non-life insurance products (some policies are mandatory in many countries, e.g. MTPL). Many studies find results conflicting with previous research, and some of the contradictions are shown to be attributed to economic conditions of the country, demographics, or geographic factors.

There is no doubt that extent of the research on demand for non-life insurance is low. Especially when we take into account a number of published papers dealing with the life insurance consumption. Both, individuals (natural persons) and companies (legal entities) represent the demand side for non-life insurance. However, the decision to buy or not to buy insurance coverage remains on the individual itself (or group of individuals). An individual has to decide for himself, for another person, or on behalf of the company.

Most of the previous papers dealing with the non-life insurance demand are based on the theoretical models in which the purchase of insurance is viewed as the exchange of a certain sum of money – premium for a sum of money with uncertainty as a compensation.

Research on particular factors influencing demand for non-life insurance is significantly lower than the scope of papers focused on life insurance demand. The demand for non-life insurance was examined by several authors as Szipiro (1985), Beenstock et al. (1988), Outreville (1990), Browne et al. (2000), Esho et al. (2004), Hussels et al. (2005) and also Millo and Carmeci (2011), Khovidhunkit and Weiss (2005), Feyen et al. (2011) and Zhang and Zhu (2005). A list of published studies on demand for non-life insurance is in the table below.

Table 1 Non-Life Insurance Demand Papers

Year	Author(s)	Journal	Title
1985	Szipiro	The Journal of Risk and Insurance	Optimal Insurance Coverage
1988	Beenstock, Dickinson a Khajuria	The Journal of Risk and Insurance	The Relationship between Property-Liability Insurance Premiums and Income: An International Analysis
1990	Outreville	The Journal of Risk and Insurance	The Economic Significance of Insurance Markets in Developing Countries
2000	Browne, Chung a Frees	The Journal of Risk and Insurance	International Property-Liability Insurance Consumption
2004	Esho, Kirievsky, Ward a Zurbruegg	The Journal of Risk and Insurance	Law and the Determinants of Property-Casualty Insurance
2005	Hussels, Ward a Zurbruegg	Risk Management and Insurance Review	Stimulating the Demand for Insurance
2011	Millo a Carmeci	Journal of Geographical Systems	Non-Life Insurance Consumption in Italy: A Sub-Regional Panel Data Analysis

Source: authors

The table illustrates the significant number of studies performed compared to life insurance. The reason for the lower interest in the research of determinants in non-life insurance is, as we have already mentioned, the nature of non-life and the frequent presence of the obligation to buy a certain type of non-life insurance in many countries.

Despite the fact that it is not possible to create an overview of literature based on previous research to the extent as in the case of life insurance, we will focus on a summary of the findings of non-life insurance research. We use also results of research of life insurance demand determinants that can help us as a proxy for non-life insurance demand. Based

on existing theoretical and empirical literature, we identify most examined demographic and economic characteristics that could affect the demand for non-life insurance. These factors are age, gender, education, dependents, employment status, marital status, income, savings and religion.

An empirical study by Hammond et al. (1967) and theoretical paper by Campbell (1980) both found that one of the main purposes of life insurance is to protect dependents against financial hardship in the case of the wage earner's premature death. From the non-life insurance perspective, it is also necessary to protect property as a possible means for inheritance. Campbell (1980) and Burnett and Palmer (1984) argue that the protection of dependents against financial hardships is the major force driving insurance consumption. Chui and Kwok (2008) find that with the increasing number of dependents of a person, this person needs to buy more insurance. Most of the previous studies have provided empirical evidence that the consumption of insurance and the number of dependents in a country are positively related (e.g. Hammond et al, 1967; Beenstock et al, 1989).

Education not only lengthens the dependency period but higher level of education may lead to a greater degree of risk aversion and more awareness of the necessity of insurance in general (Browne and Kim, 1993). The level of an individual's education may determine his/her ability to understand the benefits of risk management and savings (Beck and Webb, 2003). Education is one of the few demographic determinants examined in studies of demand for non-life insurance. Outreville and Esho et al. (2004) confirmed its positive impact on demand in the non-life insurance. Education is related to greater awareness of the different types of risks and mitigation of their impact through insurance.

Age is found to be positively significant in majority of studies, e.g. Showers and Shotick (1994), Truett and Truett (1990) and negatively significant in studies: Ferber and Lee (1980), Chen et al. (2001). Hammond et al. (1967) found age to be a significant factor affecting premium expenditures for insurance for the low income and middle income groups. Showers and Shotick (1994) used the age of the respondent as a proxy for the general "stage" of the family unit.

There are limited papers considering the gender as the determinant of insurance demand. Many studies confirm that women are more risk averse than men (Halek and Eisenhauer, 2001). Another recent study by Luciano et al. (2015) finds that women are less likely to be insured than men.

Browne and Kim (1993) suggest that religious people tend to purchase less insurance, because they perceive that buying life insurance shows a distrust of God's protection. Beck and Webb (2003) find that insurance consumption is significantly lower in Islamic countries than in other countries, whereas Outreville (1996) finds that this relationship is weak. Feyen et al. (2011) proved that the presence of Islamic individuals in the population has the negative impact also on the development of non-life insurance market.

Employment status is expected to be positively related to life and non-life insurance demand as a Miller (1985) reports that retirees have less insurance than active workers of the same age. Marital status influences the interest in insurance positively (Halek and Eisenhauer, 2001; Baek and DeVaney, 2005). Although there is not any paper directly focused on the determinant head of household, we included it in our analysis. Several studies (e.g. Hammond et al., 1967; Campbell, 1980) suggest that the head of household has its unique place, which makes it suitable to an increased interest in insurance.

Income is considered as a key determinant of the insurance demand in majority of studies. Higher income increases not only the standard of living but also wealth of individuals. As income increases, insurance becomes more affordable. Positive impact of income on non-life insurance demand has shown majority of the studies that include Beenstock et al. (1988), Outreville (1990), Browne et al. (2000), Esho et al. (2004). The growth of individuals' income is followed by the growth of their assets, which are the subject of non-life insurance. Ultimately, growth in assets is moving to the need for the additional coverage through insurance, thereby increasing the demand for non-life insurance.

Savings of the individuals are undoubtedly connected with the income. But the impact of savings as a variable of the non-life insurance demand is ambiguous in previous studies. While Rose and Mehr (1980) argue that the savings have a negative effect on the consumption of insurance, Headen and Lee (1974) find the opposite. These attitudes come from the perception of savings as a compensation of insurance or as an additional source of funding.

We mentioned only the most important determinants of the demand for insurance identified by the previous research. However, we can identify other microeconomic determinants of the individuals' demand for non-life insurance as bequest motive, race, ownership of credit cards, house ownership, occupation and others.

3 Methodology and Data

We use survey data to examine determinants of non-life insurance demand. Sample consists of respondents of Slovak Republic aged over 18 years. At the data collection phase, we received a total of 1044 respondents, of whom we selected by random selection a representative sample of 870 respondents, which corresponded to the distribution of the population of the Slovak Republic by age and gender, according to data from the Statistical Office of the Slovak Republic.

We use logistic regression to examine various determinants of demand for non-life insurance. The dependent variable that we will model is the ownership of non-life property insurance. As explanatory variables, we chose gender (GEN), age (AGE), savings (SAV), education (EDU), head of household (HEAD), working status (EMPL), marital status (MAR_S), dependent children (DEP) and religion (REL).

In the first step we tested the determinants and found the interdependencies between them to exclude multi-collinearity. The analysis of the determinants of the demand for insurance was realized through logistic regression. We have chosen this type of regression because of the categorical nature of our variables. Due to the nature of the explained variables, logistic regression is a special type of generalized linear model. The moderate association rate is present between the determinants: MAR_S and DEP; MAR_S and AGE; INC and SOC_S. Due to the presence of a moderate association rate between MAR_S and DEP variables, we included another variable of their cross effect MAR_S* DEP. We also wanted to include other MAR_S * AGE and INC * SOC_S crossover variables, but the quality of the logistics model did not improve. For this reason, we did not include these interaction variables in the resulting model.

4 Results and Discussion

The non-life insurance demand model is statistically significant at the significance level 0.05. At this level of significance, several parameters are statistically significant: gender (GEN), age (AGE), marital status (MAR_S), savings (SAV), income (INC), head of household (HEAD). Results are shown in table below.

Table 2 Model Parameters and Significance Tests

Analysis of Maximum Likelihood Estimates

Parameter			DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept			1	0.0295	0.5112	0.0033	0.9539
GEN	*Man*		1	-0.4273	0.1739	6.0347	0.0140
AGE1	*18 - 24*		1	-1.6102	0.3605	19.9516	<.0001
AGE2	*25 - 39*		1	-0.8981	0.1945	21.3098	<.0001
MAR_S	*Married/Living in couple*		1	0.7767	0.3039	6.5326	0.0106
SAV	*No*		1	-0.8340	0.2182	14.6136	0.0001
INC1	*331 - 880 €*		1	0.3592	0.3535	1.0323	0.3096
INC2	*881 - 1 500 €*		1	1.0067	0.3920	6.5954	0.0102
INC3	*over 1 500 €*		1	1.5203	0.4682	10.5459	0.0012
EDU	*Primary / Secondary*		1	0.0364	0.1822	0.0399	0.8416
HEAD	*No*		1	-0.5475	0.1780	9.4561	0.0021
EMPL_1	*Employed*		1	0.3733	0.2876	1.6844	0.1943
EMPL_2	*Self-employed*		1	0.4252	0.3539	1.4437	0.2295
DEP	*No*		1	-0.4185	0.3137	1.7801	0.1821
*MAR_S*DEP*	*Married/Living in couple*	*No*	1	0.5281	0.3935	1.8012	0.1796
REL1	*Nonbeliever*		1	0.1355	0.2825	0.2299	0.6316
REL2	*Believer*		1	0.0905	0.2628	0.1186	0.7306

Model parameters: -2 Log Likelihood 893,544; AIC 927,544; SC 1008,608.
Source: authors

The determinant gender (GEN) is statistically significant in our model. The chance of ownership of non-life insurance product by man is only 0.65 times the odds compared to a woman. Women are therefore more interested in non-life insurance. Their higher rate of risk aversion thus manifests itself not only in life insurance but also in the protection of own property. The results of Gandolfi and Miners (1996) show the increased interest of women in life insurance, and we can extend these findings to non-life insurance.

In variable age (AGE), we have confirmed a statistically significant impact in all its subcategories. The chance that an individual between the ages of 18 and 24 will have a non-life insurance contract is 0.20 times the chance of an individual who is between 40 and 61 years old. Although this chance has doubled in the 25-39 age category, the odds ratio is still 0.41 times for those aged 40 to 61. The continued growth of interest in non-life insurance with higher age is obvious. The cause can be found primarily in the gradual obtaining of property of individuals during their lifetime. Increasing amount of property also generate higher need for insurance cover.

Marital status (MAR_S) is also statistically significant determinant of demand for non-life insurance. The chance that an individual will buy the non-life insurance policy as a change of his status from single to married increases 2.17 times. Increased interest also has its merit. The commitments are related, among other things, to the need for own housing, or the acquisition of movable and immovable property, which creates prerequisites for widening coverage of risks in non-life insurance. Individuals are aware of the need to protect common values, which they can properly address through insurance.

We can confirm the positive and significant impact of savings (SAV) on non-life insurance interest. If the individual does not save money, his chance of ownership of the non-life insurance product is 0.43 times that of the person making the savings. The fact that the individual creates savings is also related to one of the motives for handling the free means of their use for the growth of property. This also increases the need for insurance cover. Savings are related not only to better availability of non-life insurance but also to their investment in the purchase of additional assets.

Income (INC) is one of the few determinants investigated in the research of demand for non-life insurance in higher extent. Although there were more income groups in our survey, not all of them are statistically significant. Our findings are similar to studies by Beenstock et al. (1988), Browne et al. (2000) and Esho et al. (2004). Growth of income is also linked to the growth of assets. Income is then used for consumption of items that are not necessary in the lives of individuals (including insurance). Revenue is also a significant factor in our case, which is involved in modeling demand for non-life insurance.

Determinant head of household (HEAD) is statistically significant in our model. A person who is the head of a household has a greater chance of the ownership of non-life insurance. These individuals often have different types of non-life insurance policies, although other members of the household can also take part in the decision process to buy them and acts as the main policyholder.

We do not prove the assumption of the positive impact of education (EDU) on the demand for non-life insurance confirmed by Outreville (1990), as well as by Esho et al. (2004) in our model. There is no significant difference between groups in the interest of non-life insurance. Our model bring similar results for other variables as employment status (EMPL), dependent children (DEP) and religion (REL).

5 Conclusions

Research of factors influencing the demand for non-life insurance is in large contrast to published research in life insurance. While the interest of individual consumers in life insurance has been investigated in many studies, only marginal attention has been devoted to non-life insurance. The reason is the nature of non-life insurance, the obligation to buy some types of non-life insurance, but also the fact that the demand for non-life insurance is also represented by legal entities. By using logistic regression and data from realized survey, we have identified important determinants of individual interest in non-life property insurance in the conditions of the Slovak Republic. Paper contributes to the understanding of consumer behavior in the purchase of non-life insurance from the microeconomic perspective. As there are very few existing empirical works on non-life insurance demand due to the lack of household-level data of insurance our contribution enriches existing literature and we assume our findings can motivate more research in this field. We identified following determinants as statistically significant: gender (GEN), age (AGE), marital status (MAR_S), savings (SAV), income (INC), head of household (HEAD). Our results can help in addressing the marketing of insurance companies, especially by focusing on the target segment of potential clients. The results can also be beneficial to policy makers in questions about taxation of non-life insurance products. Discussed indicators of non-life insurance market in Slovak Republic point to a low interest in non-life insurance policies in Slovakia, and the results of our research point to groups whose decisions to buy property insurance can be greatly influenced.

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factors influencing group decision-making' provided by the Ministry of Education, Science, Research and Sport of the Slovak Republic.

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Decomposition of ROE to Selected Financial Analysis Indicators

Denisa Oriskóová[1], Renáta Pakšiová[2]

[1] University of Economics in Bratislava
Faculty of Economic Informatics, Department of Accounting & Auditing
Dolnozemská cesta 1, 852 35 Bratislava, Slovakia
E-mail: denisaorisko@gmail.com

[2] University of Economics in Bratislava
Faculty of Economic Informatics, Department of Accounting & Auditing
Dolnozemská cesta 1, 852 35 Bratislava, Slovakia
E-mail: renata.paksiova@euba.sk

Abstract: *The existence of company in a rapidly varying environment is conditioned by the ability to respond properly to challenges arising from changing business environment and customer requirements. Decisions on the future direction of a company eventually are translated into financial form and affect the financial health of company. Assessment and prediction of financial health is key to the company's management. Data sources for assessment of financial situation for internal users are not only financial statements but also various internal reports. However, to external users are available only published financial statements and annual reports, which are the resources of information for financial situation assessment as basis for decision making. The picture of the company's financial performance is supplemented by financial analysis indicators, which should be evaluated in their mutual contexts. Evaluation based on one indicator can lead to incorrect conclusions, so for this reason in this paper is investigated decomposition of the return on equity (ROE) to selected indicators. The aim of the paper is to quantify the impact of indicators, such as tax burden ratio, interest burden ratio, earnings before interest and tax (EBIT) margin, asset turnover and financial leverage, on ROE development. In the paper are used statistical methods, specifically regression and correlation analysis, which were applied on the sample of the Slovak Republic engineering industry company's. By linear regression model were found out that to the development of ROE the most significant impact has tax burden indicator and asset turnover, while the equity multiplier has the least significant impact.*

Keywords: return on equity, corporate finance, impact of financial indicators

JEL codes: M41, G32

1 Introduction

The success of a company in the long run is the result of past decisions and the ability to maintain competitiveness in a rapidly changing environment. An effort to understand and meet customers' quality and price requirements forces companies to find new opportunities to achieve sustainable profitability (Džubáková and Kopták, 2017). To assess the correctness of a decision, it is necessary to define what indicators are considered in company to be a measure of success. A precondition for evaluating the development of indicators is their comparability, so they need to be expressed in the same measurement units. A comprehensive system of accounting and reporting is a relevant source of comparable information in monetary terms. To assess financial performance and to predict future developments the sources are accounting information presented in the financial statements (Lovciová, 2017). Providing information for executives and financial management of company is a priority role of accounting (Baštincová, 2017). Executives and financial management are considered as internal users of information with access to comprehensive data beyond the published information required by laws available for example via the European e-Justice Portal (MacGregor and MacGregor, 2017). External users, shareholders and creditors make their decisions only based on published documents, such as the annual report and financial statements. From these basic documents, using the financial analysis instruments, can be reconsidered the financial health of the business entity. (Benetti, 2016) Individuals remain only partly informed, which leads to a situation

where some market participants have more information than others (Tumpach and Baštincová, 2014). In any case, managers in decision making should use the information asymmetry to maintain competitiveness. Development of information and communication technologies and the application of optimization methods for solving problems ensures greater business efficiency, more flexible performance of organizations in the market, accelerating transactional operations, reducing logistics costs and increasing profits (Mijailović et al., 2015). For comparison of company's efficiency and performance is often used as indicator profit or loss, although alone is an inappropriate to treat as comparable value. The amount of accounting profit or loss itself does not indicate the size of the company or industry in which it operates. Comparability of variables can be ensured besides other conditions by financial analysis ratios. Rentability ratios are used to assess the financial performance, which application depends on requirements and entitlements of users. Till 70's of the 20th century the main objectives of companies were measured based on ratio return on asset (ROA), later return on equity (ROE) became widespread (Kharatyan et al., 2016). Company DuPont Corporation applied first the formula for the calculation of return on assets, which was multiplying two indicators, namely the profit margin and the asset turnover (1).

$$ROA = \frac{Net\ profit}{Sales} \times \frac{Sales}{Asset\ turnover} = \frac{Net\ profit}{Asset\ turnover} \quad (1)$$

Return on assets supplemented by leverage indicator expresses return on equity and reflects indebtedness of the company (2). As a result of this development ROE, as a relevant indicator, was more widely applicated than ROA. The ROE decomposition into individual indicators allow to assess the strengths and weaknesses of a company and reflects more comprehensive picture than ROE itself (Prajapati and Danta, 2015). ROE has the greatest importance from the point of view of the owners and investors as evaluates the profitability of shareholders' equity. (Blahušiaková, 2017; Mareček and Rowland, 2017).

$$ROE = ROA \times \frac{Total\ assets}{Shareholder´s\ equity} \quad (2)$$

Based on the previous extension of profitability ratios, ROE can be calculated by multiplying profit margin, asset turnover and equity multiplier (3, 4).

$$ROE = Profit\ margin\ x\ Asset\ turnover\ x\ Equity\ multiplier \quad (3)$$

$$ROE = \frac{Net\ profit}{Sales} \times \frac{Sales}{Total\ assets} \times \frac{Total\ assets}{Shareholder´s\ equity} \quad (4)$$

Extending the profit margin to another three indicators, tax burden ratio, interest burden ratio and EBIT margin (5), allows more extensive investigation and understanding of company's various financial aspects. (Prajapati and Danta, 2015).

$$Profit\ margin = Tax\ burden\ ratio \times Interest\ burden\ ratio \times EBIT\ margin \quad (5)$$

The subject of further investigation will be the extension of ROE to five indicators as shown in formula 6. The indicators asset turnover and EBIT margin capture the impact of the investment and operational decisions of the company on overall profitability. The interest burden ratio and equity multiplier reflect the impact of company's financing policy on ROE as well as overall indebtedness. Last indicator, tax burden ratio captures the corporate taxation impact on ROE development. (Kijewska, 2016).

$$ROE = \frac{Net\ profit}{EBT} \times \frac{EBT}{EBIT} \times \frac{EBIT}{Sales} \times \frac{Sales}{Total\ assets} \times \frac{Total\ assets}{Shareholder´s\ equity} \quad (6)$$

One of the ROE components is tax burden ratio, which expresses the impact of taxes to ROE (Grashuis, 2018). It represents the proportion of net profit to profit before taxes. The tax

burden ratio equals to one if the amount of taxes is zero. The lower the value of the tax burden ratio, the higher is the tax burden on the company.

In the case of an interest burden ratio, the indicator expresses the impact of interest paid on debt to ROE. If the amount of interest is zero, then the interest burden ratio equals to one. Increase in indebtedness reflects in lower values of interest burden ratio. Lack of equity caused by low share capital and low undistributed profits from previous accounting periods stimulates companies to use debt financing. In general, the cost of share capital paid in the form of dividends or profit share is higher than the price of borrowed resources paid as interest. The reason is that investors are the main carriers of the risk associated with decline of company or poor management, which can lead to lose of invested capital (Sedláček, 2017). High indebtedness is a barrier when finding new creditors in the future. The higher level of liabilities leads to decrease of investments into fixed assets and ultimately reduces the value of the company. (Kim, 2016)

Indicator profit before interest and taxes (EBIT) evaluate the potential for generating profit and abstracts from the capital structure and tax burden. EBIT makes possible to compare companies regardless of the financing strategy and the differences in the tax environment. EBIT margin is the proportion of profit before interest and taxes to total sales.

Asset turnover represents how many units of sales accounts for unit of asset, serves to evaluate the performance of the company through asset use efficiency. Efficiency of company can be judged to be fair, if the ratio is higher than one, so sales are in higher amount than assets in the given accounting period (Ďurišová and Myšková, 2010). Asset turnover measures asset efficiency in generating revenues (Kharatyan et al., 2016).

The equity multiplier the last but not least ratio from the ROE components, expresses how many euros of asset accounts for one euro of shareholder's equity. The higher the equity multiplier, the higher is also the indebtedness, which means that company is more financed by debt (Kijewska, 2016). The high level of equity multiplier is positive feature, if the return on assets is higher, than the interest amount paid on debt. Increase in indebtedness causes increase in ROE (Ďurišová and Myšková, 2010), which also results form the difference between the formulas of ROE and ROA calculation.

2 Methodology and Data

The aim of this paper is to quantify the impact of tax burden and interest burden ratios, EBIT margin, asset turnover and equity multiplier on ROE development. Selected indicators for year 2016 were examined on a sample of companies in the Slovak Republic engineering industry. This industry together with the automotive industry represents the driving force of the Slovak economy. The engineering industry has a strong historical background, holds a stable position and is a key and still growing pillar in the Slovak industry. The data for statistical analysis was drawn from the Financial Statements Register and the web portal Finstat. The sample of companies was selected based on the following criteria:

- companies in the Slovak engineering industry and simultaneously
- minimum precalculated number of employees in accounting period 2016 more than 200 and simultaneously
- companies with published financial statements for accounting period 2016 available as of 19. 3. 2018.

58 companies met the selected criteria, whose financial results presented in financial statements are subject of regression and correlation analysis.

Model Specification

To determine the extent of selected components' impact on ROE linear regression model was used. The regression model represents a simplified expression of relations between two or more variables by mathematic formula (Šoltés, 2008). One of the key tasks of regression analysis is the correct identification of independent (explanatory) and dependent (response) variables (Prajapati and Danta, 2015). One of the regression analysis assumptions is the independence of explanatory variables, which is examined

through correlation analysis. Another requirement for regression analysis is the evaluation of the distribution of independent variables, which should have a normal distribution. The relationship of dependent and independent variables can be expressed by the following linear regression model:

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_k x_{ik} + \varepsilon_i \quad (7)$$

Where β_0, β_1, …β_k are the model parameters,

x_{ij} - i^{th} value (i = 1, 2, ..., n) of explanatory variable X_j (j = 1, 2, ..., k).

In the next part of the paper we will point, out whether the basic assumptions of the regression model are met, whether the selected components are statistically significant ROE predictors and we will determine the extent of components' impact on ROE development.

3 Results and Discussion

It is very important to find the main factors that have a significant impact on financial performance in industry (Dluhošová et al., 2017), and therefore the ROE decomposition is an appropriate tool to identify strengths and weaknesses in the performance of company through various financial indicators that consider not only profitability but also indebtedness, asset turnover, interest and tax burden ratio. Prior to regression analysis indicators of descriptive statistics will be used to characterize the sample of investigated engineering industry companies (Table 1).

Table 1 Descriptive Statistics of ROE and Its Components

Indicators	Average	Minimum	Maximum	Median
ROE	12.02	-52.90	81.08	10.35
Tax burden	0.80	0.28	1.11	0.78
Interest burden	0.01	-0.02	0.03	0.01
EBIT margin	3.62	-31.01	29.57	4.00
Asset turnover	1.41	0.23	3.42	1.40
Equity multiplier	4.17	1.09	47.93	2.35

Source: author's calculations based on Finstat data retrieved on 19.03.2018 using PSPP program

ROE, expressed as the multiplying of five indicators, has average 12.02 %, intermediate values of all ROE's is 10.35 %, minimum ROE is -52.90 % and maximum 81.08 %. The tax burden ratios, as mentioned above, reach value one, if the income tax equals to zero. In the Slovak Republic all companies regardless of the economic result paid minimum tax (in the form of a tax license) for the accounting periods ending from 2014 to 2017, which is the reason why tax burden ratio reach values above one. We identified the minimum tax burden at 0.28 and a maximum of 1.11, while the average is 0.80 and a median 0.78. The interest burden ratio accounts for much lower values than the tax burden ratio. The maximum interest burden ratio is 0.03 and minimum -0.02. The average value and median value is 0.01. Interest burden ratio and equity multiplier indicate higher indebtedness of selected companies. The minimum equity multiplier is 1.09, median 2.35 and maximum 47.93. On average, companies finance one quarter (1/4.17), so 24.15 % of assets from the shareholder's equity. EBIT margin is appropriate to compare the profitability of company, while abstracting from the capital structure and corporate income tax. The average EBIT margin is 3.62, while median is 4.00, the maximum is 29.57 and the minimum value is -31.01. Asset turnover is represented by values between 0.23 and 3.42. The difference between median (1.40) and average (1.41) is minimal. Normal distribution as one of the assumptions of regression analysis can be evaluated based on difference between median and average. In this case, we have identified the smallest differences between median and average by components tax burden ratio, interest burden ratio and asset turnover.

Table 2 Correlation of Return on Equity Components

Indicators	Tax burden	Interest burden	EBIT margin	Asset turnover	Equity multiplier
Tax burden	1	0.16 (0.229)	-0.13 (0.335)	-0.30 (0.023**)	-0.11 (0.407)
Interest burden	0.16 (0.229)	1	-0.08 (0.552)	-0.19 (0.163)	-0.26 (0.046**)
EBIT margin	-0.13 (0.335)	-0.08 (0.552)	1	0.19 (0.156)	-0.08 (0.541)
Asset turnover	-0.30 (0.023**)	-0.19 (0.163)	0.19 (0.156)	1	0.25 (0.055*)
Equity multiplier	-0.11 (0.407)	-0.26 (0.046**)	-0.08 (0.541)	0.25 (0.055*)	1

Notes: p-values are shown in parentheses besides correlations; *, ** indicate statistical significance at 10 percent and 5 percent confidence levels.
Source: author's calculations based on Finstat data retrieved on 19.03.2018 using PSPP program

The results of multicollinearity testing between independent variables are subject of Table 2, based on which dependence between variables can be evaluated as weak and, in most cases, statistically insignificant. At 5 % confidence level there is a weak negative relationship between the tax burden ratio and the asset turnover, as well as the weak indirect dependence between equity multiplier and interest burden ratio. At 10 % confidence level we identified a weak direct dependence between asset turnover and equity multiplier. The assumption of the independence of explanatory variables is fulfilled and we can continue with the regression model.

Table 3 Regression Model Summary

Model summary	R	R Square	Adjusted R Square	Std. Error of the Estimate
Values	0.93	0.86	0.84	7.12

Source: author's calculations based on Finstat data retrieved on 19.03.2018 using PSPP program

A summary of the regression model is specified in Table 3, where R value represents the relationship between the explanatory and response variables. In this case, R equals 0.93 and denotes the strong relationship between the variables. R square and adjusted R square indicate how many percent of the response variable is affected by explanatory variables. R square is applied in models with one explanatory variable, while the adjusted R square in case of several explanatory variables. In this model 84 % of the ROE variability is explained by independent variables, so by ROE components.

Table 4 Parameter Characteristics of Linear Regression Model

ANOVA	Sum of Squares	df	Mean Square	F	Sig.
Regression	15760.82	5	3152.16	62.18	0.000
Residual	2636.22	52	50.70		
Total	18397.04	57			

Source: author's calculations based on Finstat data retrieved on 19.03.2018 using PSPP program

The statistical significance of the regression model is shown in Table 4 in the last column (p-value), whose value is 0.000. The model is considered to be statistically significant at the 5 % and 10% confidence level. We also verify the statistical significance based on the F value, which at the 5 % confidence level at given degrees of freedom is 2.393 and at the 10 % confidence level the 1.961 is. In the regression model the F value is 62.18, which is much higher than the limit values at 5% and 10% confidence level, so we consider the model to be statistically significant.

Table 5 Regression Equation Coefficients

Regression model coefficients	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-22.68	6.41	0.00	-3.54	0.000
Tax burden	13.08	6.19	0.12	2.11	0.039
Interest burden	234.76	225.62	0.06	1.04	0.303
EBIT margin	2.02	0.14	0.80	14.82	0.000
Asset turnover	7.88	1.72	0.26	4.58	0.000
Equity multiplier	0.88	0.15	0.34	5.99	0.000

Source: author's calculations based on Finstat data retrieved on 19.03.2018 using PSPP program

The regression coefficients and the intercept are presented in Table 5, according to which the regression coefficients based on p value are statistically significant at 5 % and 10 % confidence level except for the interest burden ratio. The inclusion of interest burden ratio into the model is important due to ROE formula decomposition. Only statistically significant ROE components will be interpreted, among which we include tax burden ratio, EBIT margin, asset turnover and equity multiplier. Statistically significant components of ROE affect ROE in different extent, from which the most significant impact have tax burden ratio and asset turnover. EBIT margin and equity multiplier have less significant impact on ROE development at 2.02 % and 0.88 %. The intercept does not have a logical interpretation as it is presented by negative value. The intercept represents the average value of ROE if explanatory variables are zero. In the case of tax burden ratio one unit positive change is responsible for 13.08 % change in ROE under remaining conditions other components. Asset turnover generates 7.88 % change in ROE while other components remain the same. Karathyn et al. (2016) based on the linear regression model presented similar results. The most significant impact on ROE development has asset turnover and equity multiplier based on normal data. The authors' team examined the impact of components on ROE also based on logarithmic data, according to which the most significant impact has the interest burden and tax burden ratio. Prajapati and Danta (2015) examined ROE decomposition in the Indian pharmaceutical industry, where ROE was most significantly affected by asset turnover and EBIT margin. Kijewska (2016) from five ROE components identified EBIT margin as responsible for ROE decline in the Polish metallurgy and mining industry.

4 Conclusions

The company's financial health is a prerequisite for future success and is in the focus of both managers' and owners' attention. Financial health is assessed by various financial indicators in terms of profitability, liquidity and activity. Owners are mostly interested in return on equity (ROE), which measures how a company utilizes owners' capital to generate profits. Managers' attention is devoted to the overall picture of the financial situation and not just to the ROE. The penetration between profitability, indebtedness and activity represents ROE decomposition to five components, which include tax burden and interest burden ratio, EBIT margin, asset turnover and equity multiplier. The ROE components were examined by a regression and correlation analysis based on the financial results of the Slovak Republic engineering industry companies sample for accounting period 2016. The aim of this paper was to quantify the impact of tax burden and interest burden ratios, EBIT margin, asset turnover and equity multiplier on ROE development. We conclude that the tax burden ratio, EBIT margin, asset turnover and equity multiplier are statistically significant predictors, while the interest burden ratio is a statistically insignificant predictor of ROE. The most significant impact on ROE development has the tax burden ratio, asset turnover and EBIT margin. We state, that ROE decomposition allows management to identify weaker aspects of the company's financial performance that require more attention and support to maintain sustainable profitability and financial health. The ROE decomposition enables to detect the reasons of adverse development by individual components and point out the potential opportunities for improvement.

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Internet shopping in the Czech Republic with the focus on the types of bought goods and services by consumers

Gabriela Oškrdalová

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: oskrdalo@econ.muni.cz

Abstract: *The internet shopping has been developing not only all over the world but in the Czech Republic too in the last years and it is possible to expect a future expansion. The aim of this paper is to describe the development of the internet shopping in the Czech Republic, introduce and interpret results of a part of own quantitative research in the field of knowledge, skills and behaviour in the internet shopping of consumers with the focus on the types of bought goods and services and compare these results of own research with the results of the Czech Statistical Office's research for the Czech Republic in the internet shopping field with the focus on the chosen types of bought goods and services by consumers. The paper's aim is reached by using of general science methods, primarily description, analysis, comparison, synthesis and deduction, and by using statistics methods (methods of descriptive statistics). On the basis of data gained by the own questionnaire research we can state, 99,4 % respondents have bought goods or services on the internet in the last year. The most respondents have bought clothes, shoes and dress accessories on the internet in the last year. If we focus on services, the most respondents have bought tickets on cultural events.*

Keywords: e-commerce, e-shops, internet shopping, goods, services

JEL codes: D100, L810

1 Introduction

The internet shopping has been developing not only all over the world but in the Czech Republic too in the last years and it is possible to expect a future expansion. In 2016 sales of internet shops in the Czech Republic were 98 billion CZK and according to APEK – Association of E-commerce the turnover of internet shops should break out the level of 100 billion CZK in 2017. (Czech News Agency – CTK, 2017) This expactation was right. In 2017 sales of internet shops in the Czech Republic increased to 115 billion CZK, it is 17 billion CZK more than in 2016, which is the year-on-year increase of 17,35 %. (Czech News Agency – CTK, 2018)

The aim of this paper is to describe the development of the internet shopping in the Czech Republic, introduce and interpret results of a part of own quantitative research in the field of knowledge, skills and behaviour in the internet shopping of consumers with the focus on the types of bought goods and services and compare these results of own research with the results of the Czech Statistical Office's research for the Czech Republic in the internet shopping field with to focus on the chosen types of bought goods and services by consumers.

2 Methodology and Data

Data for own quantitative research (in the field of the internet shopping) were collected electronically in 2017. The target group were people studying at Faculty of Economics and Administration of Masaryk University, number of respondents was 335. It is important to note on the definition of the target group, that formulated conclusions can be generalized to the population of people studying at economic colleges in the Czech Republic, for them the research sample is representative. A part of the realized and here presented research was focused on the types of bought goods and services. Respondents should answer the question "What type of goods have you bought on the internet in the last year?" and "What type of services have you bought on the internet in the last year?" too. It was possible to

mark more types of bought goods and services too. Collected data are evaluated by methods of descriptive statistics, especially by the statistic number of respondents who have bought the chosen good or the chosen service on the internet in the last year/number of respondents who mentioned they have bought on the internet in the last year.

To data processing the software Microsoft Office Excel was used.

Normative and positivist methodologies have been employed to reach the aim. The positivist methodology is used in parts, when researched issues are described only, not evaluated. The normative methodology is used, when it is not possible or desirable to avoid evaluating researched facts. The paper's aim is reached by using of general science methods, primarily description, analysis, comparison, synthesis and deduction, and by using statistics methods (methods of descriptive statistics).

3 Results and Discussion

In 2017 sales of internet shops in the Czech Republic were 115 billion CZK, it is 17 billion CZK more than in 2016, which is the year-on-year increase of 17,35 % (Czech News Agency – CTK, 2018) and it is possible to expect a future expansion. According to Vetyška, Executive director of APEK – Association of E-commerce, the turnover of internet shops will rise of 15 – 20 % this year too (Association of E-commerce, 2018). In the Table 1 we can see the development of the turnover of internet shops in the Czech Republic in years 2001 – 2017. These data confirm, that the turnover of internet shops in the Czech Republic has been increasing for a long time.

Table 1 Turnover of internet shops in the Czech Republic (2001 – 2017)

Year	Turnover (billion CZK)	Change per year (billion CZK)	Change per year (%)
2001	1	-	-
2002	2	1	100,00
2003	4	2	100,00
2004	7	3	75,00
2005	10	3	42,86
2006	14	4	40,00
2007	18	4	28,57
2008	22	4	22,22
2009	27	5	22,73
2010	33	6	22,22
2011	44	4	12,12
2012	51	7	15,91
2013	58	7	13,73
2014	67	9	15,52
2015	81	14	20,90
2016	98	17	20,99
2017	115	17	17,35

Source: Author's processing according to Financninoviny.cz (2011). APEK: Last year internet shops earned record 33 billion CZK (in Czech). *Finance.cz*. Retrieved from: http://www.finance.cz/zpravy/finance/293445-apek-internetove-obchody-loni-utrzily-rekordnich-33-mld-kc/; Czech News Agency – CTK (2017). This year e-shops sales will break the level of 100 billion. But carriers are missing drivers (in Czech). *Aktuálně.cz*. Retrieved from: https://zpravy.aktualne.cz/ekonomika/trzby-e-shopu-letos-prolomi-hranici-100-miliard-dopravcum-al/r~8a7570aed1b811e6a78c002590604f2e/?redirected=1495194613; Czech News Agency – CTK (2018). Czechia belongs to the countries where on-line shopping is most popular. Year 2017 underlined it more (in Czech). *E15.cz*. Retrieved from: http://zpravy.e15.cz/byznys/technologie-a-media/cesko-patri-k-zemim-kde-jsou-nakupy-on-line-nejoblibenejsi-rok-2017-to-jeste-podtrhl-1341730.

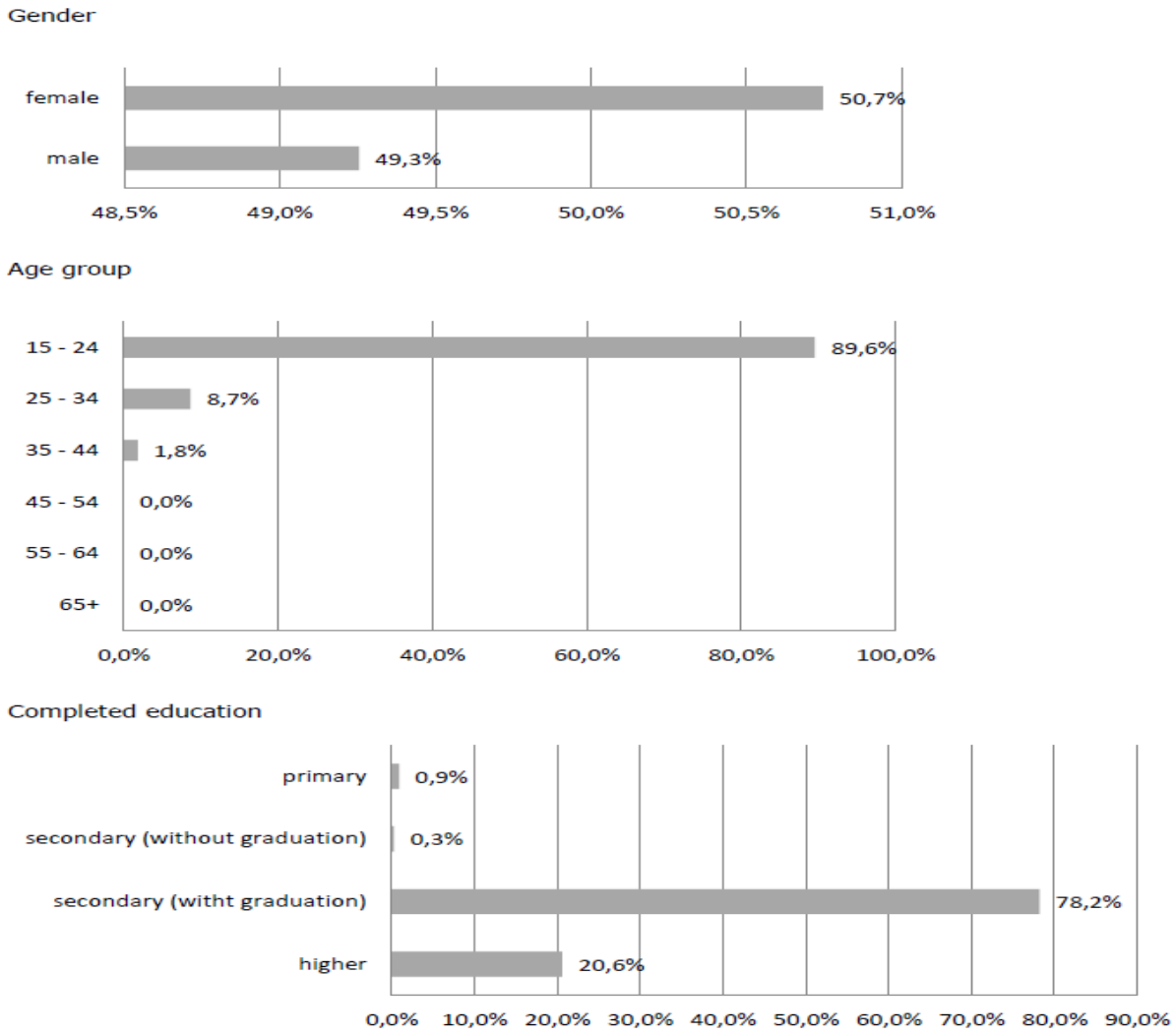
In 2017 the Czech internet shops' share in the total retail sales broke out the level of 10 % for the first time (the share was 10,5 %). According to E-commerce Europe the Czech

Republic belongs to countries with the highest share of on-line shopping in the Europe. In 2016 the Denmark was on the top of the ladder with the share of 24,0 %. The Great Britain was second with the share of 20,9 % and the Germany third with the share of 11,2 %. In the ladder the Ireland (the share of 10,2 %) and the Czech Republic follow. At the end of the ladder the Bulgaria is with the share of 1,3 %. (Kolář, 2018)

In the following section the results of own quantitative research are presented, focused on the types of bought goods and services by consumers. The target group were people studying at Faculty of Economics and Administration of Masaryk University, number of respondents was 335. The structure of the sample is represented in Figure 1 (by the gender, age and completed education). It is important to note on the definition of the target group, that formulated conclusions can be generalized to the population of people studying at economic colleges in the Czech Republic, for them the research sample is representative.

Figure 1 Structure of the sample

Basis: All respondents, n = 335



Source: Author

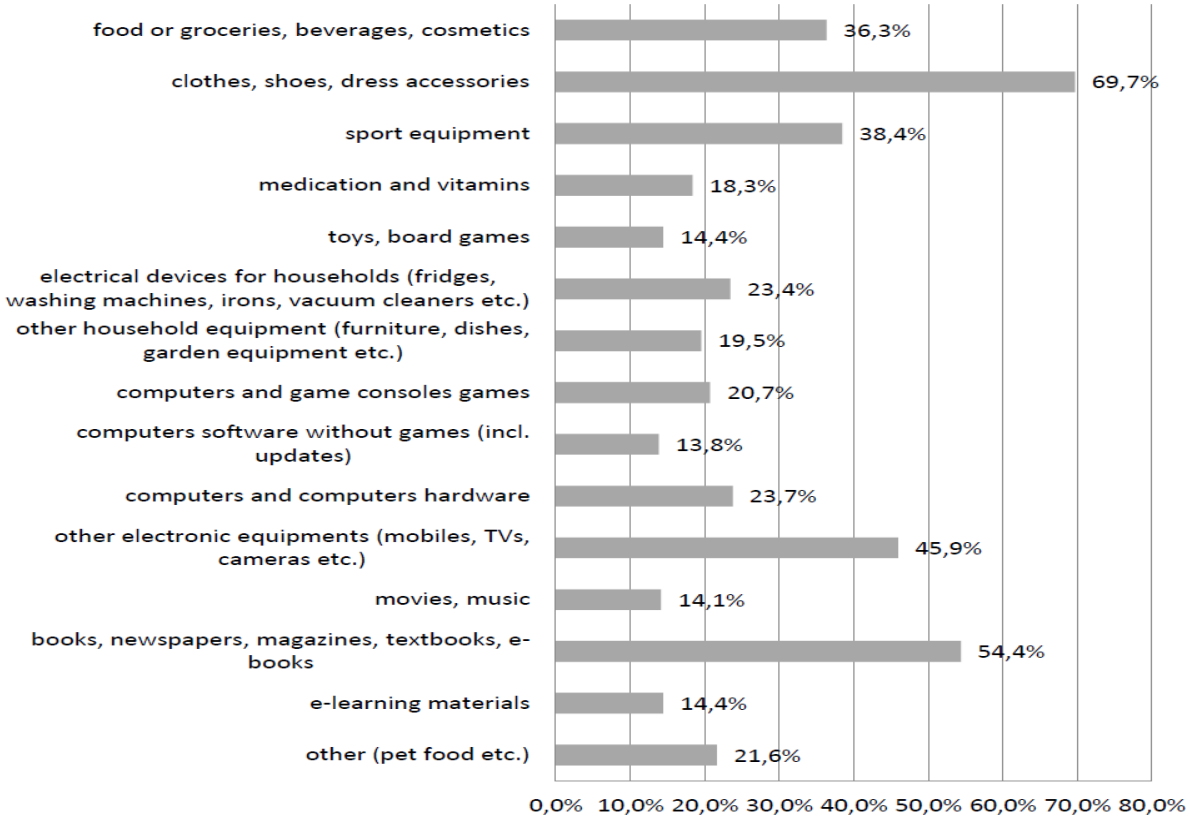
Types of bought goods and services on the internet - descriptive statistics

A part of the research was focused on internet shopping and types of bought goods and services. Respondents should answer the question "What type of goods have you bought on the internet in the last year?" and "What type of services have you bought on the internet in the last year?" too. It was possible to mark more types of bought goods and

services too. 333 respondents of 335 respondents (99,4 % respondents) mentioned they have bought goods or services on the internet in the last year. In Figure 2 we can see answers to the first question. The most respondents have bought clothes, shoes and dress accessories (69,7 % respondents who mentioned they have bought on the internet in the last year), books, newspapers, magazines, textbooks and e-books (54,4 % respondents who mentioned they have bought on the internet in the last year) and other electronic equipments as mobiles, TVs, cameras etc. (45,9 % respondents who mentioned they have bought on the internet in the last year). Fewest respondents of the researched sample answered, that they have bought computers software without games, including updates (13,8 % respondents who mentioned they have bought on the internet in the last year), movies and music (14,1 % respondents who mentioned they have bought on the internet in the last year), toys and board games (14,4 % respondents who mentioned they have bought on the internet in the last year) and e-learning materials (14,4 % respondents who mentioned they have bought on the internet in the last year too).

Figure 2 Types of bought goods on the internet (in detail) – descriptive statistics

What type of goods have you bought on the internet in the last year?
Basis: Respondents who mentioned they have bought on the internet in the last year, n = 333

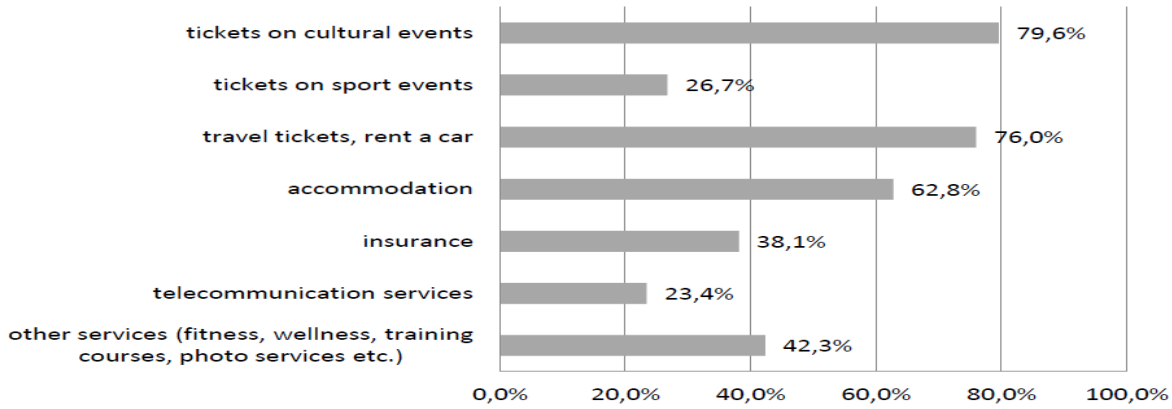


Source: Author

The second question was focused on the bought types of services. As we can see in Figure 3, the most respondents have bought tickets on cultural events (79,6 % respondents who mentioned they have bought on the internet in the last year), travel tickets and rent a car (76,0 % respondents who mentioned they have bought on the internet in the last year) and accommodation (62,8 % respondents who mentioned they have bought on the internet in the last year). Fewest respondents of the researched sample answered, that they have bought telecommunication services (23,4 % respondents who mentioned they have bought on the internet in the last year) and tickets on sport events (26,7 % respondents who mentioned they have bought on the internet in the last year).

Figure 3 Types of bought services on the internet (in detail) – descriptive statistics

What type of service have you bought on the internet in the last year?
Basis: Respondents who mentioned they have bought on the internet in the last year, n = 333



Source: Author

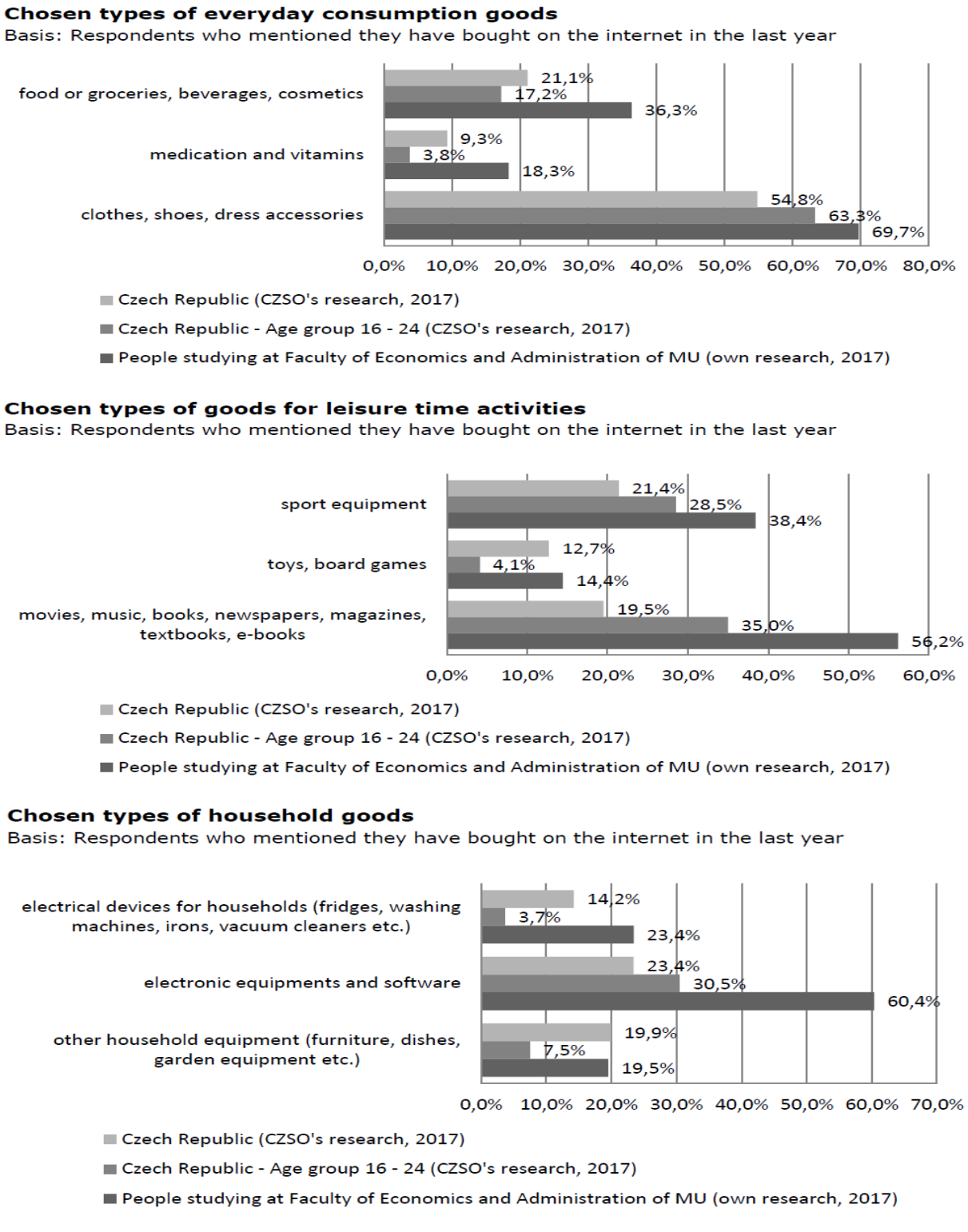
Chosen types of bought goods and services on the internet - descriptive statistics – comparison of the results of own research and Czech Statistical Office's research for the Czech Republic

In the following section we can compare the results of own research and the results of the research of the Czech Statistical Office (CZSO) in the field of internet shopping, focused on the chosen types of bought goods and services on the internet in the last year. To the research of the Czech Statistical Office it should be mentioned that respondents were 16+ years old people from the Czech Republic and formulated conclusions can be generalized to the population of 16+ years old people in the Czech Republic, for them the research sample is representative. For the better comparison of the results respondents of the age group 16 – 24 years from the Czech Republic of the Czech Statistical Office's research can be introduced (formulated conclusions can be generalized to the population of 16 – 24 years old people in the Czech Republic, for them the research sample is representative), because 89,6 % respondents of own research were 15 – 24 years old. More information about the Czech Statistical Office's research is in Czech Statistical Office (2018).

As we can see in Figure 4, all chosen types of everyday consumption goods (food or groceries, beverages, cosmetics; medication and vitamins; clothes, shoes, dress accessories) have been bought on the internet in general by more respondents of own research than by respondents of the Czech Statistical Office's research (16+ years old respondents) in the last year (for example according to own research 36,3 % respondents who mentioned they have bought on the internet in the last year have bought food or groceries, beverages and cosmetics on the internet in the last year vs. according to the Czech Statistical Office's research only 21,1 % respondents who mentioned they have bought on the internet in the last year have bought this type of everyday consumption goods on the internet in the last year).

The similar situation we can observe by chosen types of goods for leisure time activities (sport equipment; toys, board games; movies, music, books, newspapers, magazines, textbooks and e-books) and for households (electrical devices for household as fridges, washing machines, irons, vacuum cleaners etc.; electronic equipments and software) too. The only exemption is other household equipment (furniture, dishes, garden equipment etc.), but the difference by this type of goods in both groups is very small (in the Czech Statistical Office's research 19,9 % respondents who mentioned they have bought on the internet in the last year have bought other household equipment on the internet in the last year vs. in own research 19,5 % respondents who mentioned they have bought on the internet in the last year have bought other household equipment on the internet in the last year).

Figure 4 Types of bought goods on the internet (own research and Czech Statistical Office's research) – descriptive statistics



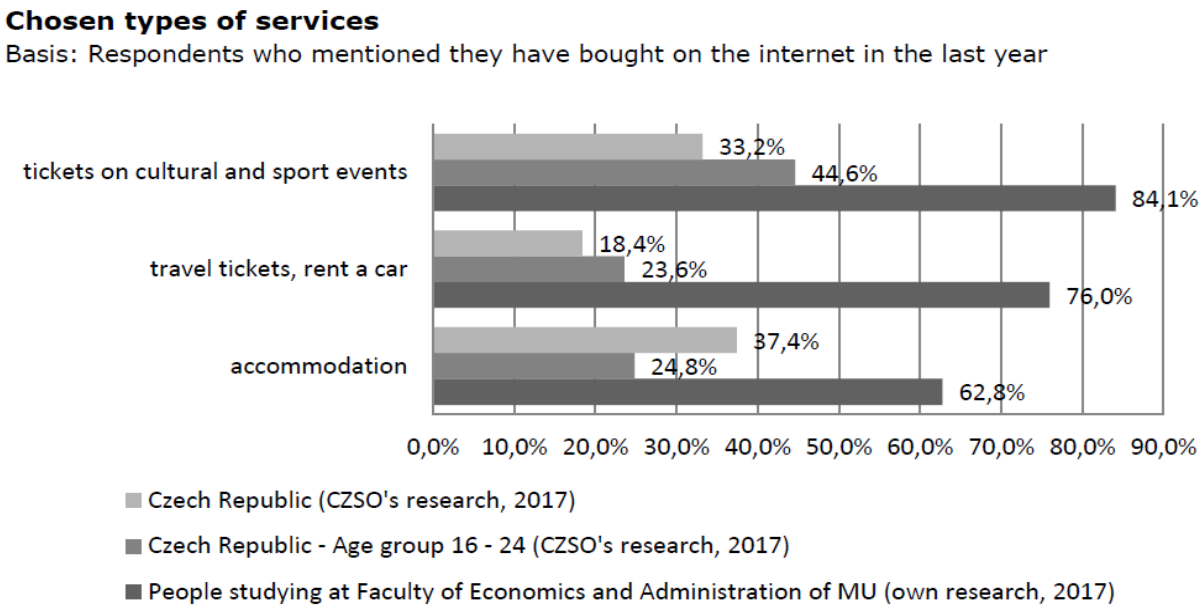
Source: Author's processing according to Czech Statistical Office (2018). Use of information and communication technologies in households and by individuals – 2017 (in Czech). *Czech Statistical Office*. Retrieved from: https://www.czso.cz/csu/czso/vyuzivani-internetovych-ulozist-7h8xejoqlw and own research.

If we compare answers of respondents of own research and 16 – 24 years old respondents of the Czech Statistical Office's research, the conclusions are same. All chosen types of goods for everyday consumption, leisure time activities and households have been bought

on the internet in general by more respondents of own research. The differences in these two groups are considerable (everyday consumption goods: 17,2 % vs. 36,3 %, 3,8 % vs. 18,3 %; goods for leisure time activities: 28,5 % vs. 38,4 %, 4,1 % vs. 14,4 %, 35,0 % vs. 56,2 %; household goods: 3,7 % vs. 23,4 %, 30,5 % vs. 60,4 %, 7,5 % vs. 19,5 %) .

As we can see in Figure 5, the situation is similar by chosen types of bought services too. In general we can state more respondents of own research than the Czech Statistical Office's research (16+ years old respondents) who mentioned they have bought on the internet in the last year have bought tickets on cultural and sport events (84,1 % vs. 33,2 %), accommodation (62,8 % vs. 37,4 %), travel tickets and rent a car (76,0 % vs. 18,4 %) on the internet in the last year. If we compare answers of respondents of own research and 16 – 24 years old respondents of the Czech Statistical Office's research, we can state all chosen types of services have been bought on the internet in general by more respondents of own research. The differences are considerable too (44,6 % vs. 84,1 %, 23,6 % vs. 76,0 %, 24,8 % vs. 62,8 %).

Figure 5 Types of bought services on the internet (own research and Czech Statistical Office's research) – descriptive statistics



Source: Author's processing according to Czech Statistical Office (2018). Use of information and communication technologies in households and by individuals – 2017 (in Czech). *Czech Statistical Office*. Retrieved from: https://www.czso.cz/csu/czso/vyuzivani-internetovych-ulozist-7h8xejoqlw and own research.

4 Conclusions

In 2017 sales of internet shops in the Czech Republic were 115 billion CZK, it is 17 billion CZK more than in 2016, which is the year-on-year increase of 17,35 %. The Czech internet shops' share in the total retail sales broke out the level of 10 % for the first time (the share was 10,5 %). According to E-commerce Europe the Czech Republic belongs to countries with the highest share of on-line shopping in the Europe. (Czech News Agency – CTK, 2018)

On the basis of data gained by the own questionnaire research we can state, 99,4 % respondents have bought goods or services on the internet in the last year. The most respondents have bought clothes, shoes and dress accessories (69,7 % respondents who mentioned they have bought on the internet in the last year), books, newspapers, magazines, textbooks and e-books (54,4 % respondents who mentioned they have bought on the internet in the last year) and other electronic equipments as mobiles, TVs, cameras

etc. (45,9 % respondents who mentioned they have bought on the internet in the last year) on the internet in the last year. If we focus on services, the most respondents have bought tickets on cultural events (79,6 % respondents who mentioned they have bought on the internet in the last year), travel tickets and rent a car (76,0 % respondents who mentioned they have bought on the internet in the last year) and accommodation (62,8 % respondents who mentioned they have bought on the internet in the last year) on the internet in the last year.

If we compare these results and the results of the research of the Czech Statistical Office (Czech Statistical Office, 2018), we can state all chosen types of everyday consumption goods have been bought on the internet in general by more respondents of own research (people studying at Faculty of Economics and Administration of Masaryk University) than by respondents of the Czech Statistical Office's research (16+ years old people from the Czech Republic) in the last year. The similar situation we can observe by chosen types of goods for leisure time activities and for households and by chosen types of bought services too. If we compare answers of respondents of own research and 16 – 24 years old respondents of the Czech Statistical Office's research, the conclusions are same. All chosen types of goods for everyday consumption, leisure time activities and households and all chosen types of bought services have been bought on the internet in general by more respondents of own research. The differences are considerable.

Acknowledgments

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Czech News Agency – CTK (2018). *Czechia belongs to the countries where on-line shopping is most popular. Year 2017 underlined it more* (in Czech). Retrieved from: http://zpravy.e15.cz/byznys/technologie-a-media/cesko-patri-k-zemim-kde-jsou-nakupy-on-line-nejoblibenejsi-rok-2017-to-jeste-podtrhl-1341730.

Czech Statistical Office (2018). *Use of information and communication technologies in households and by individuals – 2017* (in Czech). Retrieved from: https://www.czso.cz/csu/czso/vyuzivani-internetovych-ulozist-7h8xejoqlw.

Financninoviny.cz (2011). *APEK: Last year internet shops earned record 33 billion CZK* (in Czech). Retrieved from: http://www.finance.cz/zpravy/finance/293445-apek-internetove-obchody-loni-utrzily-rekordnich-33-mld-kc/.

Kolář, V. (2018). *E-shops participate in retail sales already by ten percents. Czechia is in on-line shopping the fifth in the Europe* (in Czech). Retrieved from: https://byznys.ihned.cz/c1-66005950-e-shopy-se-na-maloobchodnich-trzbach-podileji-jiz-deseti-procenty-cesko-je-v-online-nakupech-pate-v-evrope.

The Termination of Foreign Exchange Interventions and the Balance Sheet of the Central bank

Dalibor Pánek

Masaryk University
Faculty of Economics and Administration
Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: panek@econ.muni.cz

Abstract: *The aim of the text is an analysis of the changes of selected items of the balance sheet of the Czech national bank in the course of and after completion of foreign exchange intervention as a monetary policy instruments and the context in the banking sector. The analysis of the manifestations of foreign exchange intervention in the central bank's balance sheet was carried out on the basis of the data for the years 2012 – 2017. This period includes the progress of the use of this tool of monetary policy and the state after its completion. The text characterizes the effects of the active and passive sides of the balance sheet of the central bank and assesses the achievement of the objectives set. Analysis of selected items of the balance of the central bank was made on the basis of theoretical knowledge of the resources listed and the practical knowledge of the author. In conclusion, the author presents his views on the use of this tool of monetary policy, especially in the period after his termination. For text processing were used methods of description of the theoretical and practical parts, methods of comparison, analysis and prediction in the part of the text following the development of the on-balance sheet items in the course of and after completion of foreign exchange intervention.*

Keywords: Central bank, non-standard monetary policy instrument, exchange rate intervention, the balance of the central bank, the banking sector, the reserve banks, foreign exchange reserves

JEL code: G28

1 Introduction

The starting point of the text is knowledge about the activities of the central bank acquired in the course of historical development and on the basis of their current legal status in the financial system. Attention to the text is focused on the features and tools of the central bank, their use and impact on the balance sheet of the central bank. The basis for this text is the constitutional position of the central bank of the Czech Republic, the law on the central bank, the theoretical knowledge of the listed authors and the practical findings of the author.

The main objective of the monetary policy of the Czech national bank is to maintain price stability. The inflation target is set at 2 %. The basic standard instruments of monetary policy of the national bank are interest rates, open market operations, automatic facilities and reserve requirements. The main standard tool of monetary policy are open market operations with a view to influence the development of the reserves of banks and interest rates in the economy.

Foreign exchange intervention, announced in November 2013 were non-standard measures the central bank. The bank board of the Czech national bank decided to use the exchange rate of the domestic currency as the main tool for monetary easing. The aim was the weakening of the domestic currency and limiting deflationary pressures in the economy. These tendencies already, it was not possible to suppress further reduction of the interest rate of the central bank.

The aim of the text is an analysis of the manifestations of non-standard monetary-policy measures in the balance sheet of the central bank in the course of and after his termination in the years 2012 to 2017. To achieve the objectives of the text are used the methods of description and comparison of the development of selected items of the balance of and

relationships between selected items of the balance sheet and the termination of foreign exchange intervention.

2 The balance sheet of the central bank

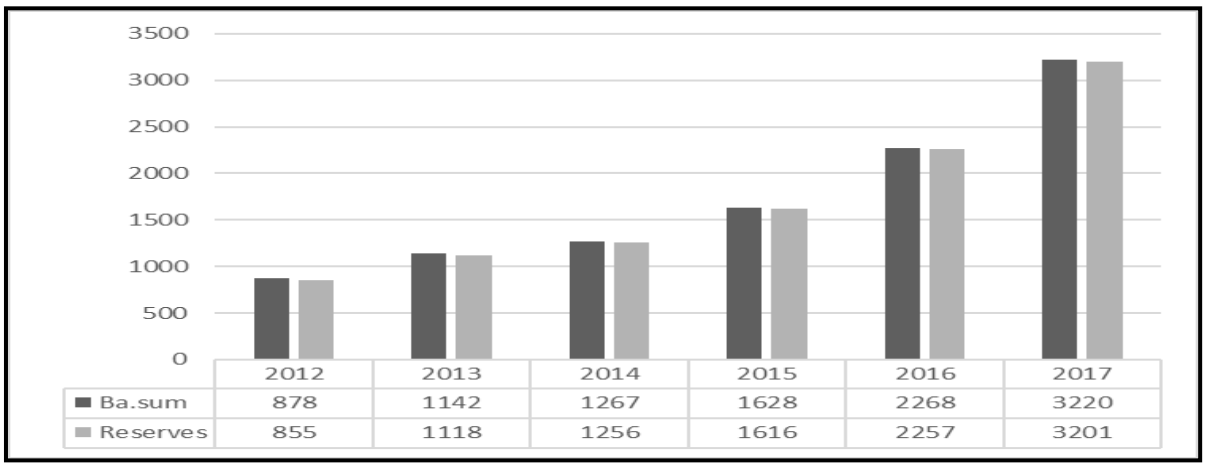
The balance of the central bank does not have the structure of the business balance of the commercial banks. Assets balance sheet of the central bank containing the channels of emission of money, the liabilities represent the location and form of money in the economy. The balance of the central bank characterized by a high proportion of foreign exchange reserves on the assets and the share of the reserves of the commercial banks and the money in circulation in the liabilities of balance.

The main focus of the text is devoted to the impact of exiting non-standard monetary policy instruments on the balance sheet of the central bank in 2017. The development of the balance sheet of the central bank, the assets of foreign exchange reserves, on the liabilities of the development of the monetary base, reserves of commercial banks and the results of operations of the central bank. The period of the course and termination of foreign exchange interventions changed the form of the balance of payments of the Czech national bank. There has been a gradual increase in the balance sheet of the central bank more than threefold

Assets of balance sheet of the central bank

On the active side of the balance sheet of the central bank, we can track the movement of the value of foreign exchange reserves in relation to currency interventions of the central bank. The assets of the Czech national bank shall contain as a main item of foreign exchange reserves (over 90%). The structure of the reserve consists of deposits in foreign banks, securities, gold and reserves with the IMF. The value of foreign exchange reserves is recognised in the balance sheet of the central bank in domestic currency. Movement of the exchange rate of the domestic currency fundamentally operates on the level of reserves and affects the economic result of the central bank.

Chart 1 The Sum of the Balance Sheet and Foreign Reserves 2012-2017 (bn. CZK)



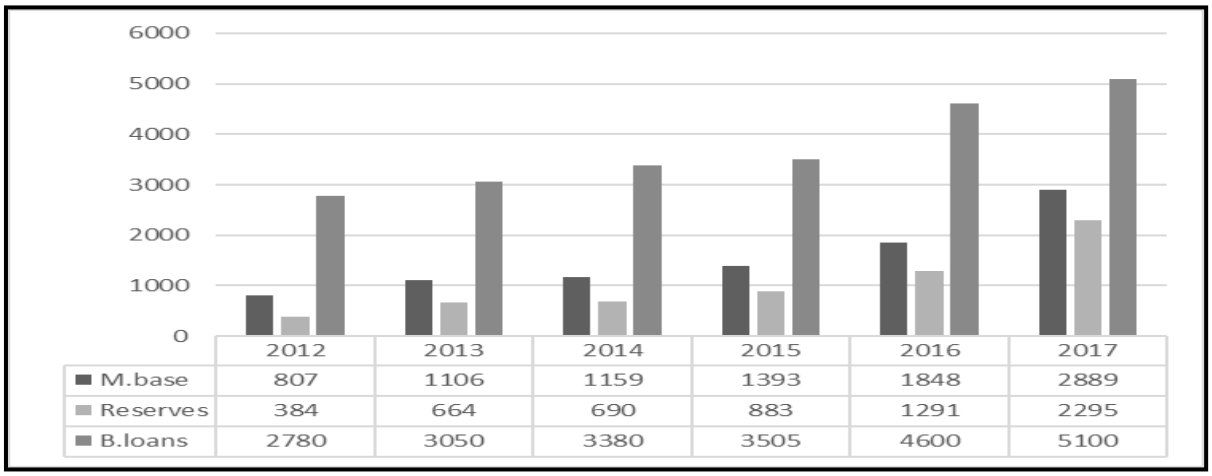
Source: compiled by the author according to the Annual reports of the Czech National Bank

The decline in the exchange rate of the domestic currency increases the volume of foreign exchange reserves and the reporting of the economic result of the central bank. The proceeds from the higher volume of invested foreign exchange reserves to further enhance their value. The movements of the value of the foreign exchange reserves were mainly due to foreign exchange interventions of the central bank. Foreign exchange intervention also influenced the active item advances to banks, where they manifested long-term systemic excess liquidity of commercial banks. Gradually increasing credit demand of the clients in commercial banks, the item claims to commercial banks in the central bank's balance sheets has a long-term zero value.

Liabilities of balance sheet of the central bank

On the passive side of the balance sheet of the central bank in the foreign exchange interventions showed a substantial increase in the monetary base involving the item banknotes and coins in circulation, required and free reserves of commercial banks at the central bank. These items form a significant part (90%) of the liabilities of the central bank.

Chart 2 The Monetary Base, Reserve of Banks and Bank Loans 2012-2017 (bn. CZK)



	2012	2013	2014	2015	2016	2017
M.base	807	1106	1159	1393	1848	2889
Reserves	384	664	690	883	1291	2295
B.loans	2780	3050	3380	3505	4600	5100

Source: compiled by the author according to the Annual reports of the Czech National Bank

Liabilities of the central bank to domestic banks grew in the period foreign exchange intervention more than threefold. The increase in bank reserves caused the inflow of domestic currency into the banking sector the influence of foreign exchange intervention.

Structurally there has been an increase in particular voluntary reserve banks influence monetary easing. Increase voluntary reserves of the commercial banks, inadequate credit demand and interest amount of reserves limit the potential returns of commercial banks.

A related influence on increasing the monetary base is the growth of banknotes and coins in circulation, the value of the currency has reached 594 billion CZK in 2017.

The increase in the liquidity of commercial banks in the course of foreign exchange interventions of the central bank has caused an increase in the credit activity of commercial banks only partially. The volume of granted bank loans did not correspond to the growth of bank reserves. He was influenced by the development of the domestic and the European economy.

The period of foreign exchange intervention was extended several times. Prerequisite completion in 2015, has been extended, the new governor of the central bank announced in 2016 the continuation of the foreign exchange intervention. The termination of the intervention announced by the board at the end of 2016 to the first half of 2017. Foreign exchange intervention because of its nature a short-term instrument of monetary policy to revive the economy, their use in the medium term, it causes some negative trends in the economy. It is an advantage of certain business groups, reduce the pressure on the efficiency of firms and the impact of interventions is hampered by price increase import of inputs and technology.

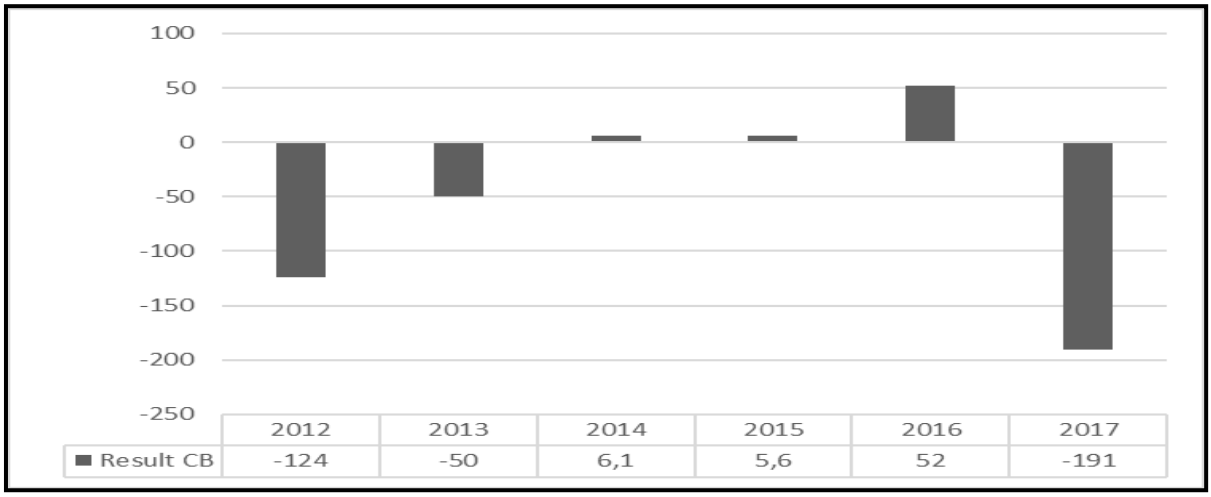
3 The result of the management of the central bank

Priority activities of the Czech National Bank is not making profit but the appropriate monetary policy for the domestic economy. According to economic theory, show the central banks profit. Loss results created by the central bank is not an unusual situation and does not have any substantial influence on activities of the central bank.

During the years 2012 to 2017 recorded the results of operations of the central bank to considerable fluctuations. The result of the management of the Czech national bank

fundamentally affect the foreign exchange differences of the domestic currency and the related change in value of foreign exchange reserves.

Chart 3 The Cumulative Economic Result of the CNB 2012-2017 (bn. CZK)



Source: compiled by the author according to the Annual reports of the Czech National Bank

Turning point for the coverage of accumulated losses from previous years was the year 2014. This effect of exchange rate differences on the financial result of the central bank will last for the entire period of non-participation of the Czech Republic in the euro area.

The development of the prices of the monetary reserves against the domestic currency and their impact on the economic result of the central bank lasts even after the end of foreign exchange intervention. You can assume that the different development of the price of gold compared to the price of the currency reserves would reduce this dependency. Gold is currently less than one percent of the share of the foreign exchange reserves of the central bank. The increase of this share to five percent of the reserve would positively reduce the dependence of the development of the prices of reserves on monetary reserves.

4 Conclusions

Assets balance sheet of the central bank consist mainly of foreign exchange reserves, on the liabilities is dominated by bank reserves and money in circulation. In the period 2012 – 2017 has increased the balance sheet of the central bank three times. Significant influence on the increase in the balance of payments should foreign exchange intervention of the central bank with the aim of kick-starting the domestic economy and the achievement of the inflation target. Use the exchange rate of the domestic currency as an instrument of monetary policy caused an increase in foreign exchange reserves on the assets and the increase in bank reserves and money in circulation on the liabilities.

A substantial increase in the share of bank reserves on the monetary base further affecting the liquidity surplus in the banking sector. Money issued into circulation in the period foreign exchange interventions were not issued as a credit emissions relative to effective business plans and investment, therefore, you cannot assume their download of the repayment of the loans. The money in circulation amounted to the fulfilment of the inflation target, however, they may in the next period to create a cash imbalance.

During the years 2012 – 2017 affected the foreign exchange intervention and their completion twice fundamentally the result of management of the central bank. The coverage of accumulated losses in 2014 was replaced by new loss after the termination of the interventions in the year 2017. The direct influence of the development of the prices of currency reserves on the financial result of the central bank could partially change the change the structure of the reserves in the increase in the share of gold reserves. Adverse influence on the management of the central bank will also increase interest rates associated with interest bearing reserves of banks with the central bank. Borrowing by commercial

banks from the central bank cannot be expected due to the permanent excess liquidity of commercial banks.

The precise calculation of the macroeconomic impact and the impact of foreign exchange interventions cannot be determined. It can be noted that during the reporting period was achieved by the recovery of the economy of the Czech Republic. Achieve the objectives of inflation, GDP growth, reaching a value of around 5%, unemployment fell to the level of around 3%. Except for the measures of the central bank positively affected the growth of the improved condition of the euro area economy (increase GDP in 2017 by 2.5%), rising household consumption, government expenditure including the increase in state employees by 31 thousand and the stable performance of exporting companies.

Managed floating exchange rate of the domestic currency gets to the level before the foreign exchange interventions, supportable estimates for its development cannot be accurately determined. The movement of balance sheet items of the central bank, especially foreign exchange reserves, will be further affected by its level. For the future it is necessary to search for a solution in the final decision about the date of receipt of the single European currency.

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Investors' Expectations, Price-Dividend Dependence and P/E Ratio for Common Stock: Specifics of Well-Developed Markets and Emerging Markets

Sergey Petrov [1], Nadezhda Yashina[2], Oksana Kashina[3], Nataliya Pronchatova-Rubtsova[4]

[1, 2, 3, 3, 4] Lobachevsky State University of Nizhny Novgorod
Institute of Economics and Entrepreneurship, Department of Finance and Credit
Bolshaya Pokrovskaya street 37, 603000 Nizhny Novgorod, Russian Federation
E-mail: [1]petrov_ss@list.ru, [2]sitnicof@mail.ru, [3]oksana_kashina@mail.ru, [4]pronat89@mail.ru

Abstract: *It is well known that a role of dividend payments as a criterion for the effectiveness of portfolio investments increases with the rise in their time horizon. The comparison of share price performance and dividend payments in more than a hundred-year retrospective had allowed to find out the phenomenon of anomalous volatility for stock prices. The result had a powerful influence on the concept of risky asset evaluation. The authors of the paper proposed to study time series of stock prices and dividend payments in a somewhat different frame of reference. The aim of the paper is to examine investors' perception of growth prospects for equities based on the investigation of share price dynamics compared to annual dividend payments. The proposed theoretical model uses an original procedure of continuously growing dividend discounting with arbitrary investment period. The research deals, but not limited to, with the shares of American and Russian corporations from 1985 till 2016. The central issue of the research is to compare the observed price-dividend dependence for the share with the one corresponding to classical dividend discount model assuming that the growth of dividend is uniform and the period of investment is infinite. The result of the analysis carried out is that both in well-developed and in emerging markets authors' technique allows to gain an insight (for many securities) into the primary motive for "representative shareholder" to evaluate a security: is it an income from share price growth or a willingness to receive stock dividends. Similar diagnostics is of undoubted interest for portfolio management; it is more exact for developed markets that have longer history and are less volatile. We show in the paper that the proposed method makes it possible to define the concept of earnings shares and growth shares more concretely.*

Keywords: Discount model for common stock pricing, price-dividends dependence for well-developed and emerging markets, econometric analysis of stock price and dividends, stockholders' expectations evaluation, P/E ratio

JEL codes: C-12, G-11, G-12, G-15, G-17

1 Introduction

In recent decades speculative behavior of investors has an impact on capital market developments in many respects. A lot of fundamental studies of capital asset pricing under conditions of financial market turbulence (see, for example, Cochrane, 2011; Shiller, 2014) show that the motives of investor's behavior are materially more complicated than classical asset pricing theory supposed (Cochrane, 2005). In the long run (getting off a subject of financial market variations) price-dividend dependence is still a general criterion for verification of theoretical concepts of shareholders' motives and theoretical models of capital asset pricing (we do not also neglect other fundamental indicators such as "price-earnings ratio" and "book-to-market value" for share (Graham, 2004)). A number of researchers have been analyzing this dependence; substantial results were obtained by studying price-dividend dependence trend (Campbell and Shiller, 1987; Campbell and Shiller, 1988; Engsted and Pedersen, 2010) as well as by exploring share price variations about the trend (Hussainey et al., 2010); the last-mentioned line of research had stimulated the development of behavioral finance (Fama, 1998; Shiller, 2003; Shiller, 2014).

The present paper being based on the analytical model proposed by Petrov et al. (2016) aims, in the first place, to develop a technique allowing to estimate the importance of shareholders' speculative motive (on average for the time period under consideration) using price-dividend dependence for the equities (we interpret shareholders' speculative motive as their focus on outrunning growth of the share price comparing to the growth of the corporation's financial performance). Such investigations (see also Greenwood and Shleifer, 2014) detail the momentary estimation of "the payment for expected growth" for shares obtained by using P/E ratio (Brealey et al. (2010)); note that P/E ratio varies significantly year after year. The results of Petrov et al. (2016) show that although shareholders' speculative motive varies along with the change in market sentiment, it is usually observed for one and the same securities; in contrast, the motive is not usually observed for other shares (the market evaluates these shares as a source of dividend rent). An insight into the speculative character of evaluating of any particular shares is important for a portfolio investor: apparently, the price of speculative share can differ markedly from its fundamental value; the fact makes a share price drawdown highly probable. On the contrary, equities that are evaluated by capital market as a source of dividend rent, have smaller chance for drawdown in case of a drop in the market.

In the second place, we aims to test the approach developed in the paper for securities trading in well-organized stock markets (we are placing greater focus on the American shares) as well as for the equities of emerging markets (shares of Moscow Exchange are considered as an example). An experience of some previous studies (Petrov et al (2016)) permits to expect that the joint analysis of share price dynamics and dividends becomes less effective under conditions of emerging markets. Firstly, historical time series of key variables are usually significantly shorter for emerging markets; at the same time, share price is distinctly more volatile (Mirza and Afzal, 2012). Next, corporate management in developing economies hasn't formulated some standards of dividend policy yet; dividend payments of corporations are relatively unstable in that context. Analyzing the original data of Standard and Poor's Financial Services, one can conclude that dividend payments of American corporations became more regular only roughly beginning in 1950th; so the hypothesis of continuously increasing dividends (Gordon, 1959) turned out to be urgent.

2 Methodology

Consider an investor who intends to buy some share at the initial time $t = 0$ and to hold it for n years (time t is a discrete variable); let d_t $(t = 1,2,..,n)$ are the expected annual dividends per share. Besides dividends, the investor may have some income at the end of the period if he will sell the share; let V_n is its appropriate expected price at the time n. The current price of the share V_0 from the investor's point of view in this case may be found as a sum of discounted dividends and discounted resale price with discount rate r (see, e.g., Brealey et al. (2010)):

$$V_0 = \sum_{t=1}^{n} \frac{d_t}{(1+r)^t} + \frac{V_n}{(1+r)^n}, \tag{1}$$

The investor can't know how dividends d_t $(t = 1,2,..,n)$ will vary in the future. In this regard, the hypothesis of the classical Gordon's model (Gordon, 1959) about uniformly increasing dividends looks quite plausible:

$$d_{t+1} = d_t(1+g), \tag{2}$$

where $t = 0, 1, ...(n-1)$, g - constant rate of growth (estimated by the investor). So the present value of dividends in the relation (1) may be summarized as a geometric progression; so the general relation (1) of share evaluating is shaped into

$$V_0 = \frac{d_0(1+g)}{r-g}\left(1 - \left(\frac{1+g}{1+r}\right)^n\right) + \frac{V_n}{(1+r)^n}, \tag{3}$$

where d_0 - the previous dividend per share. If the investor does not plan to sell a share, we obtain the well-known Gordon's relation (Gordon, 1959)

$$V_0 = \frac{d_0(1+g)}{r-g}. \quad (4)$$

We should stress now one substantial feature of Gordon's model, which is the reference point for the further empirical data analysis. As the future price V_t at the moment $t = 1, 2,...$ is connected with dividend payment d_{t+1} by relation similar to (4), the formula (2) gives rise to the uniform growth of price with the same rate g :

$$V_{t+1} = V_t(1+g). \quad (5)$$

So if we will apply the formula (3) for subsequent time moments $t = 1, 2,..(n-1)$ taking them as datum, both summands in the right-hand side will annually rise proportionally by a factor of $(1+g)$. In other words, a peculiar kind of time dependence of the share price resulting from the Gordon's model (relation (5)) makes relations (3) and (4) equivalent to each other at any n (i.e., the period of investment does not matter). These arguments suggest how to verify the Gordon's model for stock evaluating: dividend and share price should increase proportionally.

The formula (3) is the basis for the further reasoning that allows to reveal investors' expectations of securities' investment possibilities. We use the well-known method proposed by Fama (1970). This method (Fama, 1970; Fama, 1998) allows to verify theoretical "ex-ante" models using historical "ex-post" data. Following Fama, we can expect that if the stock market is efficient the relation (3) between the share price at the beginning of each year and the previous annual dividend should be fulfilled upon the time-average.

The procedure of revealing of investors' expectations based on the relation (3) so requires historical time series of: actual share price V_t at the beginning of each $(t+1)$ year for exception of the calendar effect "end of the year" (Brealey et al., 2010); we have considered averaged price for the first quarter as a price of the beginning of the year; dividend per share d_t for the year "t".

In such a way we can represent equation (3) in an equivalent form:

$$V_t = \frac{d_t(1+g)}{r-g}\left(1-\left(\frac{1+g}{1+r}\right)^n\right) + \frac{V_{t+n}}{(1+r)^n} \quad (6)$$

where the moment t is considered as initial.

To verify the price-dividend dependence implying by formula (6) we have used some simple econometric technique. The Figure 1 illustrates the essence of our method. The chart represents price-dividend dependence for Microsoft Corporation from 2003 to 2014. The vertical coordinate of every point shows the average share price V_t (in dollars) for the first quarter of every year, the horizontal coordinate - annual dividend per share d_t (in dollars also) for the same year.

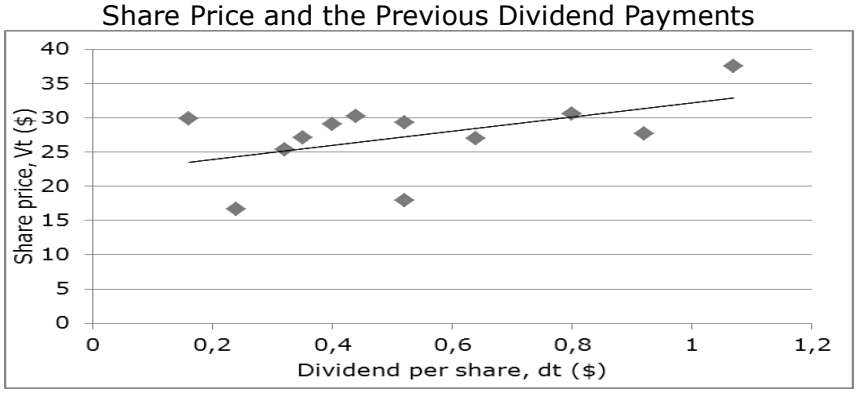
The Figure 1 demonstrates that historical share price and dividend per share are connected by more or less stable dependence; full line in the chart marks its linear trend. Represent the equation of the linear trend in general form

$$V_t = \beta \times d_t + \alpha \quad (7)$$

where coefficients β and α are calculated with the help of econometric methods. The level of their statistical significance can be measured by the criterion of *t*-statistics. However, it is impossible to compare their values with parameters of the relation (6), because the

second term in the right-hand side of the relation including the expected resale price V_{t+n} is obviously non-stationary. Another problem is associated with hypothetical period of investment; there is no reason to think of this "hidden" parameter as a constant.

Figure 1 The Historical Dependence (2003-2014) between Microsoft Corporation's Share Price and the Previous Dividend Payments



Source: author's calculations based on the data from website: http://ycharts.com

Nevertheless, we draw a conclusion from the analysis of the Figure 1 that the Microsoft Corporation's shares are not evaluated by Gordon's model. The fact is that coefficient α of the linear trend is substantially positive (its average value $\overline{\alpha} = 10.22$ \$, *t*-statistic value $t = 6.77$). This argument means that the second term in the relation (6), proportional to the expected price V_{t+n}, have been increased more slowly than the first term, proportional to the dividend d_t. If the share evaluates in accordance with Gordon's model, both terms in the relation (6) should increase proportionally. In this case the trend line should pass through the origin (the coefficient α should be equal to zero within the statistical error of its calculation) as it follows from the relation (4).

In other words, the "representative shareholder" of the Microsoft Corporation had little in common with long-term investor who is present in Gordon's model. His motives were not speculative (expected growth of share price have not generated its current price). However, the extended analysis shows that evaluating of the shares was different in the initial period of time (between 1986 and 2000): their price had increased faster than their dividend. This fact was conditioned by the phenomenon of stock market "bubble" in the USA in 1984 – 1999 (see, e.g., Schiller (2003)). The situation had drastically changed after 2000: the contribution of the expected share price to its current price had been steady declined in comparison with increasing dividends.

3 Results and Discussion

The previous arguments reduce to a simple technique of revealing of investors' expectations using the analysis of price and dividend time series. It needs to construct a linear regression of the share price as a function of the dividend per share and to analyze coefficients β and α of the equation (7). If the price-dividend dependence is statistically significant one may conclude something about the investors' motives.

1. Coefficient $\alpha > 0$. This type of expectations was presented by the example of the shares of Microsoft Corporation. They may be characterized as "income shares" because the supposed growth of the share price increment is relatively behind of changes in dividend. Current share price increases (upon the average) more slow than dividend, and the trend line on the chart similar to Figure 1 is displaced up from the origin.

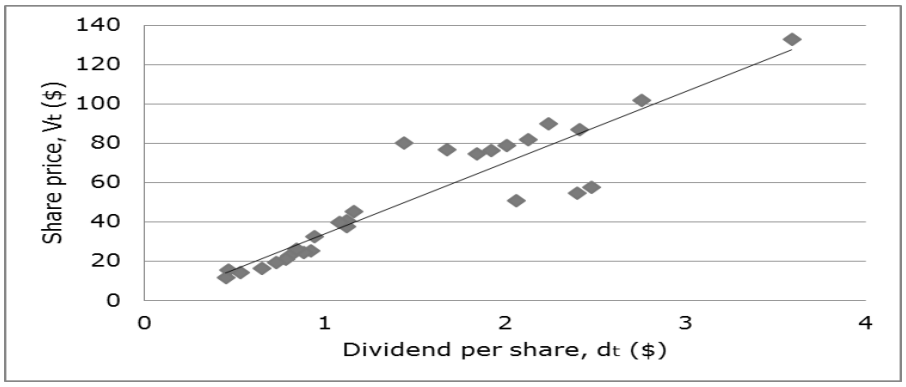
2. Coefficient $\alpha < 0$. In this case current share price increases relatively more rapid than dividend. Price growth is generated by advancing expectations of the future share price increment; these equities may be characterized as "growth shares". The trend line on the price-dividend chart is displaced down from the origin.

3. Coefficient $\alpha = 0$. Current share price (upon the average), dividend and, as a consequence, supposed share price increment rise proportionally to each other. As we have already noted, this situation is characteristic for classical Gordon's model; such type of equities may be called "coherent shares". The trend line on the price-dividend chart passes through the origin.

We next consider the most typical cases of revealing of investors' expectations for a number of American common stock (between 1985 and 2016 predominantly) and for Russian securities (between 2005 and 2016). We have examined the group of shares is owned by corporations from diverse branches. In spite of the stock market boom in the USA in 1989-2000 and its subsequent decline price-dividend dependence for American securities is more or less distinct. However, only a few of them are pricing in accordance with Gordon's model assumptions.

"Coherent" investors' expectations, for example, were revealed for American 3M Company's securities. The historical dependence (1986-2014) between the share price (was obtained as before) and the previous dividend payment for the company is shown on the Figure 2; we see that the changes in price were closely connected with changes in dividend during the period under review. In contrast to Microsoft Corporation's shares the trend line in the Figure 2 displays the proportional dependence with $\alpha = 0$ (see equation (7)) within the statistical error of its calculation. It means that "representative stockholder" of the 3M Company is essentially close to a long-term investor who is implied in the Gordon's hypothesis.

Figure 2 The Historical Dependence (1986-2014) between 3M Company's Share Price and the Previous Dividend Payments



Source: author's calculations based on the data from website: http://ycharts.com

It is interesting to note that the "coherent" type of investors' expectations makes possible to analyze market evaluating of the share in more detail. If we compare the equation (7) of the "ex-post" linear trend bearing in mind that $\alpha = 0$ with "ex-ante" Gordon's relation (4), under hypothesis of market efficiency we obtain

$$\beta = (1+g)(r-g)^{-1} \tag{8}$$

$$r = \beta^{-1}(1+g) + g \tag{9}$$

The coefficient β is calculated from the observed data on prices and dividends have been used for the plotting Figure 2. To estimate the average rate of dividend growth g we note that if dividend increases uniformly according to the relation (2) its logarithm increases linearly:

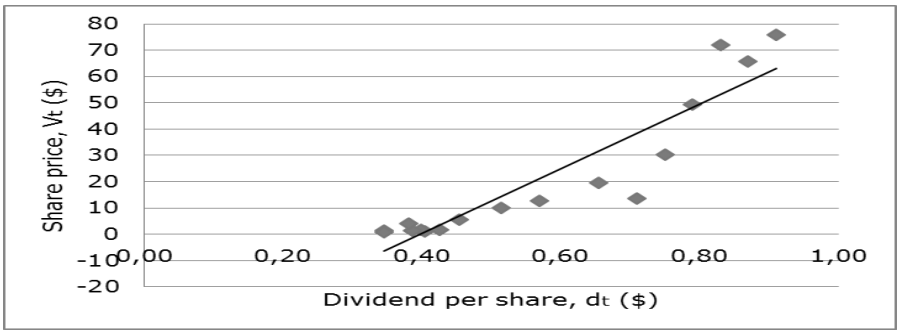
$$\ln d_t = \ln d_t + t \times \ln(1+g) \tag{10}$$

So, we should consider time series for the logarithm of dividend payments and study its linear trend; the factor $\ln(1+g)$ may be then determined as a slope coefficient of the trend

line. Analyzing time series of dividend per share and share price, we obtain $g = 9.8\%$, $r = 9.7\%$.

Our research has revealed a speculative type of investors' expectations for a number of American "growth shares". Consider, for example, price-dividend dependence for the shares of Apple Corporation (see Figure 3). We note that the chart's trend line is displaced down from the origin ($\alpha < 0$); statistical analysis characterizes the result as quite significant. Hence share price has tended to increase relatively faster than dividend; the speculative motive have been the most probable reason of this.

Figure 3 The Historical Dependence (1998-2014) between Apple Corporation's Share Price and the Previous Dividend Payments



Source: author's calculations based on the data from website: http://ycharts.com

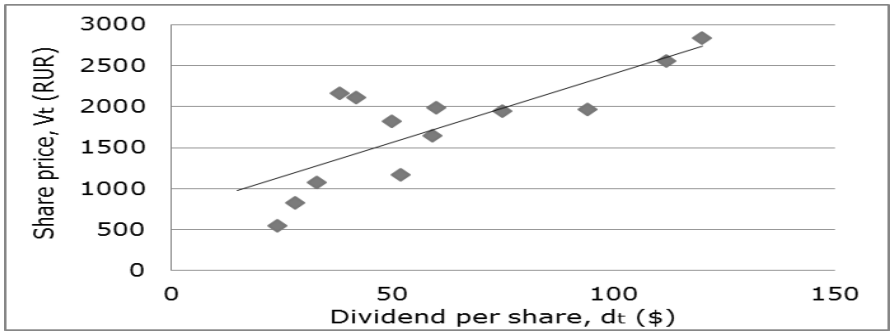
In contrast with developed markets, stock market in Russia is highly volatile, so observable price-dividend dependence is usually quite fuzzy. Most Russian corporations began to pay relatively stable dividends only after the mid-2000s. Consequently, the available period for revealing of shareholders' expectations for Russian securities is not more than 9-10 years. In general this amount of time is too short for econometric technique; however, particular conclusions of the investigation are of some interest. The analysis of time series of share price and dividend per share has disclosed that only two securities (The NOVATEK and The Financial Corporation Sistema) are characterized by statistically significant dependence between key variables. As for the 3M Company's shares (that are also "coherent") we have estimated the average rate of dividend growth g and the discount rate r for the NOVATEK Corporation's shares. The result of our procedure gives $g = 24.5\%$, $r = 27.4\%$; apparently, either rate of the company's growth (note that the expected "*ex-ante*" growth is in agreement with the real "*ex-post*" growth for "coherent" securities) or the discount rate for the shares are much greater for the emerging stock market in Russia. Probably, such differences in the evaluating of shares in developed market and in emerging market reflects substantial risk of "emerging" investments.

The revealing of investors' expectations for most of Russian securities allows to classify them as "income shares". For example, Figure 4 illustrates the price-dividend dependence for LUCOIL Corporation shares.

Next, objective estimation of the discount rate possible for the coherent shares expands the opportunities of P/E-ratio using (see Graham, (2004)). P/E-ratio may be represented as a sum of two components: "payment for the current company's income" (it is equal to r^{-1}), and "payment for the expected growth" (see Brealey et al. (2010)):

$$\frac{P}{E} = \frac{1}{r} + \text{payment for the expected growth} \qquad (11)$$

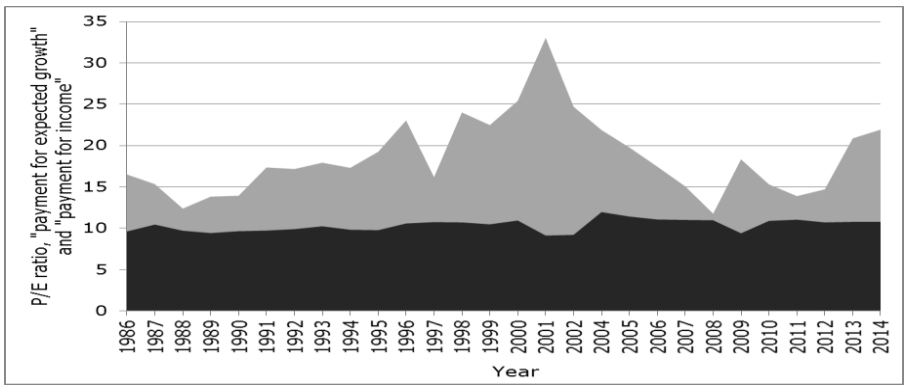
Figure 4 The Historical Dependence (2001-2016) between LUCOIL Corporation's Share Price and the Previous Dividend Payments



Source: author's calculations based on the data from website: http://www.investfunds.ru

For example, the Figure 5 illustrates dynamics of "payment for the expected growth" (grey color), "payment for income" (black color) and *P/E* ratio (sum of the blue and green) for the coherent shares of the 3M Company. According to the research conducted for the shares the average *P/E* ratio is equal to 18.6. Using the estimation for the discount rate (see above in this section), we find that average "payment for income" is equal to 10.4 (i.e. investors pay for the company's income about 56% and for the expected growth about 44%).

Figure 5 Dynamics of "payment for expected growth" (grey color), "payment for income" (black color), P/E ratio (sum) for 3M Company (1986-2014)



Source: author's calculations based on the data from website: http://ycharts.com

We may conclude that payment for the income is a significant fraction of *P/E*-ratio for the equities in developed market. Payment for the income is more stable than payment for the expected growth because investors' expectations can vary over a wide range. Similar investigation for the NOVATEK Corporation's equities shows that payment for the income is not too large due to high risk of investment. If it is replaced by the payment for the expected growth stock market becomes high volatile.

4 Conclusions

Price-dividend dependence is quite steady for a lot of equities in developed markets. This dependence allows to reveal investors' expectations of the future share price growth. In emerging markets clearly marked price-dividend dependence for the shares is not typical as a result of large price fluctuations, so the procedure has been developed is correct only for a few securities.

In developed markets (and for particular securities in emerging markets also) our method allows to comprehend what is the primary motive for shareholders to evaluate a security: is it the expected growth of its price or the dividend payments on it. As a result of investors'

expectations revealing one may classify equities as "income shares" or "coherent" or "growth shares". Only a few shares may be considered as "coherent". The point of this conclusion is that shareholders' plans in general have a limited period of investment. "Coherent" shares are especially convenient for further investigation; analyzing their price-dividend dependence one can determine the discount rate for them. Just as P/E -ratio for common stock consists of two components – "payment for income" and "payment for the expected growth" (Brealey et al. (2010)), so the discount rate of "coherent" shares may be represented as a sum of the "real" and the "virtual" parts. This virtual part is considerably larger in all appearance for the securities in emerging markets; this assertion is in agreement with the idea of their high volatility. The procedure of price-dividend dependence analysis permits to define a concept of "shares of income" and "shares of growth" (Brealey et al. (2010)) more exactly.

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Long-term Stock Returns of Companies Implementing Diverse Dividend Policy: Evidence from Poland

Aleksandra Pieloch-Babiarz

University of Lodz
Faculty of Economics and Sociology, Department of Business Analysis and Strategy
41, Rewolucji 1905 St., 90-214 Lodz, Poland
E-mail: apieloch@uni.lodz.pl

Abstract: *The aim of this article is to examine whether there is a statistically significant relationship between the type of dividend policy and the long-term stock returns. Considering the diverse dividend policy of companies, I am particularly interested in the role of constant dividend per share policy, constant payout ratio policy, extreme dividend policy, residual dividend policy and hybrid dividend policy in shaping the market share price of companies listed on the main market of the Warsaw Stock Exchange in the years 2001-2016. I conduct the research employing the buy-and-hold abnormal return, Fisher's LSD test and OLS regression model. The main results of my empirical study indicate that the buy-and-hold returns for the companies implementing a specified dividend policy are higher than the buy-and-hold returns for the WIG index. Moreover, regardless of the type of dividend policy, abnormal stock returns increase along with an increase in the number of years of the regular dividend payouts. The main conclusion from my analysis is that conducting the specified dividend policy has a significant impact on the long-term market share price behavior. I observe that the diversity of dividend policy is accompanied by the diverse stock returns achieved by the stock market investor. The scientific research presented in this paper seems to be valuable due to the lack of academic studies on the impact of implementing the different types of dividend policy on achieving the long-term abnormal stock returns.*

Keywords: dividend policy, stock returns, buy-and-hold abnormal returns, capital gain, the Warsaw Stock Exchange

JEL codes: G10, G11, G14, G35, G41

1 Introduction

The dividend policy consists in making decisions regarding the distribution of net profit to dividend and retained earnings. Those decisions are crucial for both the company and the stock market investors, since adopting a specified dividend policy is a strategic decision conditioning not only the company's development opportunities but also affecting the market value of company as well as the shareholder value (Lacina and Zhang, 2008). One of the most important aspects of dividend policy is to make a decision about dividend initiation. An initial dividend is understood as the first dividend paid out after the company has gone public (Lipson et al., 1998). The literature emphasizes that the decision on dividend initiation should be thought out because the stock market can threat it as a declaration of further dividend payouts (Hobbs and Schneller, 2012). If expected dividend is not paid out there may be a decrease in the market share price (Michaely et al., 1995; Kumar, 2017). In turn, if the dividend occurs regularly in the years following the dividend initiation the stock market usually reacts positively (How et al., 2011). Such dividend payments are called the regular dividend payouts[15].

The company can pay out dividend implementing the diverse types of regular or irregular dividend policy. Among the model forms of regular dividend policy are: constant dividend per share (plus extra dividend) policy, constant payout ratio policy, extreme dividend policy (100%) and residual dividend policy (Pieloch-Babiarz, 2017). In turn, among the model

[15] For the regular dividend payout the Warsaw Stock Exchange considers the dividend that has been paid out for at least 5 following years.

forms of irregular dividend policy are: extreme dividend policy (0%) and hybrid dividend policy (Baker and Smith, 2006).

The constant dividend per share policy provides shareholders with a fixed dividend per share regardless of the net profit generated by the company. Therefore, this dividend policy is based on regular but relatively low dividend payments. An increase in dividend per share is observed only if the company has achieved higher and stable level of net profit. However, if the net profit has increased unexpectedly and is not expected to be achieved at the same level in the future, this policy ought to be adjusted, i.e. in the years of abnormal net profit the 'extra' dividend should be paid out to avoid a decrease in the market value of company in the years when abnormal net profits will not be achieved (Duraj, 2002). Moreover, the companies that financial standing is good can adjust this policy by paying out higher dividend every year. In this case the dividend policy is called the growing dividend per share policy (Zyguła and Oleksy, 2016). In turn, the essence of the constant payout ratio policy consists in paying out a fixed part of the net profit. Therefore, the dividend per share paid every year varies along with the change in net profit. The main disadvantage of this policy is seen in a probable decrease in the market share price in the years of lower net profits (Cwynar and Cwynar, 2007). By contrast, the residual dividend policy means paying out dividend after financing the investment projects. Its implementation may result in the variability of dividend per share, and may even lead to cessation of payouts in some years affecting the market value of company (Baker and Smith, 2006). In turn, the extreme dividend policy concerns two extremely different types of dividend policy. The first one consists in paying out 100% of net profit, which results in the necessity of raising external capital to finance the investment. The second one, is the policy of not paying out dividend. In this case the company uses the net profit mainly for development (Duraj, 2002). The last type of dividend policy is the hybrid dividend policy that consists in combining at least two different types of dividend policy.

The studies concerning the changes in the market share price of companies focus mainly on the reaction of stock market investors to: the dividend initiation (Hobbs and Schneller, 2012; Lacina and Zhang, 2008), an increase or decrease in the dividend level (Michaely et al., 1995; Kumar, 2017) and the length of time of the regular dividend payouts (How et al., 2011). However, there are no academic research regarding the impact of different types of dividend policy on the market share price of company. I noticed, therefore, a research gap that prompt me to conduct the scientific research in this area.

The main aim of this article is to investigate whether there is a statistically significant relationship between the type of dividend policy and the long-term stock returns. This research goal is important in terms of the impact of dividend policy on the market value of company and the shareholder value. Therefore, it is crucial to posit the research hypothesis stating that the shareholders of companies conducting the diverse dividend policy achieve the diverse long-term stock returns.

The remainder of this paper is organized as follows. Section 2 describes the research sample and details research methodology. Section 3 presents the results of empirical research and discusses them. Section 4 highlights the main research findings.

2 Methodology and Data

Empirical research has been conducted among the companies listed on the main market of the Warsaw Stock Exchange (the WSE) in the years 2001-2016. The condition for including the company in the research sample is to initiate dividend in the analytical period and then pay it out regularly for at least 5 years. The adopted selection criteria have been met by 87 companies. However, after excluding from the sample the financial institutions and companies with missing data, the sample consists of 75 companies.

The study is carried out in three stages. Firstly, the companies are categorized against the types of dividend policy. Secondly, the long-term stock returns of regular dividend payers are calculated. To do that, I employ the methodology of buy-and-hold return (BHR) and assume that investor purchases shares at the closing price on the day of the resolution of

the general meeting of shareholders concerning the dividend initiation (declaration date) and holds them for 5 years. An implementation of such research assumptions eliminates the impact of short-term market share price changes, particularly its increase in the last days of listing before the record date, as well as its decrease on the ex-dividend date. The long-term stock returns resulting from the adopted investment strategy are calculated as the following (Michaely et al., 1995):

$$BHR_T^{DI,i} = \prod_{t=2}^{T}\left(1+R_{i,t}\right)-1, i=1,2,...,n \quad (1)$$

where $BHR_T^{DI,i}$ is the buy-and-hold return on shares of *i*-th company initiating and paying out dividend regularly in the observation period *T* and $R_{i,t}$ denotes the rate of return on shares of the *i*-th company on the *t*-th day of trading.

The rates of return calculated on the basis of the above formula take into account not only the factors specific to the company but also general characteristics of the stock market. To eliminate the influence of the general changes in the stock market sentiment, I adjust the obtained results by the rate of return on the market portfolio using the Warsaw Stock Exchange Index (the WIG index) on a given trading day as a benchmark. The buy-and-hold return on the market portfolio is given as follows (Sosnowski, 2015):

$$BHR_T^{WIG,i} = \prod_{t=2}^{T}\left(1+R_{WIG,t}\right)-1, i=1,2,...,n \quad (2)$$

where $BHR_T^{WIG,i}$ is the buy-and-hold return on the WIG index corresponding to the *i*-th company during the observation period *T* and $R_{WIG,t}$ denotes the rate of return on the WIG index on the *t*-th day of trading.

The buy-and-hold return on shares adjusted for the buy-and-hold return on the WIG index refers to the abnormal changes in the market share price of companies paying out dividend. The rates of return resulting from the buy-and-hold investment strategy are given by the following formulas (Michaely et al., 1995):

$$BHAR_T^{DI,i} = BHR_T^{DI,i} - BHR_T^{WIG,i} \quad (3)$$

$$BHAR_T^{DI,i} = \prod_{t=2}^{T}\left(1+R_{i,t}\right) - \prod_{t=2}^{T}\left(1+R_{WIG,t}\right) \quad (4)$$

where $BHAR_T^{DI,i}$ indicates the buy-and-hold abnormal return on shares of *i*-th company initiating and paying out dividend regularly in the observation period *T*.

In order to compare the long-term rates of return on shares issued by the companies implementing diverse dividend policy, I use the average buy-and-hold abnormal return given by the formula:

$$\overline{BHAR_T^{DI}} = \frac{1}{n}\sum_{i=1}^{n} BHAR_T^{DI,i} \quad (5)$$

where $\overline{BHAR_T^{DI}}$ is the average buy-and-hold abnormal return on shares of the companies initiating and paying out dividend regularly in the observation period *T* and *n* is the number of companies.

The statistical significance of results is examined using the conventional statistics (*t*) described by the following formula (Lyon et al., 1999):

$$t = \frac{\overline{BHAR_T^{DI}}}{\sigma\left(BHAR_T^{DI}\right)/\sqrt{n}} \tag{6}$$

where $\sigma\left(BHAR_T^{DI}\right)$ stands for the standard deviation of buy-and-hold abnormal return.

Conducting the study I compare the average buy-and-hold abnormal returns for both five years of dividend payouts and five types of dividend policy implemented by the surveyed companies. I use the descriptive statistics and Fisher's Least Significant Difference (LSD) test (Williams and Abdi, 2010) to explore all possible pair-wise comparisons of average buy-and-hold abnormal returns observed for the companies conducting different dividend policy.

In the third stage of the study, I investigate the existence of the relationship between different types of dividend policy and the level of long-term stock returns. I use the Ordinary Least Squares (OLS) regression model which is constructed in a way allowing to avoid the perfect multicollinearity due to the so-called dummy variable trap. I drop from the model the dummy variable $Const_DPS_i$ (which is equal to 1 if the *i*-th company implements the constant dividend per share policy and 0 otherwise) and estimate the structural parameters of the following model:

$$\begin{aligned} BHAR_{T,i} &= \beta_0 + \theta_1(Growth_DPS_i) + \theta_2(Resid_DIV_i) + \theta_3(Const_PAYOUT_i) + \\ &+ \beta_1 \Delta PROFIT_{T,i} + \beta_2 \Delta SIZE_{T,i} + \beta_3 \Delta DEBT_{T,i} + \varepsilon_i \end{aligned} \tag{7}$$

where $BHAR_{T,i}$ stands for the buy-and-hold abnormal return on shares of *i*-th company in period *T*; $Growth_DPS_i$ denotes a dummy variable equal to 1 if the *i*-th company conducts the growing dividend per share policy and 0 otherwise; $Resid_DIV_i$ is a dummy variable equal to 1 if the *i*-th company implements the residual dividend policy and 0 otherwise and $Const_PAYOUT_i$ stands for a dummy variable equal to 1 if the *i*-th company conducts the constant payout ratio policy and 0 otherwise. Moreover, three control variables are considered as determinants of *BHAR* of dividend payers, i.e.: $\Delta PROFIT_{T,i}$ denotes the growth rate of return on total assets of the *i*-th company in the period *T*; $\Delta SIZE_{T,i}$ stands for the growth rate of the *i*-th company's size in the period *T* (it is measured by the natural logarithm of total capital) and $\Delta DEBT_{T,i}$ is the growth rate of debt ratio of *i*-th company in the period *T*.

The financial data used in this study are obtained from the Notoria Service database, the market share prices are received from the stock market portal Infostrefa.com, while the information about dividend policy is retrieved from the websites of surveyed companies. The research is conducted using statistical package Statistica.

3 Results and Discussion

The empirical research on the dividend policy shows that most of the companies listed on the WSE do not pay out dividend regularly. Among the companies that pay dividend for the first time in years 2001-2016, only 75 companies continue the dividend payouts for at least 5 years after the dividend initiation. Analyzing the research sample in terms of the type of dividend policy, it should be noted that the majority of companies implement the stable dividend policy that is manifested in a fixed or increasing payouts, i.e. growing dividend per share policy (32% of companies) and constant dividend per share policy (21.33%). Moreover, some companies conduct residual dividend policy (21.33%), hybrid dividend policy (12%), extreme dividend policy (8%) and constant payout ratio policy (5.33%)[16] (see Table 1).

[16] Since the extreme dividend policy (100%) can be considered as a type of the constant payout ratio policy in this paper they are investigated together. Moreover, the hybrid dividend policy is not analyzed in this study due to the lack of stable dividend payouts.

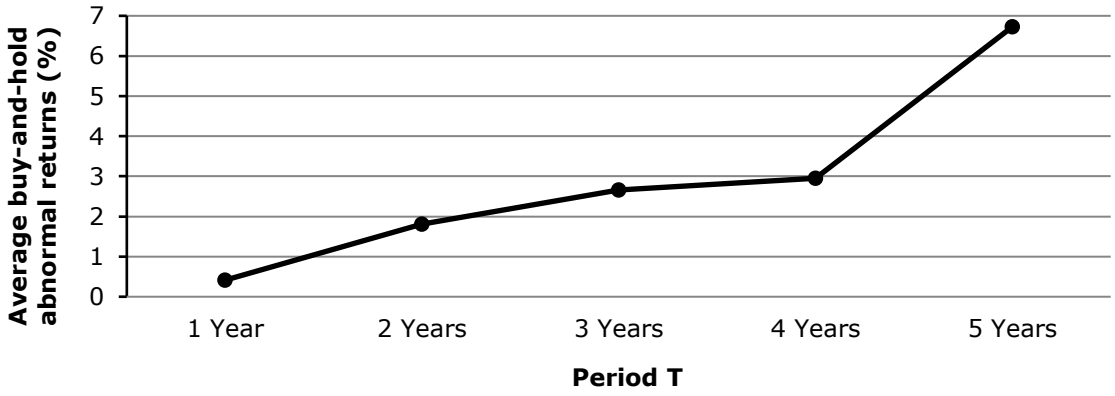
Table 1 Research Sample Broken Down by the Type of Dividend Policy

Specification	No. of companies	Share (%)
Constant dividend per share policy	16	21.33
Growing dividend per share policy	24	32.00
Residual dividend policy	16	21.33
Constant payout ratio policy	4	5.33
Extreme dividend policy (100%)	6	8.00
Hybrid dividend policy	9	12.00
Sum	75	100.00

Source: own study on the basis of the data collected from Notoria Service and companies' websites

The research shows that in each of five periods the stock market values the regular dividend payers higher than the companies included in the portfolio of the WIG index. This is evidenced by the positive values of the average buy-and-hold abnormal returns. What is more, the average buy-and-hold abnormal return increases along with the number of regular dividend payments. At the end of the year of dividend initiation the average buy-and-hold abnormal return is at 0.41%, while after five years of the regular dividend payouts it is equal to 6.28%. The largest increase in the average buy-and-hold abnormal return occurs after two, and then after five years of regular dividend payouts. The average BHAR in two years after dividend initiation is over four times higher than the average BHAR in the year of first dividend payment. In turn, the average BHAR after five years of payouts exceeds more than twice the average buy-and-hold abnormal return for the previous period (see Figure 1). The reason for this could be seen, among others, in a behavior of the long-term investors for whom the fifth dividend payout is an important signal from the company confirming once implemented dividend policy. This information results in the above-average positive reaction of the capital market, which is reflected in the high values of the abnormal BHAR after five years of regular dividend payouts.

Figure 1 Average Buy-and-hold Abnormal Returns in Five-year Period after Dividend Initiation (statistical significance at the level of α = 0.01)



Source: own study on the basis of the data collected from Infostrefa.com

The descriptive statistics presented in Table 2 provide some characteristics of companies paying out dividend. The figures indicate the existence of diversity among the companies in terms of the type of dividend policy and the period of payment. Regardless of the type of dividend policy, it can be observed that after five years of regular dividends payouts, the average buy-and-hold abnormal returns are higher than those in the year of dividend initiation. At the end of the first year of payout, the highest average BHAR is noticed for the companies implementing constant dividend per share policy (mean is at 0.86%). In

this case, in half of companies BHAR is higher than 0.16% and in every fourth company it is higher than 0.67%. In turn, after five years of dividend payout the companies conducting constant dividend per share policy are valued relatively the lowest (mean is at 2.46% and median is at 0.17%). The reason for such market share price behavior could be seen, among others, in relatively low dividend payouts. After five years of regular dividend the highest average BHAR is observed for the companies paying out high dividend, i.e. the companies implementing constant payout ratio policy and growing dividend per share policy (36.21% and 26.74%, respectively). However, it should be noted that in those both cases of dividend policy the average BHAR has decreased in relation to the average BHAR received after four years of payout (52.46% and 30.84%, respectively). The reason for the decrease in average BHAR could be explain, inter alia, by using the net profit to pay out dividend rather than spend it on investment. Conversely, when analyzing the buy-and-hold abnormal return for companies conducting residual dividend policy one should notice an increase of mean and median. After five years of investment the average BHAR is at 3.69%, while the median is at 2.54%. Given figures are higher than in the case of constant dividend per share policy which indicates higher market valuation of the companies investing the net profit.

Table 2 Descriptive Statistics of BHAR for Different Types of Dividend Policy (%)

Specification	Des. Stat.	1 Year	2 Years	3 Years	4 Years	5 Years
Constant dividend per share policy	**Mean**	0.856	1.837	0.994	1.245	2.460
	S.D.	1.772	3.083	1.735	3.001	7.067
	Min	-0.237	-1.445	-1.802	-2.190	-1.584
	.25	0.023	-0.173	-0.027	-0.209	-0.138
	Median	0.156	0.900	0.672	0.261	0.174
	.75	0.670	3.245	1.552	2.060	1.816
	Max	6.132	9.457	5.148	9.557	25.688
Growing dividend per share policy	**Mean**	0.578	1.136	10.931	30.835	26.741
	S.D.	0.803	1.933	20.352	53.140	75.969
	Min	-0.496	-0.905	-1.836	-1.669	-1.656
	.25	0.034	-0.157	0.157	-0.220	-0.218
	Median	0.259	0.647	1.059	0.575	0.280
	.75	1.097	1.735	5.214	83.988	2.258
	Max	2.787	7.344	65.525	154.328	127.048
Residual dividend policy	**Mean**	0.260	1.459	2.017	3.254	3.694
	S.D.	0.514	2.411	4.021	4.429	4.138
	Min	-0.581	-0.655	-4.016	-1.335	-0.599
	.25	-0.053	-0.095	0.152	0.006	0.056
	Median	0.091	0.253	0.738	1.865	2.537
	.75	0.495	3.054	2.410	4,560	5.746
	Max	1.333	7.156	11.101	11.437	11.440
Constant payout ratio policy	**Mean**	0.503	5.264	26.673	52.458	36.207
	S.D.	0.245	4.964	31.734	70.426	53.758
	Min	0.081	-0.382	-1.408	0.197	-0.080
	.25	0.375	0.723	0.885	1.121	0.676
	Median	0.503	5.229	9.672	14.946	14.518
	.75	0.650	9.458	62.386	96.041	61.962
	Max	0.888	12.431	75.026	203.731	147.143

Source: own study on the basis of the data collected from Infostrefa.com

The results of Fisher's Least Significant Difference test show the occurrence of some statistically significant differences in the average buy-and-hold abnormal return depending on the type of dividend policy. One can note that differences in the average BHAR given at the end of the first year of payouts are not statistically significant which means that right after the dividend initiation stock market investors do not differentiate between various types of dividend policy. Some statistically significant differences start to be observed after

two years of dividend payouts. These differences can be seen especially for constant payout ratio policy. After five years of the regular dividend payments the average BHAR observed for companies with constant payout ratio policy is statistically different with regard to the others (see Table 3).

Table 3 The *p*-value of Fisher's Least Significant Difference Test

Specification	1 Year	2 Years	3 Years	4 Years	5 Years
GR_1 vs. GR_2	0.459	0.499	0.126	0.061	0.423
GR_1 vs. GR_3	0.141	0.730	0.884	0.907	0.908
GR_1 vs. GR_4	0.470	0.009	0.002	0.010	0.010
GR_2 vs. GR_3	0.387	0.755	0.149	0.067	0.499
GR_2 vs. GR_4	0.924	0.001	0.036	0.212	0.035
GR_3 vs. GR_4	0.518	0.004	0.002	0.011	0.013

Symbols: GR_1 is a group of companies conducting constant dividend per share policy, GR_2 stands for a group of companies implementing growing dividend per share policy, GR_3 means a group of companies conducting residual dividend policy and GR_4 is a group of companies implementing constant payout ratio policy.

Source: own study on the basis of the data collected from Infostrefa.com

Estimation results of the multiple regression model are presented in Table 4. Depending on the duration of dividend policy the estimation results are diversified. The analysis of coefficients for the model concerning all years of research allows to conclude that those companies that increase the amount of dividend every year are valued by the capital market higher than those that pay out dividend per share at the same level. The BHAR of companies conducting growing dividend per share policy is higher by 0.135 p.p. than that of the companies with constant dividend per share policy. Moreover, the companies paying out a constant part of net profit every year are valued higher than those paying out dividend at a fixed level. The BHAR of companies conducting constant payout ratio policy is higher by 0.281 p.p. in relation to those with constant dividend per share policy. In addition, the changes of return on total assets (ΔPROFIT) have a significant impact on the long-term stock returns of companies (coefficient is at 0.180).

Table 4 The Results of Estimation of Ordinary Least Squares Regression Model

Specification	1 Year	2 Years	3 Years	4 Years	5 Years	All years
Growth_DPS	-0.128	-0.107	0.174	0.183	0.191	0.135
	(0.485)	(0.513)	(0.308)	(0.259)	(0.290)	(0.075)
Resid_DIV	-0.193	-0.040	-0.006	0.012	0.011	0.002
	(0.318)	(0.804)	(0.969)	(0.934)	(0.951)	(0.981)
Const_PAYOUT	-0.115	0.387	0.486	0.417	0.373	0.281
	(0.509)	(0.013)	(0.002)	(0.005)	(0.029)	(0.000)
ΔPROFIT	0.063	0.017	0.239	0.421	-0.011	0.180
	(0.683)	(0.898)	(0.079)	(0.001)	(0.944)	(0.003)
ΔSIZE	0.005	0.063	0.154	0.004	-0.005	0.012
	(0.975)	(0.647)	(0.235)	(0.975)	(0.975)	(0.847)
ΔDEBT	-0.118	0.000	0.000	-0.013	0.007	0.022
	(0.447)	(0.998)	(0.997)	(0.917)	(0.967)	(0.714)
R^2	0.049	0.194	0.268	0.319	0.125	0.101
Adjusted R^2	0.002	0.095	0.174	0.235	0.005	0.080
***F*-statistic**	0.359	1.961	2.864	3.821	1.045	4.919
***p*-value**	0.901	0.089	0.018	0.003	0.409	0.000
N	75	75	75	75	75	375

Note: The *p*-values for *t* test statistics are shown in the parentheses below coefficient estimates.

Source: own study on the basis of the data collected from Infostrefa.com

4 Conclusions

The results of empirical research conducted on the Warsaw Stock Exchange show that most of the companies paying out dividend regularly have implemented the fixed or increasing dividend payouts. This finding allows to presume that one of the reasons for choosing such dividend policy is signaling the good financial standing to the stock market investors which can result in an increase of the market value of company. This conjecture seems to be confirmed because regular dividend payers are usually valued higher than the companies from the WIG index, and the average buy-and-hold abnormal return increases along with the number of years of dividend payouts. What is more, the market value of company is different due to the type of dividend policy. The companies conducting constant dividend per share policy are valued relatively the lowest. In turn, the companies with constant payout ratio policy, which in the conditions of the Polish market usually pay out a great part of the net profit, are valued the highest. This indicates that surveyed companies are valued by investors in relation to the amount of dividend that they pay out.

The research results presented in this paper should not be generalized due to a few limitations. Therefore, there is a need to extend the study towards some other research directions. First, the research sample should be extended to financial institutions because they usually conduct stable policy of regular dividend payouts. Second, it is worth to conduct comparative analysis for companies listed on the global capital markets. Third, the study should consider the other determinants of the market value of company.

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The Issue of Responsibility for Financial Security in Old Age and Additional Retirement Saving

Sylwia Pieńkowska-Kamieniecka

University of Warmia nad Mazury in Olsztyn
Department of Social Policy and Insurance, Faculty of Economics
Oczapowskiego 4, 10-719 Olsztyn, Poland
E-mail: sylwia.pienkowska@uwm.edu.pl

Abstract: *In connection with the lowering benefits from public pension systems responsibility for financial security in old age should become more individualized. People should take greater responsibility for future benefits and standard of living in old age. The objective of the article is to assess how perception of who should take care of financial security during old age impacts the decision regarding additional retirement saving. The article presents the data of the research conducted by the Social Insurance Institution in 2016 on a representative for the whole population of Poland sample of 1,030 people. The main conclusion which may be drawn from the research is that when individuals think that it is mainly the State's responsibility to care of retirement security, they save less for old age.*

Key words: responsibility, saving, retirement, old age

JEL codes: D14, D31,H31, H55, J32

1 Introduction

In the face of reducing the generosity of the pay-as-you-go public pension systems threatened by ageing population (Bohn, 2002; Börsch-Supan, 2004; Chybalski and Marcinkiewicz, 2018), the issue of assuring economic safety for citizens in old age is broadly debated in many countries in the world (Hershey et al., 2010). Introduction of multi-pillar pension system at the end of the twentieth century in Poland which included mandatory and voluntary elements of retirement provision stressed the role of voluntary saving for old age (Rutecka-Góra, 2016).

The most significant factor which determines the situation of pension systems is demographic structure (Czapiński and Góra, 2016; Bielawska et al., 2015). In ageing Europe, including Poland, the number of pensioners in relation to contribution payers has increased, the scale of financial burden of professionally active individuals also increased whereas the employment rate has decreased. As a result, with unchanged retirement age, future ratio between the rate of pension and salary will be decreasing (Czapiński and Góra, 2016). Stiglitz (2000) claims that public pension systems should provide only minimum benefits.

There are numerous factors which determine willingness to save, including additional saving for old age. They include economic, social and legal factors as well as those which refer to socio-demographic characteristics of a particular individual. The most significant factors are gender, age, education, family size, annual income (Shinde and Zanvar, 2015; Heckman and Hanna, 2015, Walczak and Pieńkowska-Kamieniecka, 2018), place of residence and marital status (Anioła-Mikołajczak and Gołaś, 2014). Women generally have less retirement wealth (Brown et al., 2016). Munnell et al. (2014) point to the importance of starting saving early (in mid-30s) and retiring late. Meanwhile, young people are characterised by a lower retirement awareness which results from lack of financial knowledge, characteristic not only for this age group, but the whole society. Individuals with lower level of education are less willing to save additionally for old age (Cole and Shastry, 2007).

It is also important to stress job-related factors such as job characteristics and status of employment (Tamborini and Purcell, 2013; Liberda 1999). Mastrogiacomo and Alessie (2014) highlight lower pension savings among self-employed. While they are more financially knowledgeable than those who do not conduct business activity, they are less

prepared for retirement (Sappleton and Lourenço, 2016). Of importance is also the degree of trust in the pension system and financial institutions (Ben-Ner and Halldorsson, 2010). The relation between social trust (also in various institutions) and economic welfare of society members, also in old age, has been recognised and has become the subject of numerous studies (Tonkiss, 2009).

Velkoff (2001) indicates that many elderly people expect financial help from adult children. However, in most societies this support is in opposite direction, i.e. from elderly parents to adult children. Yet, this trend is less visible in developing countries.

Above all, it seems crucial to asses if individuals themselves are worried about their financial situation in the future and if they undertake any actions in order to assure adequate standard of living in old age. People must be also able to make well-informed financial decisions (Lusardi and Mitchell, 2013) and need to realize that additional saving for old age (apart from the mandatory system) is becoming a necessity (Oehler and Werner, 2008) as relying on old-age security provided by the State is not sufficient.

The aim of the article is to assess how perception of who should take care of financial security during old age impacts the decision regarding additional saving for old-age.

Also, it analyses other demographic, social and economic factors which may facilitate additional saving for old age by individuals.

2 Methodology and data

The article presents data of representative survey study regarding the knowledge and attitudes of Poles to social insurance, including additional saving for old age, which was conducted in Poland in 2016 at the order of the Social Insurance Institution. 1,030 participants took part in the study. They were aged 15-75. To realize the research task, the method of logistic regression was used. While constructing the logit model the following dichotomous dependent variable was used:

Y – Do you save additionally for old age?

The aforementioned variable took on the following form:

$$Y = \begin{cases} 1, \text{if the respondent saves} \\ 0, \text{if the respondent does not save} \end{cases}$$

Independent variables, both qualitative (with the reference groups in particular variables) and quantitative, which were used in the model, are presented in Table 1. High p-value in Hosmer-Lemeshow test (>.05) allows to conclude that the selection of variables to the model was correct and the model is correct. Significance level to stay in the model was 0.05.

Table 1 Descriptive Statistics for the Independent Variables

Variable	Variant of variable	N	%
	Qualitative variables		
Gender	**Women (ref. group)**	533	51.7
	Men	497	48.3
Age	**Aged 60 and more (ref. group)**	258	25.0
	Aged 15-24	144	14.0
	Aged 25-39	300	29.1
	Aged 40-59	328	31.8
Level of education	**Higher (ref. group)**	149	14.5
	Primary	170	16.5
	Vocational	375	36.5
	Secondary	334	32.5
Place of residence	**Rural areas (ref. group),**	393	38.2
		336	32.6

	Cities with population <100 k.	177	17.2
	Cities with population 100-499 k.	124	12.0
	Cities with population >500 k.		
Marital status	**Single**	363	35.2
	Married	482	46.8
	Divorced/separated	70	6.8
	Widowed (ref. group)	115	11.2
Status of employment	**Full-time job (ref. group)**	515	50.7
	Casual work	50	4.9
	Unemployed	114	11.2
	Pensioner/retiree	264	26.0
	Student	72	7.1
Own enterprise	**No (ref. group)**	1.012	98.3
	Yes	18	1.7
Trust in Social Security Institution	**Yes (ref. group)**	449	43.6
	No	454	44.1
	It's difficult to say	127	12.3
Who should take care of financial security in old age?	**The State (ref. group)**	647	62.8
	Citizens	290	28.2
	It's difficult to say	93	90.0
Old-age security should depend mainly on individual prudence (individual prudence)	**I disagree (ref. group)**	328	31.9
	I agree	602	58.4
	It's difficult to say	100	9.7
Adult children should support financially elderly parents	**I strongly disagree (ref. group)**	48	4.7
	I rather disagree	142	13.8
	I generally agree	499	48.4
	I strongly agree	242	23.5
	It's difficult to say	99	9.6
Do you do shopping on a daily basis? (shopping)	**No (ref. group)**	568	55.1
	Yes	462	44.9
	Quantitative variables		
Income of a household per person in thous. PLN (income)	**Continuous variable**		

Source: own elaboration based on the research Social Insurance Institution, 2016

3 Results and Discussion

The results of the research indicate that not all independent variables have a significant impact on additional saving for old age. Table 2 presents only those factors which turned to be statistically significant.

Table 2 Estimates of Logistic Regression Model for Dependent Variable: Additional Saving for Old Age

	Variant of variable	**S.E.**	**The significance level**	**Exp(B)**
Place of residence	**Rural areas (ref. group)**		.017	
	Cities with population <100 k.	.192	.511	1.134

	Cities with population 100-499 k.	.241	.803	.941
	Cities with population >500 k.	.249	.003	2.084
Status of employment	**Full-time job (ref. group)**		.000	
	Casual work	.469	.001	.217
	Unemployed	.291	.004	.437
	Disability pensioner/pensioner	.203	.000	.456
	Student	.368	.050	.486
Own enterprise	**No (ref. group)**	.523	.028	.316
Trust in Social Insurance Institution	**Yes (ref. group)**		.001	
	No	.169	.001	1.744
	It's difficult to say	.308	.497	.811
Financial security in old age	**Country (ref. group)**		.000	
	Citizens	.171	.000	2.822
	It's difficult to say	.350	.779	.907
Individual prudence	**I disagree (ref. group)**		.010	
	I agree	.184	.008	1.682
	It's difficult to say	.355	.641	.847
Shopping	**No (ref. group)**	.165	.004	1.601
Const.		.241	.000	.132
Cox–Snell's R-squared			.124	
Nagelkerke's R-squared			.185	
Hosmer-Lemeshow (p-value)			.249	
Log likelihood			986.758	
N			1,013	

Source: own elaboration based on the research Social Insurance Institution, 2016

Place of residence of the respondent has a significant impact on saving. Inhabitants of cities with population over 500 k. are two times more likely to save additionally for old age than those who live in the countryside or cities below 500 k. (no differences were observed between these two groups). Moreover, greatest odds for saving for old age have individuals with a full-time job and stable income which is usually subject to mandatory social insurance. As a result, they have greater knowledge regarding social insurance and greater insurance awareness, including the one concerning the need to save for old age outside the public pension system. The remaining categories of individuals have smaller opportunities for saving and therefore also lower odds for pension savings. They include mainly people with casual jobs or the unemployed (odds for additional old-age saving are lower by approximately 78% and 56% as compared to the reference group, i.e. people with full-time job). At this point it needs to be stressed that greater odds for savings than individuals with causal jobs have only students or pensioners. This can be evidence that learning about economy, i.e. gaining economic knowledge and experience connected with social insurance such as drawing (low) pension, result in greater willingness to save.

Additionally, owning an enterprise does not foster additional saving for old age. In such case, odds for retirement savings decrease by 68% as compared to those who do not conduct business activity. This may result from previous experience connected with social insurance, i.e. mandatory pension system and paid premiums for social insurance which in the view of many entrepreneurs hinder business activity.

Of importance is also the issue of trust to the institution which handles the public system of pension security. Individuals who do not trust Social Insurance Institution have 1,7 times higher odds for additional old-age saving than those who declare such trust. Lack of trust

in this Institution may signal the perception that pension benefits offered within the public pension system cannot guarantee decent life in old age. Therefore, individuals with little trust in Social Insurance Institution save additionally more.

In the light of the article aim and the subject in question, of greatest significance is the question how perception of who should take care of financial security during old age impacts the willingness to save and take care of standard of living during retirement individually. It can be observed that those who think that above all it is the State's responsibility to assure decent standard of living during retirement, have 2,8 times lower odds for old-age savings than those who claim that it is an individual matter of each citizen.

Simultaneously, the results of the research indicate that people who disagree with the statement that old-age security should depend mainly on individual prudence have 70% higher odds for additional retirement savings.

Moreover, the results obtained with the use of the model of logistic regression show that doing daily shopping is a factor which determines additional saving for old age. People who do shopping every day have approximately 60% higher odds for retirement savings outside the public pension system. This may result from the fact that they are well-aware of prices in the shops. As a result, they better understand and anticipate what financial resources they will need for old age in order to maintain a similar standard of living as compared to the one during their professional activity.

4 Conclusions

The results of the research indicate that not all independent variables analysed in the model of logistic regression have a significant impact on the decision to save for old age. The greatest odds for additional retirement savings have individuals who live in big cities, have a full-time job, do not own an enterprise, do shopping on a daily basis and have no trust in the insurance institution which pays pension benefits from the public pension system.

Above all, old-age saving is mostly influenced by the individual's perception of who should assure standard of living during retirement which would be adequate to one's needs. Only those who claim that it is not only the State's role but one's own initiative, will save additionally for old age outside the public pension system. Nonetheless, having in mind this conclusion one needs to stress the generosity of the public pension system. According to the study of F. Chybalski and E. Marcinkiewicz (2018), participation of working people in voluntary pension schemes is greater in countries with less generous basic pension systems.

Evidently it is crucial to highlight the issue of low awareness and knowledge of pension system members observed not only in Poland, but also other countries worldwide (Lusardi and Mitchell, 2007; Drexler et al., 2013; Potrich et al., 2015; OECD, 2016). Shaping insurance awareness by providing knowledge (Szumlicz, 2011) is key to understand the need to save, make the decision to save and chose proper forms and methods of saving. Proper economic education should result in greater participation in voluntary pension systems and greater adequacy of benefits from the whole pension system (Cichowicz and Rutecka-Góra, 2017). As a matter of fact, personal financial knowledge has a significant impact on financial behaviours, including saving behaviours (Robb and Woodyard, 2011; Pieńkowska-Kamieniecka and Walczak, 2016). It changes one's way of perceiving old age and raises the awareness of the fact that financial security during retirement depends mainly on one's own initiative, resulting in greater retirement prudence and the decision to save additionally for old age.

Therefore, it is necessary to shape the perception of individuals in such a way to fully realize social and individual aims associated with financing consumption in old age, i.e. in the period when we do not produce anything, but still want and need to consume (Czapiński and Góra, 2016).

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The Efficiency of Health Care Systems in OECD Countries. Does it Make a Difference?

Anatoliy Pilyavskyy[1], Lucie Kopecká[2]

[1] Lviv University of Trade and Economics
Faculty of International Economic Relations and Information Technology, Department of Higher Mathematics and Quantitative Methods
Tuhan-Baranovskogo 10, 79005 Lviv, Ukraine
E-mail: apiliavs@mail.lviv.ua

[2] University of Pardubice
Faculty of Economics and Administration, Department of Mathematics and Quantitative Methods
Studentská 84, 532 10 Pardubice, Czech Republic
E-mail: lucie.kopecka1@student.upce.cz

Abstract: *The main aim of this article is to compare the Efficiency of Health Care Systems in 35 OECD countries during period 2008 – 2015. The efficiency of health care system is discussed topic in many articles and it is very difficult task to find the right methods according to which to measure health care efficiency. In our case for the comparing of the efficiency of health care systems we use nonparametric method, namely Data Envelopment Analysis (DEA). Two different output oriented models are used. The first one is with one output: life expectancy at birth and three inputs: health expenditures, total health and social employment and number of hospitals. The second one is with two outputs: all causes of deaths and infant mortality and three inputs like in the first model. All indicators are obtained from OECD database. Comparing results for these two models, that are very similar, show that both developing and developed countries can be effective.*

Keywords: Health care system, OECD countries, Efficiency, Data envelopment analysis.

JEL codes: I11, C60, C61

1 Introduction

Health state of population and health care belong to the most important questions which the individual countries must solve. Health population means that the people are able to work to earn money. This is the reason why the countries with a good health status of population have a highly developed economy. However, not only health status of population influences state of economy but on the other hand state of economy influences health status of population as well as described in (Jindrová and Kopecká, 2017).

Health care belongs to the most important area of the economy. The main results of health care efforts high life expectancy and low mortality caused by critical illnesses should be. Health care needs lots of financial funds which are used for health expenditure, health employment, hospitals, hospital facilities etc. These health resources should be employed effectively. Many publications deal with issues of efficiency of health care systems, which confirms the importance of this topic, for instance (Asandului et al., 2014; Bem et al., 2014; Evans et al., 2000; Hollingsworth et al., 1999; Kujawska, 2015; Pilyavsky and Staat, 2006).

The most of these papers use Data Envelopment Analysis (DEA) for measuring efficiency not only of health care systems but also another firms. For details see (Charnes et la., 1978; Charnes et al., 1995; Chlebounová, 2017; Dlouhý et al., 2007; Golubchikov, 2006; Pilyavsky et al., 2006; Sherman and Zhu, 2006). This method evaluate efficiency of objects according to values of input and output variables where it can be more of the both kinds of variables. This is very difficult task how to determine input and output variables because inputs should affect outputs but input variables should not be in association each other as well as output variables. Next problem can be observed in case of output variables of health care systems such as life expectancy and mortality because these outputs are not only influence by health care but they are influence by another factors as well. For instance, gender, life style (alcohol, smoking), age structure of population but also

political and economic conditions can be reasons for low life expectancy and high mortality (AMIEHS, 2011; Kossarova et al., 2013; Mackenbach, 2013).

OECD, 2016 compares life expectancy and mortality like outputs for measuring efficiency of health care systems. Final result of this comparison is that mortality is more suitable for measuring this efficiency because it is less affected by non-medial determinants than life expectancy.

2 Methodology and Data

The main objective of this article is to compare the efficiency of health care systems in 35 OECD countries during period 2008-2015 by using nonparametric method, namely DEA. DEA scores are computed based on inputs and outputs which are obtained from OECD database. Following variables are determined as inputs: health expenditure per capita (all financing schemes, US dollars), total health and social employment (per 1 000 population) and hospitals (per 1 000 000 population). Next following variables are stated as outputs: life expectancy at birth, all causes of death (per 100 000 population) and infant mortality (per 1 000 live birth). However, due to strong negative association between live expectancy at birth and all causes of death, two separate models are constructed.

Model Specification

It was Farrell, 1957 who first operationalized a frontier method to estimate the efficiency of a decision-making unit (DMU) by using approach which compared an individual DMU's observed level of inputs and outputs with the best practice production frontier. The frontier was derived by DMUs which could minimize inputs given output (input-oriented model) and maximize output given inputs (output-oriented model) under the usual assumption of production such as homogeneity of degree 0, strong disposability of inputs and outputs and ray homotheticity.

CCR and BCC model (Charnes et al., 1995) belong to the basic DEA models which exist for efficiency estimation of set of economic agents.

In this article output-oriented DEA model for measuring technical efficiency of health care systems is used. The main aim of output-oriented model is to maximize the outputs with the same level of inputs. Formula (1) expresses CCR output-oriented model which calculates technical efficiency proceedings from an assumption of constant return to scale (CRS). For details see (Charnes et al., 1995).

$$max\phi + \varepsilon\vec{1}s^{+} + \varepsilon\vec{1}s^{-}; s.t. X\lambda + s^{-} = X_0; Y\lambda - s^{+} = \phi Y_0;\ \lambda \geq 0;\ s^{+} \geq 0;\ s^{-} \geq 0 \quad (1)$$

where $X=\{x_{ij}\}$ – matrix of inputs ($i=1,2,\ldots M$) $Y=\{y_{rj}\}$ – matrix of outputs ($r=1,2,\ldots N$), $\varepsilon > 0$ is the so called non-Archimedean element that is determined as a number, which is smaller than any positive real number; s^{+}, s^{-}– vectors of slacks.

Then technical efficiency is according to formula (2):

$$\theta = \phi^{-1}. \quad (2)$$

Next output-oriented efficiency can be estimated proceedings from an assumption of variable return to scale (VRS). This assumption is ensured by the introduction of limitation into formula (1). Formula (3) expresses this limitation.

$$\vec{1}\lambda = 1 \quad (3)$$

VRS means that increase of inputs do not have to be followed by the same increase of outputs.

This model was developed from CCR and it is called BCC output-oriented model as describe in (Charnes et al., 1995). Efficiency, calculated according to BCC model, is called pure technical efficiency (PTE) which excludes scale effect. It means that technical efficiency calculated according to CCR model can be decompose onto two components, namely pure technical efficiency and scale efficiency (SE).

3 Results and Discussion

As mentioned above, output-oriented models considering CRS and VRS were calculated within estimation of efficiency of health care systems. However, for purposes of this article the results of output-oriented DEA models considering VRS are displayed because both CRS and VRS provide very similar results.

Both models employ the same three input variables, namely health expenditures per capita (US dollar), total health and social employment per 1 000 population and number of hospitals per 1 000 000 population. Health expenditure has increased on average from 3 101 US dollars per capita to 3 471 during period 2008 – 2015. Maximum health expenditures are 7 550 and on the other hand minimum expenditures are 891 in 2008. In the last observed year 2015 maximum value of health expenditures is 8 749 and minimum value is 942. Total health and social employment has increased on average as well from 45 to 49 per 1 000 population during this period. Maximum and minimum values of this indicator are 105 and 8 in 2008 and 109 and 9 in 2015. Finally number of hospitals per 1 000 000 population has decreasing trend. It has decreased from 31 to 29 on average. Maximum is 68 and minimum is 11 in 2008 and 72 and 10 in 2015.

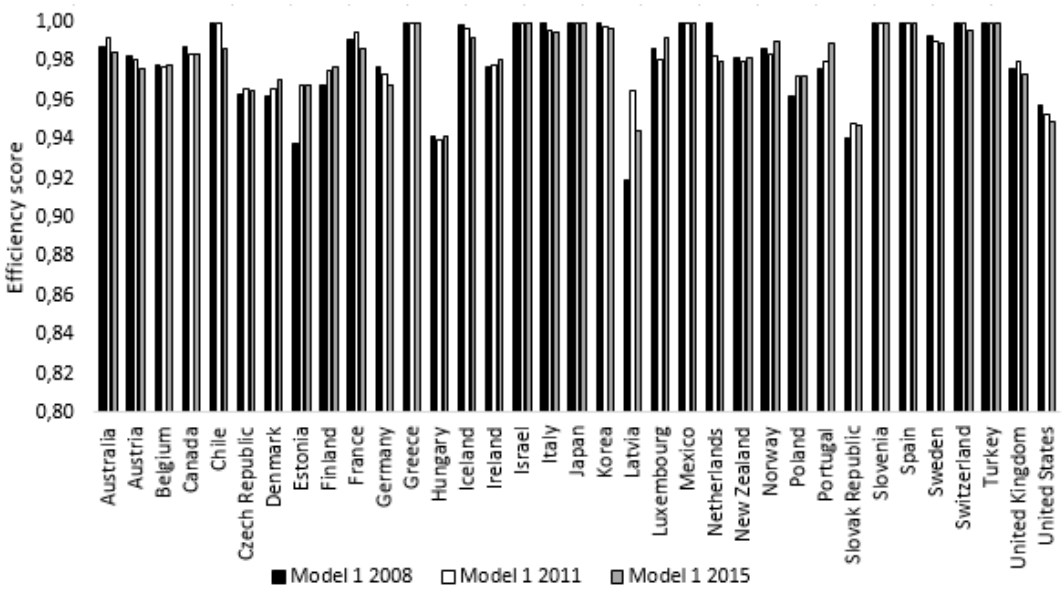
We also constructed two different models for the estimation of the efficiency of health care system (according to the different outputs used), namely Model 1 and Model 2.

Model 1 has one output: life expectancy at birth. This indicator has grown from 79 to 81 years on average during period 2008 - 2015. Maximum and minimum values have increased as well. Maximum value of this indicator has increased from 83 in 2008 to 84 years in 2015 and minimum value has increased from 72 in 2008 to 75 in 2015.

The second model, Model 2 has two outputs: all causes of deaths per 100 000 population and infant mortality per 1 000 live births. All causes of deaths have decreased from 877 in 2008 to 792 in 2015 on average. Maximum value of this indicator has decreased from 1 375 to 1 163 during this period and minimum value has decreased from 634 to 583. The second output variable called infant mortality has decreased from 5 in 2008 to 4 in 2015 on average. Maximum value of this indicator has decreased from 16 to 13 during this period and minimum value has decreased from 1.8 to 1.6. As mentioned above the main aim of output-oriented model is to maximize the outputs with the same level of inputs. Thus, for measuring efficiency of health care systems reciprocal values of mortalities are employed.

Efficiency scores are displayed for 35 OECD countries and for Model 1 in 2008, 2011 and 2015 in figure 1.

Figure 1 Efficiency Scores (Model 1)

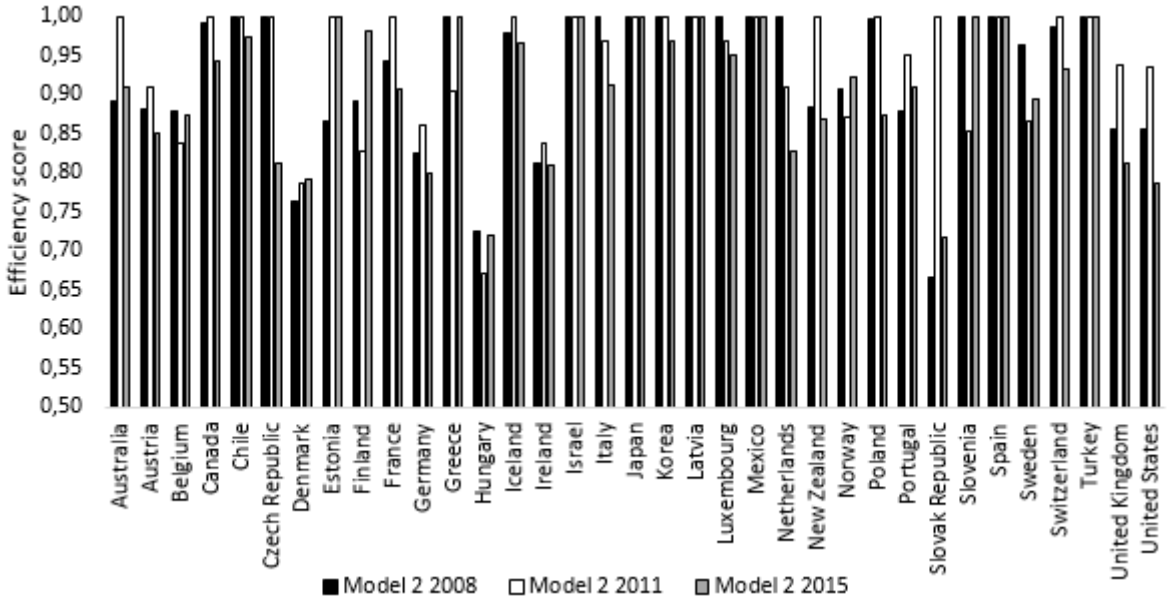


Source: OECD database

Figure 1 shows some countries which have effective health care systems in all three years, namely Greece, Israel, Japan, Mexico, Slovenia, Spain and Turkey. Some of these countries belong to the developing countries and some of them had to adopt austerity measures not only in health care systems but also in other economy sectors during this period, namely Greece and Spain. On the other hand countries such as Czech Republic, Denmark, Estonia, Finland, Hungary, Latvia, Slovak Republic and United States show very low efficiency scores during these years. It means that these inefficient countries should have higher life expectancy at birth with amount of resources which they use in comparing with another effective countries.

Next efficiency scores for Model 2 in the same three years are displayed in Figure 2

Figure 2 Efficiency Scores (Model 2)



Source: OECD database

Figure 2 shows the same countries with effective health care systems in all three years but Latvia is next effective country according to Model 2. However, the big growth in efficiency scores is observed in case of many countries from 2008 to 2011 when countries increased their efficiency scores or became effective. But on the other hand this increasing efficiency of health care systems did not last long time. This situation occurred in case of these states, namely Australia, Austria, Canada, France, Germany, Iceland, Ireland, New Zealand, Poland, Portugal, Slovak Republic, Switzerland, United Kingdom and United States. Finally countries such as Austria, Belgium, Denmark, Finland, Germany, Hungary, Ireland, Norway, Portugal, Sweden, United Kingdom and United States show very low efficiency scores in all three years. It means that these inefficient countries should have lower mortalities with amount of resources which they use in comparing with another effective countries.

In table 1 the efficiency scores for 13 selected OECD countries in period 2008 – 2015 are displayed. Countries of Western and Eastern part of Europe and non-European developing and developed countries are selected. Countries which are effective at least according to one of two mentioned models from the beginning of the period or from the next year after the first recording efficiency year are colored black. Next countries which became effective at least according to one of models after the inefficient year are colored dark gray and finally, countries which became inefficient according to both models after the efficient year are colored light grey.

Table 1 Efficiency Scores for Selected OECD Countries in Period 2008 - 2015

Model	AUS	CZE	EST	FIN	FRA	DEU	ISR	JPN	MEX	POL	SVK	ESP	UK
Model 1 2008	0.99	0.96	0.94	0.97	0.99	0.98	1.00	1.00	1.00	0.96	0.94	1.00	0.98
Model 2 2008	0.89	1.00	0.87	0.89	0.94	0.83	1.00	1.00	1.00	1.00	0.67	1.00	0.86
Model 1 2009	0.99	0.96	0.95	0.97	0.99	0.97	1.00	1.00	1.00	0.96	0.94	1.00	0.98
Model 2 2009	0.93	1.00	1.00	0.82	0.94	0.82	1.00	1.00	0.91	0.89	0.71	1.00	0.86
Model 1 2010	0.99	0.97	0.97	0.97	0.99	0.97	1.00	1.00	0.99	0.97	0.95	1.00	0.98
Model 2 2010	0.93	1.00	1.00	0.96	0.94	0.82	1.00	1.00	0.81	0.88	0.66	1.00	0.86
Model 1 2011	0.99	0.97	0.97	0.98	1.00	0.97	1.00	1.00	1.00	0.97	0.95	1.00	0.98
Model 2 2011	1.00	1.00	1.00	0.83	1.00	0.86	1.00	1.00	1.00	1.00	1.00	1.00	0.94
Model 1 2012	0.99	0.97	0.97	0.97	0.99	0.97	1.00	1.00	1.00	0.98	0.95	1.00	0.98
Model 2 2012	1.00	0.78	0.90	0.87	0.98	0.91	1.00	1.00	1.00	0.83	1.00	1.00	1.00
Model 1 2013	0.99	0.96	0.97	0.97	0.99	0.97	1.00	1.00	1.00	0.97	0.94	1.00	0.97
Model 2 2013	1.00	1.00	0.81	0.82	1.00	0.82	1.00	1.00	1.00	1.00	0.72	1.00	0.96
Model 1 2014	0.99	0.96	0.96	0.97	0.99	0.97	1.00	1.00	1.00	0.97	0.94	1.00	0.98
Model 2 2014	0.91	0.84	1.00	0.88	0.91	0.80	1.00	1.00	1.00	0.89	0.71	1.00	0.82
Model 1 2015	0.99	0.97	0.97	0.98	0.99	0.97	1.00	1.00	1.00	0.97	0.95	1.00	0.97
Model 2 2015	0.91	0.81	1.00	0.98	0.91	0.80	1.00	1.00	1.00	0.87	0.72	1.00	0.81

Source: OECD database

Countries such as Israel, Japan, Mexico and Spain have effective health care system nearly in each year of this period. Despite the fact that some of these countries keep effective health care systems they belong to the countries which have low health expectancy at birth and high mortality. This is the reason for looking for another causes of these health results. On the other hand most of Western European countries do not maintain effective health care system and use health care resources which should cause higher life expectancy at birth and lower mortality in comparison with effective countries.

4 Conclusions

Based on OECD database our results showed that efficiency of health care systems does not depend on state of health in individual countries because countries with the low life expectancy and the high mortality can be effective as well as countries with the high life expectancy and the low mortality. Especially developing countries belong to the countries which have effective health care system during all period. On the other hand, the developed European countries such as Finland, Germany and United Kingdom are not effective nearly all period 2008 – 2015. These countries employed too many health care resources and they do not reach adequate life expectancy or mortality in comparison with effective countries. This is the reason for the next research to determine how other factors such as environmental, educational, political etc. influence on the health care system efficiency in studied countries.

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Going Public in Selected CEE Capital Markets: Empirical Evidence on IPO Volumes and Drivers

Sylvia Plottová

Brno University of Technology, Faculty of Business and Management
Kolejní 2906/4, 61200, Brno, Czech Republic
E-mail: sylvia.plottova@vutbr.cz

Abstract: *The article is focused on the quantitative analysis of development of IPOs on the capital market of the Czech Republic, Poland, Slovenia and Hungary over the period between 2010 and 2016. A number of significant changes took place on the world markets mainly the global economic crisis which had significant impact on the IPO activity. It is a well-known fact that IPO numbers in Central and Eastern European capital markets are far below the IPO volumes of their Western counterparts. This article´s objective is to look at the most influential external IPO drivers such as development of interest rates, industrial production rates, gross domestic product growth rates and the local stock exchange indices. In order to determine the impact of such IPO drivers the regression analysis was used.*

Key worlds: IPO, gross domestic product, interest rates, industrial production, CEE region

JEL codes: E440, G150, F210

1 Introduction

In past decades Eastern Europe undergone long way of transformation. From planned economy to market orientated. A companies went from state owned to private owned. Their strategies of funding changed dramatically. One of them is Initial public offering hereinafter IPO. Corporate Finance Theory considers IPO as one of the most important milestones in business life. (Helvege and Packer, 2003; Brau, Francis and Kohers, 2003; Boehmer and Ljungqvist, 2004). Ritter (1991), analysts from Ernst and Young (2017) report that IPO is the first sale of securities to the general public.

Main reason why companies go public lies in their need of extra capital. (Bancel and Mitoo, 2009, Kim and Weisbach, 2008, Draho, 2004, Zinecker and Meluzín, 2009) The timing of entry to the capital market is a very difficult issue and is based on a whole range of motives. It is reported that companies enter capital markets at favorable economic conditions that support their continuous growth and development. (Loughran and Ritter, 1995; Ritter and Welch, 2002). Such conditions are therefore external and the issuing company cannot directly influence them.

Typically, they are shaped by the country's economic situation, legislative frameworks, maturity of the capital market, etc. Those factors or rather drivers which make company to go public are development of the gross domestic product, industrial production, interest rates and inflation. They determines the state of economy where company operate and its potential success. Relationships between IPO and macroeconomic factors have been investigated, for example, by Loughran et al. (1994). Their study analyzed the IPO timing in 15 countries in relation to inflation-adjusted stock price indices and gross domestic product rates. The results of the study indicate a positive relationship between IPO and stock market prices, but no positive correlation with the business cycle was found. Ameer (2012), in its study, presents a negative relationship between interest rate and IPO numbers and a strong positive relationship between industrial output and IPO number in the emerging market of Malaysia. Bilson et al (2002) also found only slight signs of a link between local macroeconomic factors and returns on emerging capital markets. Breinliger and Glogova, 2002, examined selected macroeconomic factors influencing the IPO by analyzing the sample of annual IPOs in six developed European countries for 18 years. The hypothesis that the percentage change in savings, gross domestic product growth and interest rates has a significant influence on IPO volumes was not supported by empirical evidence. (Rees, 1997) has found in its research that the number and volume of IPO is

influenced by the development of the stock indexes and that the possibility of issuing shares at high prices is an explanation of the motivation for the IPO. IPOs are positively and significantly associated with stock market levels and, in the case of numbers, the IPO is positively and significantly associated with the business cycle indicator. The causality tests show that the stock index predicts both the value and number of IPOs (Rees, 2002) Rydqvist and Hogholm (1995) compared data on a sample of family businesses in Sweden and eleven European countries between 1970 and 1989. They found that most of the IPO activities took place after a sharp increase in stock prices.

Due to limited amount of studies focused on the central and eastern European countries (CEE countries) in the post-crisis period this article´s objective is to look at the most influential domestic external IPO drivers such as development of interest rates, industrial production rates, gross domestic product rates and stock exchange indices returns. The research question is as follows: How these factors might affect the numbers and volumes of initial public offerings on the selected stock exchanges in Central and Eastern Europe between 2010 -2016.

2 Methodology and Data

In order to find out if and in what extent selected drivers influence IPO, quantitative data from the period between 2010 and 2016 were analyzed. The sources of data were Eurostat, World Bank, European central bank and national statistical offices as well as stock exchanges websites. All the IPO data were recalculated in euro currency.

The Table 1 shows numbers and values of IPOs on selected capital markets. A significant dominance of the Polish capital market is obvious. In total, 158 IPOs occurred where 88.6% of all IPOs were conducted on the Warsaw Stock Exchange. In terms of value of capital raised, only 8.9% of all IPOs are not from Poland.

Table 1 Numbers and Values of IPOs on Selected Stock Exchanges Between 2010 and 2016

	WPG-Poland		**BCPP-Czech Republic**		**BÉT- Hungary**		**LJSE- Slovenia**	
	No	Value ml. EUR	No	Value ml. EUR	No	Value ml. EUR	No	Value ml. EUR
2010	34	4005,76	1	78,26	6	38	0	0
2011	38	1931,26	1	10,00	2	0,49	2	23,6
2012	16	818,60	0	0,00	0	0	0	0
2013	13	1123,00	0	0,00	0	0	1	-
2014	13	306,00	1	15,00	1	3	0	0
2015	14	434,00	1	28,04	0	0	0	0
2016	12	255,00	1	655,55	1	9	0	0
Total	**140**	**8873,62**	**5**	**786,85**	**10**	**50,49**	**3**	**23,6**

Source: Stock exchanges website, company prospectuses, FESE monthly reports

Based on theoretical framework the following research question was outlined:

Are there any statistically significant links between IPO numbers (values) and external IPO determinants? External determinants include development of long-term interest rates, industrial production rates, gross domestic product growth rates and the local stock exchange indices. The following model was specified.

$$IPO_t = \alpha + \beta_1 GDP_t + \beta_2 IP_t + \beta_3 LTIR_t + \beta_4 SEIR_t + u_t \quad (1)$$

Where $\beta_1 GDP_t$ represents GDP growth rates, $\beta_2 IP_t$ represents industrial production rates, $\beta_3 LTIR_t$ represents long term interest rates, $\beta_4 SEIR_t$ represents stock exchange index return developments.

The model estimation was performed with the regression model. The data was evaluated at the significance level of α =5%. Statistica.CZ software was used.

3 Results and Discussion

Table 2 and Table 3 show the results of the estimation of the model described by the formula (1). The model is statistically correct. Based on the F test no significant relationships were found between volumes of IPO and industrial production growth rates. Similarly, stock indices growth rate have no explanatory power on the IPO activity on the capital markets under study. Therefore, the only statistically influential drivers on IPO numbers are the GDP growth rates and the long term interest rates. As the GDP of selected countries is increasing the interest of companies in implementing IPO is increasing as well. The positive economic outlook is proving to be the driver of IPO on selected stock exchanges. The interest rates represents the cost of the long term financing. Therefore when a company is making a decision whenever to obtain large amount of capital through borrowing or through IPO, the unfavorable interest rates may be the reason why to implement an IPO.

The GDP growth rates and the long-term interest rates were verified positively in terms of IPO numbers, however, not in terms of IPO values (for details see Table 3). No significant relationship between values of IPO and any external drivers was found.

Table 2 Results of the Estimation Model Describing the IPO Numbers with External Determinants in Selected Countries between 2010 and 2016

External determinants	Coefficient	Standard error	t-statistics	p-value
Intercept	-7.7577	3.5365	-2.19360	0.3359
GDPt	0.4745	0.2005	2.3655	0.0224
IPt	0.0729	0.1767	0.4126	0.6819
LTIRt	0.4551	0.1671	2.7230	0.0092
SEIRt	-0.2695	0.1419	-1.8995	0.0640
Observations	49			
Stand. error of residuals	7,0199			
R	0,5310			
R2	0,2820			
F(4,44)	4.3218			
p	<0,0049			

Source: Own calculations

Table 3 Results of the Estimation Model Describing the IPO Values (ml. EUR) with External Determinants in Selected Countries between 2010 and 2016

External determinants	Coefficient	Standard error	t-statistics	p-value
Intercept	-471.503	307.5216	-1.5332	0.1323
GDPt	0.2465	0.2118	1.1636	0.2508
IPt	0.2409	0.1866	1.2910	0.2034
LTIRt	0.2998	0.1765	1.6986	0.0964
SEIRt	-0.1570	0.1498	-1.0408	0.3003
Observations	49			
Stand. error of residuals	610.41			

R	0.4462
R2	0.1991
F(4,44)=	2.7349
p	<0.0046

Source: Own calculations

The findings of this study are in contradiction with study of Loughran et al. (1994) and Breinliger and Glogova (2002) who found no significant relationship between GDP growth rates and IPO. The findings are also not in accordance with study of Rees (1997) and Rydqvist and Hogholm (1995) who suggest that increase in stock prices and stock index returns positively influence the IPO activity.

4 Conclusions

This article was focused on the development of IPOs on the capital market of the Czech Republic, Poland, Slovenia and Hungary over the period between 2010 and 2016. In order to find out if and in what extent selected external drivers influence IPO, quantitative data were analyzed. Previous studies did not show consistency in terms of influence of external drivers such as GDP growth rates, industrial production rates, long term interest rates and stock exchange index return rates on IPO. For the purpose of this article only IPO from main and secondary markets of selected stock exchanges were chosen. The outcomes of regression analyses shows that business cycle represented by growth rates of gross domestic product has significant influence on IPO numbers activity as well as development of long term interest rates as measure for long term cost of capital. However, there is no significant relationship between industrial production rates and stock exchange indices returns rates. Nonetheless IPO values proved not to be influenced by any of the external drivers tested by the described regression model.

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Capital Market Determinants of Going Public: The Evidence from CEE Capital Markets

Sylvia Plottová

Newton College a.s.
Rašínova 103/2, Brno, Czech Republic
E-mail: sylvia.plottova@is.newtoncollege.cz

Abstract: *Capital markets within CEE region have shown that in case of new investment opportunities they are still significantly underdeveloped. This research is focused to examine the influence of the local capital market indicators on IPO emergence. The data sets for the capital markets of Czech Republic, Poland, Hungary and Slovenia has been analyzed over the period between 2010 and 2016. The following capital market indicators and their impact on the IPO volumes were examined: market capitalization as percentage of GDP, turnover as percentage of GDP, turnover velocity and number of listed companies. To analyze the data the quantitative approach was applied as well as in depth comparison of capital market specifics. The regression estimation model is applied to identify the impact of the capital market determinants on the number of primary issues and the value of capital raised by IPOs. The data is evaluated at the significance level of α=5%. Results show that in Poland and Hungary the capital market determinants show certain degree of influence on IPO activity.*

Keywords: capital markets, CEE region, market capitalization, initial public offerings

1 Introduction

The IPO stands for primary offering of shares to public and is one of the most important moments in company´s life. (Helvege and Packer, 2003; Brau, Francis and Kohers, 2003; Boehmer and Ljungqvist, 2004, Meluzín and Zinecker 2009). Companies do not choose to enter capital markets at any situation. Attractiveness and liquidity of the capital market shows that companies enter the capital markets when other companies enter them too. (Choe, Masulis and Nanda, 1993). De Albornoz and Pope (2004) found that the IPO is influenced by the market valuation of companies in the same industry. So it occurs when there is a positive development of the IPO in the sector in which the company operates or in the sectors that are directly related. In cases where competing companies implement the IPO successfully, other comparable companies will probably want to gain the same benefits as emitting competitors. Another theory explains that IPO timing is derived from the life cycle theory of an enterprise. This theory is based on the idea that an IPO occurs when issuers find themselves at a particular stage in the business life cycle where they need more capital for further growth. (Choe, Masulis and Nanda, 1993) The determinant characteristics of the capital markets that influence the decisions of the securities issuers in emerging public capital markets in Central and Eastern Europe were subjected to empirical research of Roženský (2008), Peterle (2013) and Brzeszczynsky (2014). They focused on the attractiveness of primary capital markets in the Central and Eastern European region and used quantitative and qualitative indicators for them. Quantitative factors such as capital market size, capital market liquidity, and return on stock indices have been tracked. Peterle (2013) was examining the IPO in the CEE region between 2000 and 2009 found that capital market factors such as market size, liquidity, and market capitalization to gross domestic product did not have a decisive impact on IPO in the mid-Eastern Europe. However, the attractiveness of the capital markets, measured by the annual yield index and the annual market growth and liquidity, may have been the incentives for an increase in the number of IPOs over the reporting period. Brzeszczynski (2014) explains that the decision of the Polish companies to issue securities on capital markets is heavily influenced by capital market developments, and that IPO numbers are rising as stock prices rise and decline as a result of their decline. Groh et al (2010) concluded that investor protection, business management rules, size and liquidity of the capital market are a determining factor for financial community expertise, business flows

and exit opportunities. If companies know they want to diversify their asset portfolio and there are favorable conditions on the market such as the growth of stock index values, other companies entering the capital market, dynamic developments in related industries, they will be more inclined to IPO implementation in their company in order to increase their wealth further. This assumption is associated with IPO timing theories. (DeTienne et al. 2015)

The capital market indicators were widely described by number of authors however in terms of Central and Eastern Europe (CEE) there is a lack of knowledge how capital market indicators might have taken influence on the IPO activity within the financial and economic crisis. Hence, this article´s objective is to search for capital market determinants of going public activity in selected countries of the CEE region. Capital market determinants such as market capitalization as percentage of GDP, turnover as percentage of GDP, turnover velocity and number of listed companies and their influence on going public activity are subject of this research. From above stated literature review follows the main research question: Do capital market indicators have an impact on IPO activity on the selected stock exchanges in Central and Eastern Europe between 2010 and 2016?

2 Methodology

The data for this article was gathered from statistical reports published by individual stock exchanges, namely by the Prague, Warsaw, Budapest and Ljubljana Stock Exchange. In addition, the yearbooks of CEESEG were used. Due to different currencies, all IPO values were recalculated while using historical EUR – local currency exchange rates. Following tables show the data sets on IPO numbers and values, numbers of domestic listed companies, market capitalization to GDP, number of transactions and turnovers.

Based on theoretical framework the following research question was outlined:

Are there any statistically significant links between IPO numbers (values) and capital market determinants? Capital market determinants include market capitalization as percentage of GDP, turnover as percentage of GDP, turnover velocity and number of listed companies. The following model was specified.

$$IPOt=\alpha+ \beta1MCPGDPt + \beta2TPGDPt + \beta3TVt + \beta4NLCt + ut \quad (1)$$

Where MCPGDPt stands for market capitalization as % of GDP, TPGDPt stands for annual turnover as % of GDP, TVt stands for turnover velocity, NLCt stands for number of listed companies. The model estimation was performed with the regression model. The data was evaluated at the significance level of α =5%. Statistica.CZ software was used.

Development of capital market indicators

Table 1 shows the IPO numbers and values in the investigated capital markets. The quantitative analysis suggests that the Polish capital market is significantly more important than its counterparts in Czech Republic, Hungary and Slovenia. Remaining stock exchanges recorded in total only 11.3% of all IPO. The value of capital raised by IPO in Poland represents 91.1% of total amount of capital raised in the whole region.

Table 1 Numbers and Values of IPOs on Selected CEE Capital Markets between 2010 and 2016

	WPG		**BCPP**		**BÉT**		**LJSE**	
	Num.	Value ml. EUR	Num.	Value ml. EUR	Num.	Value ml. EUR	Num.	Value ml. EUR
2010	34	4005.76	1	78.26	6	38	0	0
2011	38	1931.26	1	10.00	2	0.49	2	23.6
2012	16	818.60	0	0.00	0	0	0	0
2013	13	1123.00	0	0.00	0	0	1	-

2014	13	306.00	1	15.00	1	3	0	0
2015	14	434.00	1	28.04	0	0	0	0
2016	12	255.00	1	655.55	1	9	0	0
Total	**140**	**8873.62**	**5**	**786.85**	**10**	**50.49**	**3**	**23.6**

Source: WPG, BCPP, BÉT, LJSE, FESE monthly reports 2010-2016, prospectuses of selected companies

Table 2 reports numbers of listed companies in investigated stock exchanges. It is obvious that the Warsaw Stock Exchange is outnumbering all remaining exchanges based on this criterion. Budapest Stock Exchange and Ljubljana Stock Exchange are similar in regard to the number of listed companies. The Prague Stock Exchange is by far the smallest in terms of amount of listed companies. The listed companies are divided by their domicil as „L" for local, „F" for foreign and „T" for total.

Table 2 Numbers of Listed Companies in Selected CEE Stock Exchanges between 2010 and 2016

	GPW			**BCPP**			**BÉT**			**LJSE**		
	L	F	T	L	F	T	L	F	T	L	F	T
XII-10	570	15	585	16	11	27	48	4	52	72	0	72
XII-11	757	20	777	15	11	26	52	2	54	66	0	66
XII-12	844	23	867	17	11	28	51	1	52	61	0	61
XII-13	869	26	895	15	11	26	50	0	50	55	0	55
XII-14	872	30	902	13	10	23	48	0	48	51	0	51
XII-15	872	33	905	15	10	25	45	0	45	46	0	46
XII-16	861	32	893	14	11	25	42	0	42	38	0	38

Source: FESE monthly reports 2010-2016, BCPP, GPW, BÉT, LJSE

The capital market liquidity is stressed by the following set of indicators: the value of market capitalization as a percentage of GDP, turnover velocity and turnover as percentage of GDP. For details see Table 3.

Table 3 Capital Market Determinants per Stock Exchange in CEE between 2010-2016

Year	**Market cap % GDP**				**Turnover velocity in %**				**Turnover as % of GDP**			
2010	WPG	BCPP	BÉT	LJSE	WPG	BCPP	BÉT	LJSE	WPG	BCCP	BÉT	LJSE
2011	39.48	20.46	21.90	20.35	42.0	55.02	97.00	6.50	16.57	11.26	21.24	1.32
2012	28.26	17.81	13.82	12.64	65.3	51.81	93.71	9.35	18.45	9.23	12.95	1.18
2013	34.48	17.40	17.11	14.73	37.2	35.41	53.61	6.93	12.84	6.16	9.18	1.02
2014	37.72	13.97	13.59	13.76	41.4	30.58	54.78	6.00	15.61	4.27	7.44	0.83
2015	34.40	14.49	11.40	16.56	40.8	24.61	50.59	12.38	14.03	3.57	5.77	2.05
2016	29.31	13.99	17.52	17.05	44.5	26.14	42.81	6.31	13.04	3.66	7.50	1.08

Source: FESE monthly reports 2010-2016, World Bank, own calculation

3 Research Results

The following Tables 4 and 5 show results of above outlined regression estimation model. The model is statistically correct. Overall performance of the model is satisfying and *R* and *p* values are calculated for each country.

As we can see in Table 4 Polish numbers of IPOs have a statistically significant link with all the investigated capital market determinants. In terms of Polish IPO values the results differ. The number of companies listed on the stock exchange is the only statistically significant determinant having impact on the value of capital raised by IPOs. It can be concluded that Hypotheses H1, H2, H3 and H4 proved to be verified positively in regard to

the IPO numbers. The hypotheses that market capitalisation (H1), turnover (H2), and turnover velocity (H3) have explanatory power for IPO values in the Polish capital market could, however, not be supported by the model.

Table 4 Results of the Estimation Model Describing the IPO Numbers and Values in Poland in the Years 2010-2016 with Capital Market- Determinants

PL IPO numbers				
Explanatory drivers	**Coefficient**	**Standard error**	**T-statistics**	**p-value**
Intercept	-139.24	11.8973	-11.7034	0.0072
MCPGDPt	2.5246	0.1564	16.1372	0.0038
TPGDPt	-3.5663	0.2158	-16.5220	0.0036
TVt	4.6123	0.2471	18.6617	0.0028
NLCt	-0.7429	0.0108	-68.6250	0.0002
Observations 7, Standard error of res. 0.2882, R 0.9999, R2 0.9998, F(4, 2)= 4229.2, p. value <0.0002				
PL IPO values				
Explanatory drivers	**Coefficient**	**Standard error**	**T-statistics**	**p-value**
Intercept	10743.1	14863.1	0.7228	0.5448
MCPGDPt	-0.3776	1.6108	-0.2344	0.8364
TPGDPt	0.8820	2.2225	0.3968	0.7298
TVt	-0.7966	2.5448	-0.3130	0.7838
NLCt	-0.8064	0.1114	-7.2346	0.0185
Observations 7, Stand. error of residuals 206.21, R 0.9874, F(4, 2)=39.397, p.value<0.0249				

Source: Own calculation

When it comes to the Czech capital market going public is a rather rare strategy. Between 2010 and 2016 only few IPOs took place. Even though the numbers were low values of those IPO were quite high. Nonetheless as we can see in table 5 there was no significant statistical relationship found for both Czech IPO numbers and IPO values. Hypotheses H1, H2, H3 and H4 were verified positively for neither Czech IPO numbers nor values.

Table 5 Results of the Estimation Model Describing the IPO Numbers and Values in Czech Republic in the Years 2010-2016 with Capital Market- Determinants

CZ IPO numbers				
Explanatory drivers	**Coefficient**	**Standard error**	**T-statistics**	**p-value**
Intercept	10.8768	5.5997	1.9423	0.1915
MCPGDPt	-1.7696	2.3521	-0.7523	0.5303
TPGDPt	5.0013	6.4082	0.7804	0.5168
TVt	-2.7390	4.5822	0.5977	0.6106
NLCt	-0.7758	0.5266	-1.4731	0.2786
Observations 7, Stand. error of residuals 0.4387, R 0.8547, R2 0.7305, F(4, 2)= 4.3218, p. value<0.4662				
CZ IPO values				
Explanatory drivers	**Coefficient**	**Standard error**	**T-statistics**	**p-value**
Intercept	3595.3	3498.13	1.0277	1.0000
MCPGDPt	-4.0134	2.9748	-1.3491	0.3097

TPGDPt	7.8832	8.1046	0.9726	0.4333
TVt	-4.6461	5.7952	-0.8017	0.568
NLCt	0.4144	0.6660	0.6221	0.5973
Observations 7, Stand. error of residuals 274.05, R 0.7543, R2 0.5690, F(4, 2)= 0.6601, p. value<0.6762				

Source: Own calculation

As can be seen in Table 6 in case of Hungarian capital markets no significant statistical relationship between IPO numbers and capital markets determinants were found. The Hungarian IPO market is small and in this regard similar to the Czech IPO market; thus, these results are not surprising. H1, H2, H3 and H4 weren´t verified positively when it comes to IPO numbers. However in case of Hungarian IPO values there a statistically significant relationship exists between this indicator and market capitalization as % of GDP, annual turnover as % of GDP and turnover velocity. Therefore, H1, H2, H3 proved to be verified positively, H4 negatively in case of Hungarian IPO values.

Table 6 Results of the Estimation Model Describing the IPO Numbers and Values in Hungary in the Years 2010-2016 with Capital Market- Determinants

HU IPO numbers				
Explanatory drivers	**Coefficient**	**Standard error**	**T-statistics**	**p-value**
Intercept	17.3938	7.4096	2.3474	0.1434
MCPGDPt	-0.7778	0.4363	-1.7827	0.2165
TPGDPt	2.2430	0.8753	2.5625	0.1244
TVt	-0.5813	0.7228	-0.8042	0.5056
NLCt	-0.5766	0.2473	-2.3318	0.1449
Observations 7, Standard error of residuals 0.6622, R 0.9840, R2 0.9683, F(4, 2)= 15.300, p. value<0.0622				
HU IPO values				
Explanatory drivers	**Coefficient**	**Standard error**	**T-statistics**	**p-value**
Intercept	275.75	68.1746	4.0447	0.0560
MCPGDPt	-1.0252	0.2298	-4.4596	0.0467
TPGDPt	3.3244	0.4611	7.2083	0.0187
TVt	1.8461	0.3808	-4.8470	0.0400
NLCt	-0.3308	0.1303	-2.5391	0.1263
Observations 7, Standard error of residuals 6.0927, R 0.9955, R2 0.9912, F(4, 2)= 56.417, p. value<0.0174				

Source: Own calculation

In case of Slovenian IPO numbers and values, no statistically significant relationship was found. All the hypotheses failed to be verified. Slovenia is the smallest economy of all selected countries and it´s capital market is very limited in size, liquidity and attractiveness. In 2015 Zagreb stock exchange took over 100% of shares of Ljubljana stock exchange so it will be interesting to see whenever this new cooperation will bring anything new for both investors and companies regarding future IPOs.

Table 7 Results of the Estimation Model Describing the IPO Numbers and Values in Slovenia in the Years 2010-2016 with Capital Market- Determinants

SLV IPO numbers				
Explanatory drivers	**Coefficient**	**Standard error**	**T-statistics**	**p-value**
Intercept	-8.679	10.3026	-0.8424	0.4882
MCPGDPt	1.6729	2.6116	0.6405	0.5873
TPGDPt	-5.0161	5.2404	-0.9572	0.4394
TVt	4.5330	4.6351	0.9779	0.4312
NLCt	0.3397	0.5074	0.6695	0.5720
Observations 7, Standard error of residuals 0.6300, R 0.8866, R2 0.7862, F(4, 2)= 1.8390, p. value<0.3818				
SLV IPO values				
Explanatory drivers	**Coefficient**	**Standard error**	**T-statistics**	**p-value**
Intercept	7.00	924.79	0.0075	0.9946
MCPGDPt	-0.3872	3.7058	-0.1045	0.9263
TPGDPt	-0.7588	7.4361	-0.1020	0.9280
TVt	0.6325	6.5772	0.0961	0.9321
NLCt	0.5455	0.7200	0.7576	0.5277
Observations 7, Standard error of residuals 56.557, R 0.7547, R2 0.5695, F(4, 2)= 0.6616, p. value<0.67558				

Source: Own calculation

4 Discussion and Conclusions

This article was focused on the examining the influence of the local capital market indicators on IPO activity in selected capital markets from CEE region. The selected markets include the Warsaw Stock Exchange, Prague Stock Exchange, Budapest Stock Exchange and Lublania Stock Exchange. The IPO numbers and values of capital raised between 2010 and 2016 were analysed. To determine the influence of market capitalization as % of GDP, annual turnover as % of GDP, turnover velocity and number of listed companies, the regression analysis model was used.

The results show that the influence of local capital market factors varies from market to market and that a statistically significant influence of capital market determinants on IPO numbers was found only for Polish capital market. The Czech, Hungarian and Slovenian IPO numbers show no statistical link with selected capital market determinants. While looking at the results of dependence between IPO values and capital market determinants two country´s results show a certain degree of influence. The IPO values were influenced by number of listed companies in Poland and Hungarian IPO values were influenced by the market capitalization as % of GDP, annual turnover as % of GDP and by turnover velocity. Czech and Slovenian IPO values were not proved to be linked to the capital market determinants.

The findings of this article are in contradiction to e.g. Peterle (2013). She reports that capital market determinants have no explanatory power for her IPO sample. However findings of this article are in accordance with eg. Brzeszczynski (2014) who focused on the Polish capital market and concluded that the IPO activity is strongly influenced by capital market determinants. Groh et al (2010) also concluded that size and liquidity of the capital market are among the determining factor for financial community expertise, business flows and exit opportunities. And finally DeTienne et al. (2015) besides other factors see the companies entering the capital market as determinant of IPO.

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Non-financial Information according to the Act on Accounting in the Czech Republic

Veronika Popelková

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 602 00 Brno, Czech Republic
E-mail: 476057@econ.muni.cz

Abstract: *The Directive of the European Parliament and the Council of the EU on the reporting of non-financial information of some large enterprises and groups was implemented in the Czech accounting legislation. This Directive aims to achieve greater transparency and comparability of social and environmental information between undertakings from different sectors and the different Member States. For the first time in the year 2017, entities and groups will be required to report non-financial information by the wording of the Accounting Act. This contribution arises in response to current issues and, through a survey of publicly available information in ten public interest entities, presents the likely future development of a non-financial disclosure solution under the Accounting Act and the European Directive for the financial year 2017. This disclosure of non-financial information will bring significant administrative burdens, but it can also help reduce costs and increase efficiency. The paper also deals with the importance of this information for management and measuring of the corporate performance.*

Keywords: accounting, non-financial reporting, Key Performance Indicator (KPI), corporate performance management

JEL codes: M41, G30, Q01

1 Introduction

With effect from 1 January 2017, the Accounting Act 568/1991 implemented the Directive 2014/95/EU of the European Parliament and of the Council amending Directive 2013/34/EU as regards the disclosure of non-financial information and information on diversity by some large companies and groups. Section 8 of this Act - The disclosure of non-financial information in § 32f introduces the obligation to provide non-financial information for:

1. Large entities that are both a company and a public interest entity provided that their average recalculate a number of employees exceed 500 at the balance sheet date.
2. Consolidating entity of a large group of entities that is also a public interest entity if, at the balance sheet date, it exceeds 500 employees on a consolidated basis during the accounting period.

Under § 32g (1), an entity discloses non-financial information at least for the following items:

- the environment,
- social and employment,
- respect for human rights and
- anti-corruption and bribery.

The following table summarizes the possible information that an entity may disclose for each issue.

Figure 1 Non-financial Information

Environmental matters	**Human rights**
— material disclosures on pollution prevention and control	— occurrences of severe impacts on human rights relating to its activities or decisions
— environmental impact from energy use	— the process for receiving and addressing complaints, and mitigating and providing remedies to human rights violations
— direct and indirect atmospheric emissions	— operations and suppliers at significant risk of human rights violations
— use and protection of natural resources	— processes and measures for preventing trafficking in human beings for all forms of exploitation, forced or compulsory labor and child labor, precarious work, and unsafe working conditions, in particular as regards geographic areas at higher risk of exposure to abuse
— waste management	— how accessible their facilities, documents, and websites are to people with disabilities
— environmental impacts from transportation or the use and disposal of products and services	— respect for freedom of association
— development of green products and services	— engagement with relevant stakeholders
Social and employee matters	**Anti-corruption and bribery**
— the implementation of fundamental conventions of the International Labour Organisation	— anti-corruption policies, procedures, and standards
— diversity issues, such as gender diversity and equal treatment in employment and occupation (including age, gender, sexual orientation, religion, disability, ethnic origin and other relevant aspects)	— criteria used in corruption-related risk assessments
— employment issues, including employee consultation and participation, employment and working conditions	— internal control processes and resources allocated to preventing corruption and bribery
— trade union relationships, including respect for trade union rights	— use of whistleblowing mechanisms
— human capital management including management of restructuring, career management, and employability, remuneration system, training	— employees having received appropriate training
— health and safety at work	— the number of pending or completed legal actions on anti-competitive behavior
— consumer relations, including consumer satisfaction, accessibility, products with possible effects on consumers' health and safety	
— impacts on vulnerable consumers	
— responsible marketing and research	
— community relations, including the social and economic development of local communities	

Source: Own elaboration according to Commission Communication, Guidelines on the reporting of non-financial information (methodology for reporting non-financial information)

2 The legislative framework for reporting non-financial information

Non-financial information under the Accounting Act must contain at least the following structure (§ 32g (2)):

- a brief description of the business model,
- a description of the action taken by a company in the matter in question, if it fails to do so,
- a description of the results of these actions,
- a description of the principal risks associated with these issues and how these risks are managed,
- non-financial Key Performance Indicators (KPIs) relevant to the business activity concerned.

By law, an entity (group) may disclose non-financial information in an annual report (consolidated annual report) or a separate report. When an entity discloses non-financial information in a separate report, it publishes it on its website and provides a hyperlink to this report in its annual report. A separate report may also be published by the entity together with the annual report.

The law also literally states that for the disclosure of non-financial information, an entity may use one of the frameworks that define the disclosure of corporate social responsibility reports. An entity shall always indicate in the report under which the framework was compiled. On 5 July 2017, Official Journal of the European Union No. C 215/1 published a methodology for reporting non-financial information. This methodology was based on the following national, European and international reporting frameworks.

Table 1 Reporting Frameworks for Disclosure of Non-financial Information

CDP (formerly the Carbon Disclosure Project)	the International Integrated Reporting Framework
the Climate Disclosure Standards Board	Model Guidance on reporting ESG information to investors of the UN Sustainable Stock Exchanges Initiative
the OECD Due Diligence Guidance for Responsible Supply Chains from Conflict-Affected and High-Risk areas, and the supplements to it	the Natural Capital Protocol
the Eco-Management and Audit Scheme (EMAS) and the related Sectoral Reference Documents	Product and Organisation Environmental Footprint Guides
the European Federation of Financial Analysts Societies' KPIs for Environmental, Social, Governance (ESG), a Guideline for the Integration of ESG into Financial Analysis and Corporate Valuation	the Sustainability Accounting Standards Board
Global Reporting Initiative	the Sustainability Code of the German Council for Sustainable Development
Guidance for Responsible Agricultural Supply Chains of FAO-OECD	the Tripartite Declaration of principles concerning multinational enterprises and social policy of the International Labour Organisation
Guidance on the Strategic Report of the UK Financial Reporting Council	the United Nations (UN) Global Compact
Guidelines for Multinational Enterprises of the Organisation for Economic Cooperation and Development	UN Sustainable Development Goals, Resolution of 25 September 2015 transforming our world: the 2030 Agenda for Sustainable Development
Guiding Principles Reporting Framework on Business and Human Rights	UN Guiding Principles on Business and Human Rights implementing the UN 'Protect, Respect and Remedy' Framework
ISO 26000 of the International Organisation for Standardisation	

Source: Commission Communication, Guidelines on the reporting of non-financial information (methodology for reporting non-financial information)

These frameworks and methodologies can be a useful guide for corporations to report non-financial information. The survey conducted in a selected sample of entities/groups also

focused on gaining information about whether or not an entity uses any of the above frameworks to report this information for the year 2016.

3 Methodology and Data

This paper aims to define the concept of non-financial information according to the Act on Accounting and their importance for measuring the performance of commercial corporations in the Czech Republic. The contribution in its theoretical level summarizes the current legislative regulation of the given issue and also relies on the study and processing of foreign and domestic resources using methods of analysis, synthesis and compilation. The practical part analyzes the non-financial information of selected companies that meet the criteria for mandatory disclosure according to the Act on Accounting from 2017. Based on this detailed analysis are set to research questions aimed at finding the current state of publication of non-financial information in the Czech Republic. Subsequently, the expected future development in this area is defined.

The aim of the research part is to find out how the non-financial information in the Czech Republic is presented in large accounting units and groups as defined by the Accounting Act. This survey is based on publicly available data for the year 2016. Companies were selected by criteria for mandatory reporting of non-financial information. These are primarily public interest entities whose securities are traded on stock exchanges and banking institutions. For this purpose, business data was used at the Prague Stock Exchange (www.pse.cz). All selected public interest entities meet the criteria for reporting non-financial information - the number of employees and the annual total net turnover or total assets. A detailed analysis of the annual reports, websites and separate reports on the social responsibility of ten public interest entities is carried out. Based on this analysis, the following research questions are identified:

1. Does the entity/group compose a separate report for reporting non-financial information?
2. Does the entity/group use any frameworks or methodologies for disclosure of non-financial information?
3. Does the entity/group provide non-financial information on environmental issues?
4. Does the entity/group provide non-financial information on social and employment issues?
5. Does the entity/group provide non-financial information on human rights issues?
6. Does the entity/group provide non-financial information on corruption and bribery issues?
7. Does the entity/group indicate Key Performance Indicators related to its business activity?

Research issues are assessed by the current version of the Accounting Act, the European Directive and the European Commission's methodology for reporting non-financial information.

4 Results and Discussion

The survey has shown that almost all companies publish some non-financial information (some of the mandatory issues). Only one company does not publish any non-financial information. According to a survey, four out of ten surveyed companies compiled a separate report for disclosure, and three of these companies compiled this report according to the Global Reporting Initiative (GRI) framework. Reports compiled by this framework are entirely consistent with the Accounting Act and the European Non-financial Information Directive. Five companies publish non-financial information in their annual report. Almost all companies provide information on environmental and social and employment issues in full or in part by statutory regulations. Four out of ten companies report wholly or partially information on human rights, corruption and bribery issues. Six out of ten companies publish Key Performance Indicators that relate to their business.

Table 2 The Disclosure of Non-financial Information for the Financial Year 2016

	Entity/Group	Separate report	Using the CSR framework/methodology	Environmental matters	Social and employee matters	Human rights	Anti-corruption and bribery	Key Performance Indicators
1	**ČEZ Group**	Report on Sustainable Development	GRI	YES	YES	YES	YES	YES
2	**ŠKODA AUTO a.s.**	Report on Sustainable Development	GRI	YES	YES	YES	YES	YES
3	**ČD Group**	NO, within the annual report	NO	YES, partly	YES, partly	NO	NO	YES, partly within the quality management system
4	**Česká spořitelna a.s.**	NO, within the annual report	NO	YES, partly	YES, partly	NO	NO	NO
5	**O2 Czech Republic a.s.**	NO, within the annual report	NO	YES, partly	YES, partly	NO	NO	NO
6	**ČSOB Group**	Social Responsibility Report	GRI	YES	YES	YES	YES	YES
7	**PEGAS NONWOVENS SA**	NO	NO	NO	NO	NO	NO	NO
8	**Unipetrol, a.s.**	Report on health, safety and environmental protection	NO	YES	NO	NO	NO	YES, especially environmental matters
9	**Kofola, a.s.**	NO, within the annual report	NO	YES, partly	YES, partly	NO	NO	NO
10	**Komerční Banka, a.s.**	NO, within the annual report	NO	YES, partly	YES, partly	YES, partly	YES, partly	YES

Source: Own processing

Based on the survey, the question arises as to the relationship between non-financial information published by most of the surveyed companies and their performance. Aupperle et al. (1985) attempt to express the relationship between CSR (Corporate Social Responsibility) and corporate profitability in their empirical study. Corporate Social Responsibility represents the integration of the social, environmental and economic aspects of management into one functional unit to meet the needs of all Stakeholders. The authors conclude that there is no clear relationship between Corporate Social Responsibility and

corporate profitability and the assessment of this relationship is highly subjective. However, since the beginning of the 1990s, the importance of intangible and intellectual assets (so-called leading indicators), which have a significant impact on the long-term development of corporations, is increasing with the criticism of traditional financial indicators (lagging indicators). These factors include the quality of products and internal processes, the ability and motivation of employees, and relationships with other Stakeholders. According to Kaplan and Norton (1996, p. 3), targeting these factors will enable the organization:

- maintain positive relationships with existing customers and gain new customer segments,
- provide innovative products and services as required by customers,
- produce highly personalized products at the lowest cost and in less time,
- develop skills and abilities of employees and motivate them to perform better,
- develop information technology, databases and systems.

In this context, some managerial approaches, tools and systems focus on intangible and intellectual assets that are a prerequisite for the strategic development of society. Kaplan and Norton (1992) formulated a comprehensive strategic management system – Balanced Scorecard in Harvard Business Review. This system serves to clarify and translate the vision and strategy into concrete forms of measurable goals. The measures (Key Performance Indicators) are linked to strategic goals and measure the degree of achievement of these objectives. So-called strategic actions support strategic goals. Strategic actions are measures, initiatives, programs or activities that help to achieve strategic goals. Strategic goals, measures (Key Performance Indicators) and actions are assigned to individual points of view, so-called perspectives - learning and growth (employee), internal processes, customer and financial.

Individual perspectives are not separated but are interconnected through causal links between individual strategic goals. Non-financial information (indicators) are monitored within the perspectives of learning and growth (employee), internal processes and customers. Positive development of these indicators is reflected in the results of the financial perspective.

Parmenter (2008) extends the four basic perspectives of the Balanced Scorecard system to the environment/community and employee satisfaction. This expanded Balanced Scorecard corresponds to the Stakeholder Theory, defined by R. E. Freeman in 1984 (Freeman, 1984). The goal of this theory is to maximize the benefits not only for the owners but also for all Stakeholders. Individual corporations may have different interest groups (Stakeholders). It is usually possible to distinguish five major stakeholder groups (Atkinson et al., 1997): customers, employees, suppliers (goods, services, debts), owners, community. The expanded Balanced Scorecard system is also in line with Act on Accounting 568/1991 and Directive 2014/95/EU of the European Parliament and the Council. The individual perspectives include environmental issues, social and employment issues, respect for human rights and the fight against corruption and bribery. This system thus becomes an appropriate tool for measuring and performance management of public interest entities that are required to report non-financial information.

5 Conclusions

This contribution dealt with the reporting of non-financial information according to the amendment to the Act on Accounting and European Directive. This information is required to be disclosed for the first time for the financial year 2017 by June 30, 2018. A survey of publicly available information was carried out in ten public interest entities that met the criteria for the mandatory disclosure of non-financial information for the financial year 2016. The answer to the seven research questions was to estimate the expected future development of disclosure of non-financial information for the year 2017. The analysis has shown that a clear solution for the disclosure of non-financial information is to compile a separate report containing that information. The survey confirmed that most companies reporting non-financial information in a separate report compiled this report according to

the Global Reporting Initiative (GRI) framework. Reports compiled under this framework are fully in line with the amendment to the Act on Accounting. Therefore, we can expect that companies will disclose non-financial information for the financial year 2017 in accordance with this framework or this framework will inspire them. This is also confirmed by the KPMG survey (2017), which showed that 75% of the 250 largest companies in the world use the GRI framework to publish non-financial information.

The paper also addressed the importance of non-financial information for performance measurement and management. Existing surveys in this area have not confirmed the precise relationship between reporting CSR and performance (Aupperle et al., 1985). However, literature speaks of the significant influence of intangible and intellectual assets on the long-term development of companies (Kaplan, Norton, 1996). Also, Stakeholder Theory (Freeman, 1984) assumes a synergy effect between satisfying interests of Stakeholders and maximizing benefits for owners. A recommendation for companies reporting non-financial information under the Accounting Act is the implementation of the Balanced Scorecard extended by Parmenter (2008). This system extends the four fundamental perspectives of the Balanced Scorecard (Kaplan, Norton, 1992). The extended perspectives are the environment/community and employee satisfaction that encompass legally required non-financial information. Orientation to this non-financial information, in addition to administrative burdens, can help improve performance over the strategic horizon.

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Evaluation of Expense Ratio of Insurance Portfolios Belonging to Selected Insurance Companies Operating on Czech Insurance Market

Lenka Přečková[1], Eva Vávrová[2]

[1] Silesian University in Opava
School of Business Administration in Karviná, Department of Finance and Accounting
Univerzitní nám. 1934/3, 733 40 Karviná, Czech Republic
E-mail: preckova@opf.slu.cz

[2] Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 507/41a, 602 00 Brno, Czech Republic
E-mail: eva.vavrova@econ.muni.cz

Abstract: *The paper focuses on evaluation of insurance portfolios belonging to the insurance companies ČSOB and Komerční pojišťovna from the vantage point of growth rate of premium written and expense ratio of the insurance portfolio. The aim of this paper is to ascertain whether the selected insurance companies experience lower expense ratio of their insurance portfolio than what is the average expense ratio of insurance portfolios on the Czech insurance market. The reason for doing this research is in the fact that the insurance companies ČSOB and Komeční pojišťovna are entities with a developed bancassurance model. As the authors discovered in their earlier research, insurance companies using this model experience lower expense ratio. This paper analyzes the selected insurance companies on Czech insurance market considering the cooperation between the bank and insurance company. It analyzes the volume of premium written concluded through the distributional channel of bancassurance, and eventually compares expense ratios of the selected insurance companies with the average value on Czech insurance market between 2012 and 2016. Expense ratio of life insurance in both insurance companies shows lower values than the average value on the Czech insurance market. The same applies to total insurance. The research confirms that Komerční pojišťovna shows lower average value of expense ratio than ČSOB pojišťovna.*

Keywords: bancassurance, expense ratio, insurance market

JEL codes: G21, G22

1 Introduction

For the financial market, bancassurance is a topic of current importance. However, every author defines bancassurance and other related terms differently. In order for a product which a bank offers to be considered an actual bancassurance product, it must be integrated. When selling a bancassurance product, it is automatically sold together with an insurance one. According to Lím (2012), the more an insurance product is integrated with the central product of a financial institution, the more likely it will become its organic part and the better the sales will be.

There is a variety of publications which compare advantages and disadvantages of bancassurance. What is more, these advantages and disadvantages can be assessed from different viewpoints: the viewpoint of the bank, the viewpoint of the insurance company and finally, the viewpoint of the client. The main advantage of using this distributional channel is that financial subjects can use it to reduce costs.

Bancassurance came into existence in the United States about 50 years ago. According to Mesršmíd (2016), the development of bancassurance was supported by many different economic reasons. The target was to take advantage of the synergy to reduce costs

and provide clients with a comprehensive offer and more services in what is called a one-stop shop.

According to the statistics provided by the European insurance and reinsurance federation (2010), the results for bancassurance in Europe were as follows: Bancassurance was not very well developed in non-life insurance and represented less than 10% in all countries of Europe. Bancassurance was the main distribution channel for life insurance products in many western European countries. It represented up to 84.5% of the total life business in Portugal and reflected the growth of a model that was developed in the 1990s allowing access to a large number of clients on a regular basis, combined with a good knowledge of their financial resources. The high penetration rate of bancassurance in the distribution of life insurance products was particularly true for unit-linked products. Bancassurance for unit-linked products was notably strongly developed in Italy (91%), Belgium (74%), France (65%) and Croatia (55%). In the Czech Republic, it is unfortunately not possible to assess this distributional channel because there is no available data providing sales volume of bancassurance products.

Daňhel et al. (2007) claims that in consequence of a bank merging with an insurance company, operational costs can decrease by 10% to 20% for one of the integrating partners. According to Polouček (1999), providers of bancassurance report operational costs lower by 40% compared with standard insurance companies. 82% bancassurance groups operating in Europe have lower costs in providing life insurance than traditional insurance companies providing life insurance.

A comparison of the expense ratios of life insurers in France in 1991 showed that insurers relying on traditional agents had considerably higher expense ratios than banks' in-house companies (Genetay and Molyneux, 1998). The latter showed expense ratios varying from 3.1% to 9.1% while traditional insurers had expense ratios rating from 10.5% to 23.7% (Leach, 1993).

Other studies performed in Ireland (10 life insurance companies from 1991 to 2000 were examined) by Hwang and Gao (2005) suggest that the dummy indicating the distribution of insurance policies by bank branches is positively related to cost efficiency and the coefficient is statistically significant. Research done by Barros et al. (2006) in Portugal (14 life insurance companies from 1995 – 2003) confirmed that the dummy indicating the ownership by a bank institution is positively related to cost efficiency, but the coefficient is not statistically significant.

According to Swiss Re (2007) bancassurance is often considered to be more cost effective than traditional agency and broker channels. In Italy, the total expense ratio, as a percentage gross premiums from banks, was clearly lower than that of agents and financial advisors. In France, bank channels had a clear cost advantage in 2005 compared to companies which use intermediaries. In contrast, direct writing companies had a slightly lower expense ratio than banks, due to lower administration cost. Similarly, in household insurance in France, the bank channel enjoyed a lower expense ratio than other channels, apart from "mutuals without intermediaries".

The empirical results find that the following factors have played significant roles in the expanding and consolidation of bancassurance: reduction in company risk, the size of the company, reductions in company costs and increases in company revenues, the size of the national banking industry, the level of financial deregulation within a country, and the national inflation rate (Chen et al., 2009).

The article analyzes insurance portfolios of selected Czech insurance companies from 2012 to 2016. The analysis uses gross written premium (hereinafter referred to as GWP) and gross operating expenses (hereinafter referred to as GOE). The article calculates and compares growth rate of GWP; it also compares selected insurance companies from the vantage point of market shares in the Czech Republic and the share of life insurance in total insurance. The article then compares shares of bancassurance in total GWP; it calculates and compares expense ratio indicator (hereinafter referred to as ER).

The aim of this paper is to ascertain whether the selected insurance companies experience lower expense ratio of their insurance portfolio than what is the average expense ratio of insurance portfolios on the Czech insurance market. For this research, two insurance companies shall be selected: ČSOB pojišťovna, a.s. (hereinafter referred to as ČSOBP) and Komerční pojišťovna, a.s. (hereinafter referred to as KP). These two offer their financial products using bancassurance as the distributional channel. To achieve the target, two research questions shall be formulated. **Is the average value of ER in selected insurance companies lower than the average value of ER on the Czech insurance market? Does the insurance company with a larger share of bancassurance in GWP show lower value of ER?** The average value shall be based on the average from 2012 to 2016.

2 Methodology and Data

The first part of this research shall introduce the property structures of ČSOBP and KP using information available in annual reports (2017). The next step shall be dedicated to analyzing and comparing development of growth rate (GWP) for total, life and non-life insurance in both of the insurance companies from 2012 to 2016. The average growth rate for the monitored period shall be calculated together with the share of life insurance in total insurance. The research uses data from the statistics of Czech Association of Insurers (hereinafter referred to as ČAP).

The following part shall compare development of the market share of ČSOBP and KP on Czech insurance market. The share of bancassurance in total written premium shall be compared for the period from 2012 to 2016. In case of KP, the research shall use data from a questionnaire survey (2017) and in case of ČSOBP from Cach (2016).

The final part of the research shall present development of ER indicator for both of the insurance companies from 2012 to 2016. It was calculated the ratio indicator "expense ratio" (ER), which is very often used in evaluating costs of insurance activities (Pulchart, 2002; Gestel et al., 2007; Vávrová, 2014). It is the proportion of operating costs and premiums written. For the calculation, it was taken into account gross operating expenses (GOE) and gross premiums written (GWP). This indicator should reach an amount lower than 30% (Vávrová, 2014). The formula for calculating is:

$$ER = \frac{GOE}{GWP} \tag{1}$$

ER is a calculation for total, life and non-life insurance and it is compared with the development of the insurance market. Subsequently, average values for the selected period for both the insurance companies and the insurance market shall be calculated and compared. The data necessary for calculation of ER was accessed in ČAP's statistics.

3 Results and Discussion

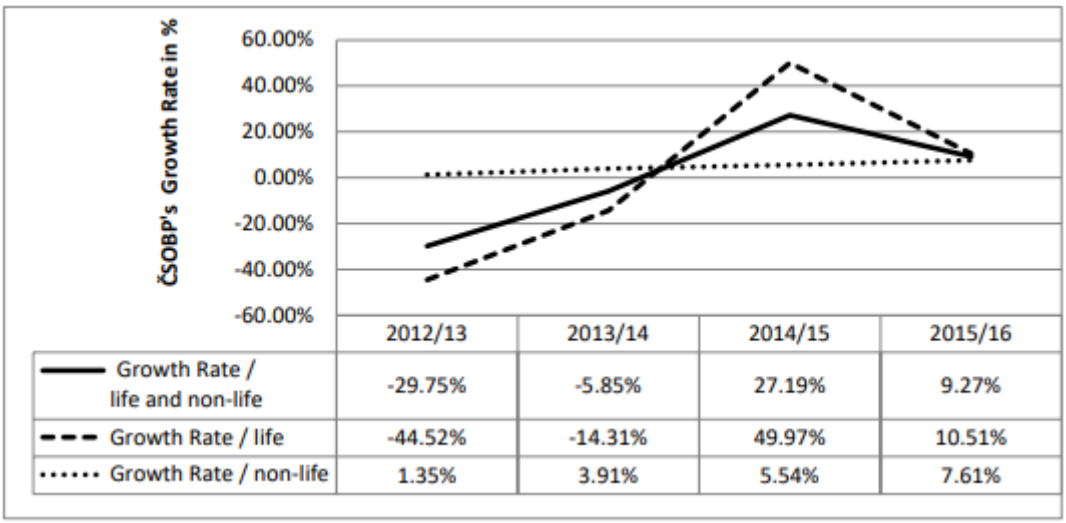
ČSOB pojišťovna and Komerční pojišťovna

ČSOB pojišťovna, a.s. (hereinafter referred to as ČSOBP), a member of the ČSOB holding is a universal insurance company. It came into existence in 1992 and it has had its current name since 2003. In 2003, ČSOBP merged with IPB Pojišťovna. The majority shareholder of ČSOBP is KBC Verzekeringer (Insurance) NV with 99.755% share. The remainder (0.245%) is owned by Československá obchodní banka, a.s. (hereinafter referred to as ČSOB). (Annual report 2017)

ČSOB is a wholly-owned subsidiary of KBC Bank NV. KBC Bank is fully owned by KBC Group NV. KBC Group is an integrated banking and insurance group that focuses particularly on clients in the following areas: individuals, private banking, SMEs and mid-sized corporations. In the same fashion, ČSOB focuses on linking banking and insurance products also in the Czech Republic.

Figure 1 shows development of GWP (total, life and non-life) using growth rate in the period between 2012 and 2016. Growth rate of life insurance shows significant fluctuations. The average value for the period reaches 0.41%. Growth rate in non-life insurance shows a rising tendency and reaches 4.6% on average.

Figure 1 Development of ČSOBP' Growth Rate



	2012/13	2013/14	2014/15	2015/16
Growth Rate / life and non-life	-29.75%	-5.85%	27.19%	9.27%
Growth Rate / life	-44.52%	-14.31%	49.97%	10.51%
Growth Rate / non-life	1.35%	3.91%	5.54%	7.61%

Source: Author's own work based on ČAP's statistics

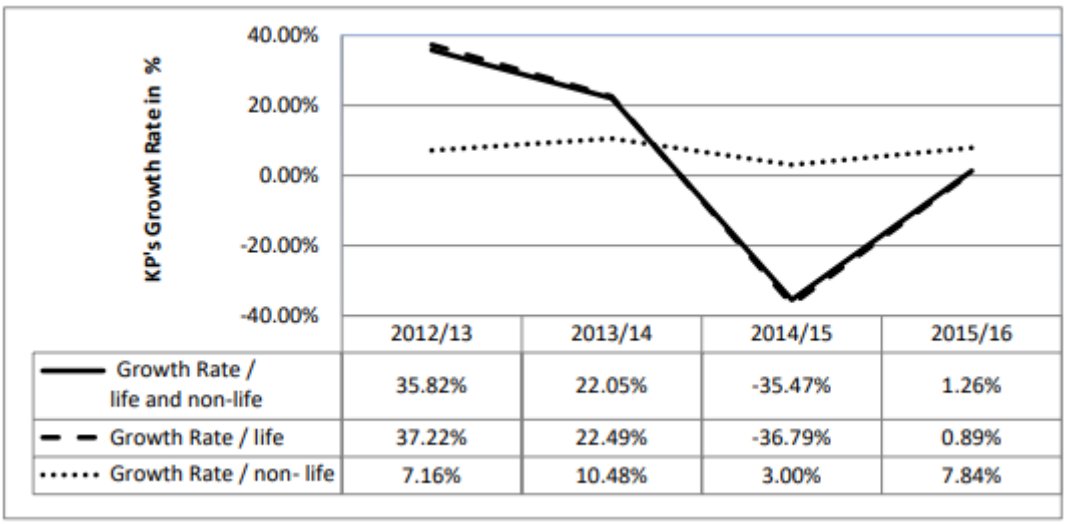
GWP of life insurance of ČSOBP in the period from 2012 to 2016 reaches average value of 6,559,675 thous. CZK and GWP of non-life insurance reaches average value of 4,740,918 thous. CZK. The average share of life insurance of ČSOBP in total insurance is 58%.

Since the acquisition of Komerční banka, a.s. (KB) by Société Générale S.A. in 2001, Komerční pojišťovna, a.s. (KP) started implementing SG's bank-insurance business model. KP therefore cooperates primarily with companies that form part of the KB Group.–The majority owner of KP's shares is insurance company SOGECAP S.A., SG's wholly owned subsidiary, which holds a 51% ownership interest. KB is a 49% minority shareholder. (Annual Report, 2017)

Figure 2 shows development of GWP (total, life and non-life) using growth rate in the time period from 2012 to 2016. Growth rate of life insurance shows, just like in case of ČSOBP, significant fluctuations. The average value for the period reaches 5.95%. Growth rate in non-life insurance is stable and reaches 7.12% on average. It is clear that growth rates life and total insurance are close to identical. The development is given by the fact that KP is exclusively focused on arranging life insurance.

GWP of life insurance of KP in the period between 2012 and 2016 reaches average value of 7,253,944 thous. CZK and GWP of non-life insurance reaches average value of 331,906 thous. CZK. The average share of life insurance of KP in the total insurance is almost 96%.

Figure 2 Development of KP' Growth Rate



	2012/13	2013/14	2014/15	2015/16
Growth Rate / life and non-life	35.82%	22.05%	-35.47%	1.26%
Growth Rate / life	37.22%	22.49%	-36.79%	0.89%
Growth Rate / non- life	7.16%	10.48%	3.00%	7.84%

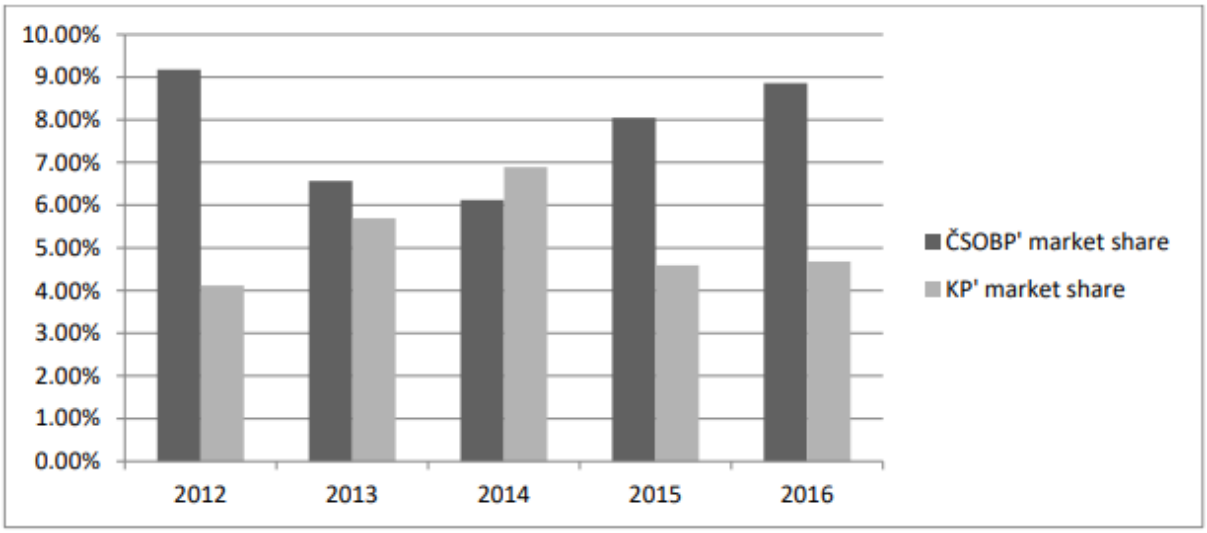
Source: Author's own work based on ČAP's statistics

Based on the presented data, it can be concluded that both of the insurance companies focus on developing bancassurance and offer integrated bancassurance products. Both of them are subsidiary companies of a financial group, of which they are members. In both of these companies, insurance portfolio is dominated by life insurance. KP is exclusively focused on life insurance. Growth rate in the period 2012-2016 shows significant fluctuations in both of the insurance companies. Average value of growth rate of life insurance is 0.41% in ČSOBP and 5.95% in case if KP. Development of non-life insurance is more stable. There is a rising tendency in case of ČSOBP.

Comparison of market share and share of bancassurance

Figure 3 compares development of share on the insurance market in the period from 2012 to 2016. The average value of ČSOBP's market share is 7.75% in the monitored period, and 5.2% in case of KP. It is obvious that ČSOBP's market share experienced diminution in 2013 and 2014. In 2016, the value was again almost as high as in 2012. KP's market share rose from 2012 and in 2015 and 2016, it decreased to the value of 2012.

Figure 3 Development of ČSOBP's and KP's Market Share



Source: Author's own work based on ČAP's statistics

As already mentioned, both of the insurance companies prefer distribution of their financial products through bancassurance. The following table shows how much insurance was arranged using the distributional channel of bancassurance.

Table 1 Share of Bancassurance in GWP in the Period 2012 - 2016

Year	Share of bancassurance, %	
	ČSOBP	**KP**
2012	Not specified	93.82
2013	8.7	95.68
2014	8.4	95.80
2015	9.8	92.96
2016	15.4	93.39

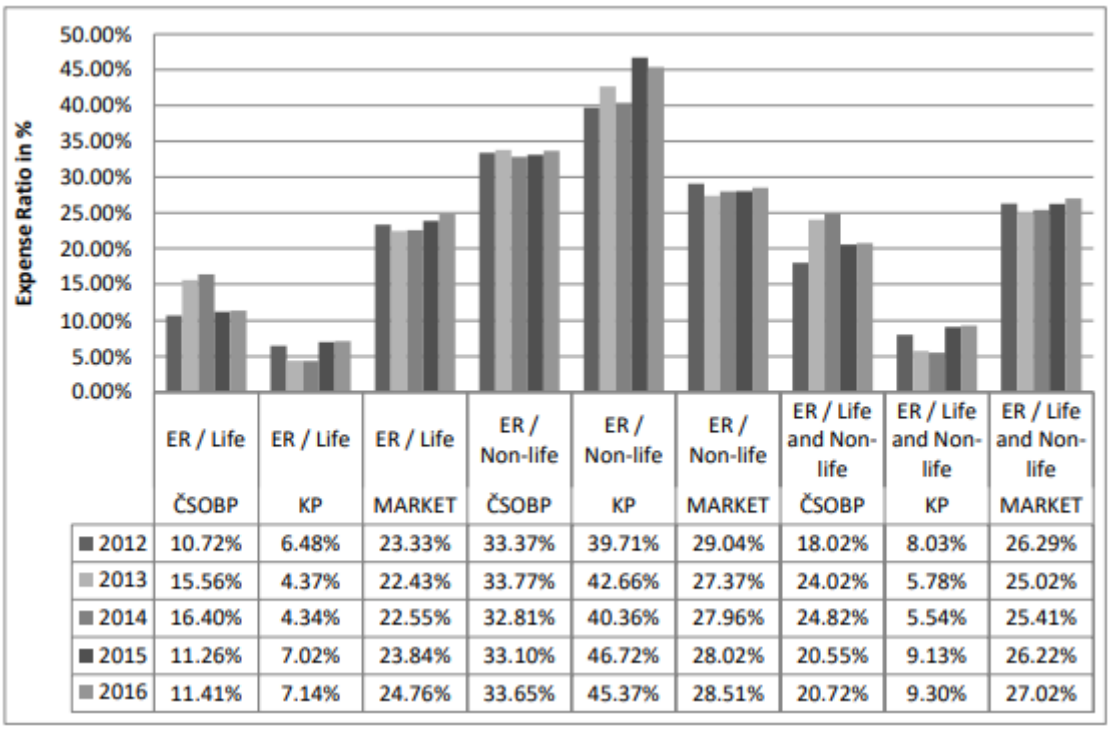
Source: Author's own work based on Cach (2016) and questionnaire (2017)

Volume of bancassurance has a rising tendency in case of ČSOBP. It reached 15.4% in 2016. The growth between 2015 and 2016 reached 57%. KP arranges insurance exclusively using bancassurance. Between 2012 and 2016, the share of bancassurance exceeded 90%.

Comparison and evaluation of expense ratio

Based on ascertained volumes of bancassurance, it can be assumed that in case of both of the insurance companies, ER will reach lower values than what is the average value on the Czech insurance market. It can also be predicted that ER will be lower in case of KP because this insurance company arranges more contracts using bancassurance.

Figure 4 Development of Expense Ratio



	ER / Life ČSOBP	ER / Life KP	ER / Life MARKET	ER / Non-life ČSOBP	ER / Non-life KP	ER / Non-life MARKET	ER / Life and Non-life ČSOBP	ER / Life and Non-life KP	ER / Life and Non-life MARKET
2012	10.72%	6.48%	23.33%	33.37%	39.71%	29.04%	18.02%	8.03%	26.29%
2013	15.56%	4.37%	22.43%	33.77%	42.66%	27.37%	24.02%	5.78%	25.02%
2014	16.40%	4.34%	22.55%	32.81%	40.36%	27.96%	24.82%	5.54%	25.41%
2015	11.26%	7.02%	23.84%	33.10%	46.72%	28.02%	20.55%	9.13%	26.22%
2016	11.41%	7.14%	24.76%	33.65%	45.37%	28.51%	20.72%	9.30%	27.02%

Source: Author's own work based on ČAP's statistics

Figure 4 shows values of ER of selected insurance companies and Czech insurance market in the period from 2012 to 2016. In case of life insurance, the value of ER in both of the insurance companies is lower than on the insurance market, this applies to all monitored years. Total insurance shows the same results. In case of non-life insurance, values of the two insurance companies are higher than on the market. Insurance companies reach higher ER than what is the recommended value (30%). The market is below 30%.

Figure 5 shows average values of ER of the selected insurance companies as well as the market. The average values supplement the situation in Figure 4. In case of life and total insurance, both ČSOBP and KP reach lower average values than the average value of the market. In case of non-life insurance, both of them show higher average value than the average value of the market. Table 2 compares average values of ER with the market.

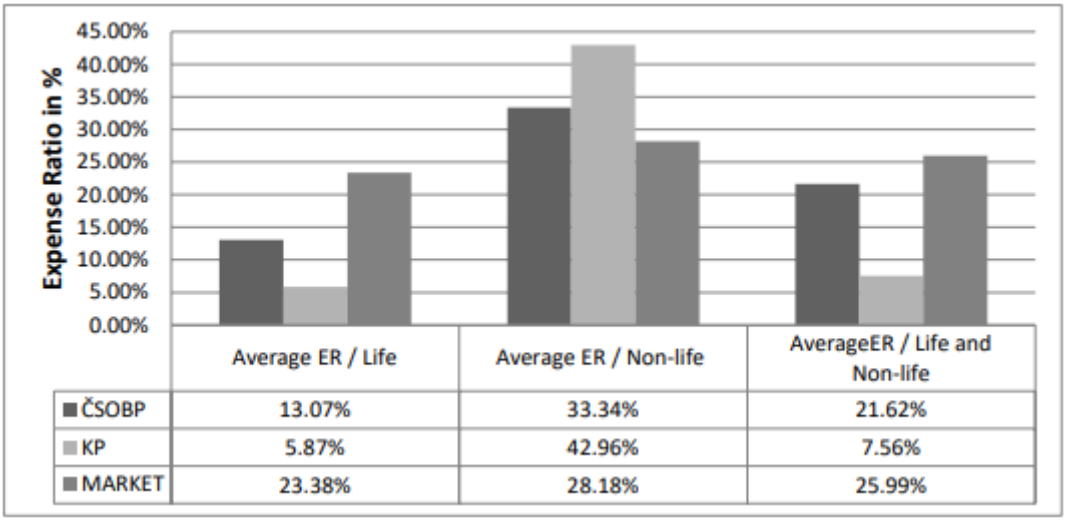
Table 2 Comparison of Average Values of ER (in %)

	Average ER (Life)	Average ER (Life and Non-life)
Market	23.38	25.99
ČSOBP	13.07	21.62
Difference between market and ČSOBP	**44**	**17**
KP	5.87	7.56
Difference between market and KP	**75**	**71**

Source: Author's own work based on Cach (2016) and questionnaire (2017)

Figure 5 confirms the assumption that the average value of ER of the insurance company KP is lower than the average value of ER of the insurance company ČSOBP. This assumption applies only to life and total insurance. In case of life insurance, the value of ER is 55% lower and the value of ER in total insurance is 65% lower.

Figure 5 Comparison of Development of ER Average Values from 2012 to 2016



Source: Author's own work based on ČAP's statistics

4 Conclusions

The article analyzes insurance portfolios of the insurance companies ČSOBP and KP in the Czech Republic from 2012 to 2016. These two insurance companies focus their business activities on offering bancassurance products. Both of them are subsidiary companies of financial groups to them they belong. ČSOBP's share of bancassurance rose and in 2016 exceeded 15%. In case of KP, the share of bancassurance is higher than 90% over the whole monitored period. In both of the insurance companies, their product portfolio is dominated by life insurance. ČSOBP's average value of life insurance share is 58%. In case of KP, it is 96%. In the period from 2012 to 2016, ČSOBP shows average market share of 7.75%. In case of KP, it is 5.2%.

The aim of this paper is to ascertain whether the selected insurance companies experience lower expense ratio of their insurance portfolio than what is the average expense ratio of insurance portfolios on the Czech insurance market. To achieve the target, two research

questions were formulated. **Is the average value of ER in selected insurance companies lower than the average value of ER on the Czech insurance market? Does the insurance company with a larger share of bancassurance in GWP show lower value of ER?** The average value was based on the average from 2012 to 2016.

ER of non-life insurance in ČSOBP and KP does not reach lower values than those shown by the Czech insurance market. This applies not only to the individual years in the period from 2012 to 2016, but also to the average value over this period. In the same period, the value of ER of non-life insurance is higher than the recommended value of 30%.

ER of life insurance in both ČSOBP and KP shows lower values than the average value on the Czech insurance market. The same applies to total insurance. KP reached significantly lower value of ER. The average value of ER in life and total insurance is lower by more than 70% as compared with the average value on the market.

The research also confirms that KP shows lower average value of ER than ČSOBP. The average value of ER of the insurance company KP is 55% lower in case of life insurance and 65% lower in case of total insurance.

Acknowledgments

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Comparison of Analysis Deviation Methods for the Multiplicative Operations

Barbora Ptáčková[1], Dagmar Richtarová[2]

[1]VSB – Technical University of Ostrava
Faculty of Economics, Department of Finance
Sokolská třída 33, 702 00, Ostrava 1, Czech Republic
E-mail: barbora.ptackova@vsb.cz

[2] VSB – Technical University of Ostrava
Faculty of Economics, Department of Finance
Sokolská třída 33, 702 00, Ostrava 1, Czech Republic
E-mail: dagmar.richtarova@vsb.cz

Abstract: *This paper is dedicated to comparison of analysis deviation methods for the multiplicative operations. Evaluation of financial performance belongs to key activities of each company. The importance of the performance concept is widely recognized, it is one of the tools, knowing which helps to manage a company efficiently. Decomposition analysis is also very important. Decomposition analysis helps to analyze the factors affecting selected key measures and quantify their impact on the key measures. In this paper five basic methods of analysis of deviations will be compare – gradual change method, decomposition method with a residue, logarithmic method, functional method and integral method. The aim of this paper is to compare analysis deviation methods for the multiplicative operations used for quantification of the influence of the component indicators to base indicator and verify if using of these five methods leads to the same results. Methods of analysis of deviations will be applied to return on equity (ROE) indicator of manufacturing industry of the Czech Republic and according these five methods main factors will be find and influence of these factors will be quantified. Annual data will be taken from Ministry of industry of the Czech Republic.*

Keywords: financial performance, analysis of deviations, pyramidal decomposition, return on equity

JEL codes: C2, C5, C58, G3, G30

1 Introduction

In today´s fast changing world and in the uncertain business environment, companies are exposed to increasingly larger business risks which they have to manage often and with new ways of doing so. Knowing the indicators representing financial performance related to the dynamic environment, where companies operate is a key element by increasing the competitiveness. Financial performance of companies is solved by many authors, see Ehrbar (1998), Mařík (2005), Vernimmen (2005), Dluhošová (2010) or Abdoli et al. (2011).

Key financial indicators of financial performance of company can be found according to the selected methods of financial performance. Find key financial ratios for a company is first step of evaluating of financial performance. It is also very important to quantify the impact of key financial ratios on key measures. Method of pyramidal decomposition together with the analysis of deviation helps to identify and quantify the impact of selected financial ratios to base ratio, Gurný, Richtarová, Čulík (2016). The impact of selected ratios to the base ratio can be analyzed according to static and dynamic methods of analysis of deviation, Ptáčková (2015) or Richtarová (2016). Decomposition of variance is one of the dynamic method used for quantification of impact of selected financial ratios to base ratio, Ptáčková, Richtarová (2017). In this paper static methods of analysis of deviation will be characterized and compared.

The aim of this paper is to compare analysis deviation methods for the multiplicative operations used for quantification of the influence of the component indicators to base indicator and verify if using of these five methods leads to the same results.

2 Methodology and Data

Evaluation of financial performance belongs to key activities of each company. The importance of the performance concept is widely recognized. Financial performance of company can be analyzed according to traditional measures or modern indicators, Dluhošová, Ptáčková, Richtarová (2017). ROE, ROI or NOPAT are traditional indicators used for financial performance of industry or company. These indicators are based on accounting data and do not reflect costs of capital, Dluhošová (2010).

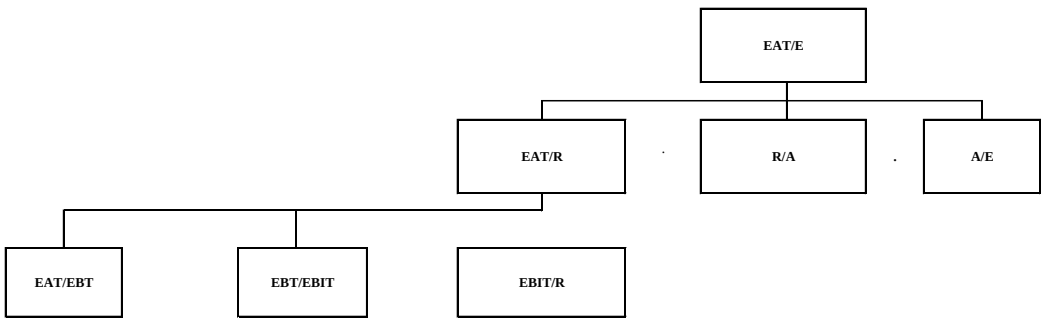
In this paper financial performance of manufacturing industry of the Czech Republic is analyzed according to return on equity (ROE). Main influencing factors of financial performance are found according to pyramidal decomposition of this ratio. Return on equity is one of the traditional measurement of financial performance. According to Vernimmen (2005) or Dluhošová (2010) return on equity is generally expressed as

$$ROE = \frac{EAT}{E} \tag{1}$$

where *EAT* is earnings after taxes and E is equity.

Method of pyramidal decomposition is applied to return on equity indicator of manufacturing industry of the Czech Republic. Pyramidal decomposition of return on equity is shown in Figure 1.

Figure 1 Pyramidal Decomposition of ROE



Source: own calculation

Pyramidal decomposition together with the analysis of deviation helps to identify the relationship between financial ratios and quantify the impact of component indicators to base financial indicator. According to analysis of deviation it is possible to quantify the impact of the changes in the component financial ratio on the base financial ratio, Zmeškal (2013).

Generally, any base indicator x can be expressed as a function of component indicators

$$x = f\left(a_1, a_2 ... a_n\right) \tag{2}$$

The change of the base financial indicator can be determined as a sum of influences of component financial indicators as

$$\Delta y_x = \sum_i \Delta x_{a_i} \tag{3}$$

where x is the base financial indicator, Δy_x is the change in the base financial indicator, a_i is the i-th component ratio, Δx_{a_i} is the impact of i-th component ratio on the change in the base ratio.

Quantification of the impact of component financial ratios on the change in the base financial ratio in pyramidal decomposition can be expressed using two relationships – additive relationship and multiplicative relationship, Zmeškal (2013).

Deviation analysis for additive relationship

According to Zmeškal (2013) additive relationship between financial ratios is expressed as

$$x = \sum_i a_i = a_1 + a_2 + ... + a_n \tag{4}$$

Quantification of the impact under the additive relationship is generally applicable. The total impact is divided in proportion to the changes in the component financial ratios as

$$\Delta x_{a_i} = \frac{\Delta a_i}{\sum_i \Delta a_i} \cdot \Delta y_x \tag{5}$$

where $\Delta a_i = a_{i,1} - a_{i,0}$ is the value of the i-th component financial ratio at the beginning of the analyzed period and a_i is the value of the i-th component financial ratio at the end of analyzed period.

Deviation analysis for multiplicative relationship

Multiplicative relationship among financial ratios is expressed as

$$x = \prod_i a_1 = a_1 \cdot a_2 \cdot ... \cdot a_n \tag{6}$$

According the way in which the multiplicative relationship is handled, it can be distinguished five basic methods: a method of gradual changes, a decomposition method with surplus, a logarithmic method, functional method or the integral method, Zmeškal (2013).

If **method of gradual changes (MGCH)** is used for quantification of an influence of component financial ratios to base financial ratio under the multiplicative relationship, influences are quantifies as follows

$$\Delta x_{ai} = \prod_{j<i} a_{j,0} \cdot \Delta a_i \cdot \prod_{j>i} a_{j,1} \cdot \frac{\Delta y_x}{\Delta x}. \tag{7}$$

According Zmeškal (2013) calculation simplicity and residue free decomposition are advantages of method of gradual changes. On the other side, there are some disadvantages – strength of the influences depends on the ranking of financial ratios in the calculation.

Decomposition method with a residue (DMR) is the second method used for quantification of an influence of component financial ratios to base financial ratio. If this method is applied influences are quantifies as follows

$$\Delta x_{a_i} = \Delta a_i \cdot \prod_{j \neq i}^{n} a_{j,0} \cdot \frac{\Delta y_x}{\Delta x} + \frac{R}{n}, \tag{8}$$

meanwhile, the residue is possible to quantify on the basis of the change of ratios as

$$R = \Delta y_x - \Delta a_i \prod_{j \neq i}^{n} a_{j,0} \cdot \frac{\Delta y_x}{\Delta x}.$$

The advantage of the decomposition method with a residue is that results are not influenced by the ranking of financial indicators. The existence of residue of component is disadvantage of this method.

Logarithmic method (LM) is characterized by the decomposition of influences without a residue. Generally, influences of component financial ratios is calculated as

$$\Delta x_{a_i} = \frac{\ln I_{a_i}}{\ln I_x} \cdot \Delta y_x \,. \tag{9}$$

Advantage of logarithmic method is that can reflect simultaneous changes of all component ratios, there is no residue. One of disadvantage of this method is that all indexes must be positive, because of index logarithm.

The calculation of an influence according to **functional method (FM)** is expressed as

$$\Delta x_{a_i} = \frac{1}{R_x} \cdot R_{a_i} \cdot \left(1 + \sum_{j \neq i} \frac{1}{2} \cdot R_{a_j} + \sum_{\substack{j \neq i \\ k \neq i \\ k > j}} \sum \frac{1}{3} \cdot R_{a_j} \cdot R_{a_k} + \sum_{\substack{j \neq i \\ k \neq i \\ k > j \\ m \neq i \\ m > k}} \sum \sum \frac{1}{4} \cdot R_{a_j} \cdot R_{a_k} \cdot R_{a_m} + \ldots \right) \Delta y_x . \tag{10}$$

When functional method is used for quantification of influences of component financial ratios, discrete returns are applied. Advantages are similar to logarithmic method and there is no problem with negative values of financial indicators.

Integral method (IM) is last method used for quantification of influences under the multiplicative relationship. Resulted influence quantification according integral method for any component ratio is expressed as

$$\Delta x_{a_i} = \frac{R_{a_i}}{R_{x'}} \cdot \Delta y_x , \tag{11}$$

where $R_{a_i} = \frac{\Delta a_i}{a_{i,0}}$ and $R_{x'} = \sum_{i=1}^{N} R_{a_i}$, R_x .

Advantages of integral method are same as for functional method, but it is also possible to analyze non-linear operations and also interpretation can be easier, Zmeškal (2013).

Data

For the comparison of analysis of deviation methods under the multiplicative operations annual data of manufacturing industry in period 2015 to 2016 were used. Input data were taken from the website of Ministry of Industry of the Czech Republic. Financial ratios were calculated on the base of input data according to chosen pyramidal decomposition of return on equity. Values of financial ratios are calculated in Table 1.

Table 1 Financial Ratios

RATIOS	T0	T1
ROE	**0,175**	**0,219**
EAT/EBT	0,803	0,813
EBT/EBIT	0,870	0,941
EBIT/R	0,063	0,075
R/A	1,768	1,823
A/E	2,236	2,087

Source: mpo.cz, own calculation

3 Results and Discussion

First, MGCH is applied and absolute deviations of component ratios are calculated. Ranking of financial ratios in the calculation is important when MGCH is used for quantification of deviation under the multiplicative operations. In the Table 2 there are three possible ranking of financial ratios, which are used for quantification of influence.

Table 2 Order of Ratios for Analysis of Deviation – Method of Gradual Changes

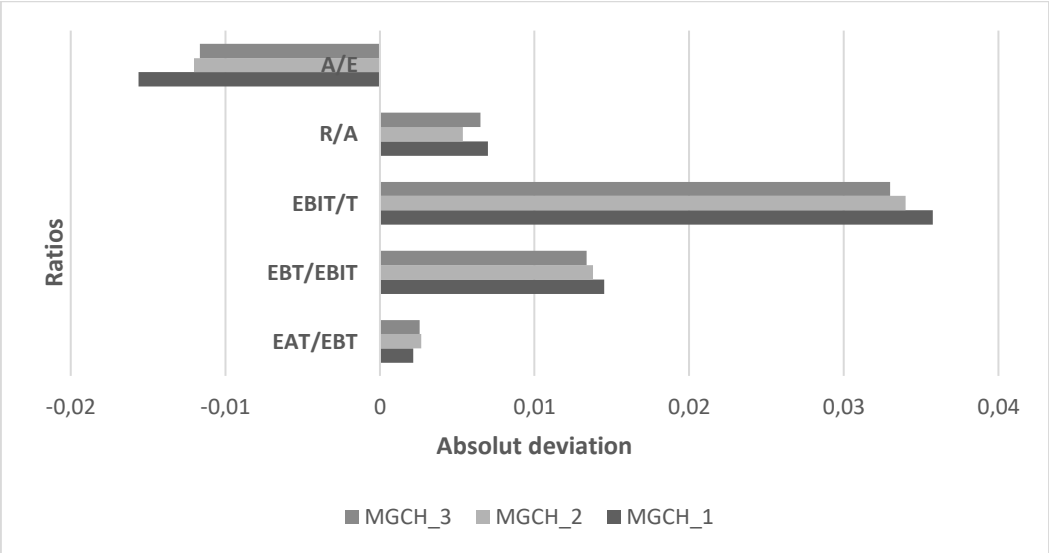
Order of ratios	MGCH_1	MGCH_2	MGCH_3
1	EAT/EBT	R/A	A/E
2	EBT/EBIT	A/E	EBT/EBIT
3	EBIT/R	EBT/EBIT	EBIT/R
4	R/A	EBIT/R	EAT/EBT
5	A/E	EAT/EBT	R/A

Source: own calculation

Generally, strength of the influences depends on the ranking of financial ratios in the calculation. It is one of disadvantage of method of gradual changes. That´s why in the calculation of influence according to MGCH ranking of component ratios were changed.

In the Figure 2 there are shown influences of component ratios in three scenarios of ranking of component ratios.

Figure 2 Absolute Value of Deviation – Method of Gradual Changes



Source: own calculation

According to MGCH it is possible to quantify the influence of component financial ratios to base financial ratio. This analysis has confirmed importance of ranking of financial indicators. From the Figure 2 it is possible to see how the value of deviation is changed when ranking of financial component ratios is changed. It is clear that the value of deviation of each component ratio has different value when the ranking of ratios is various. According to this analysis the value of influence is changing, but the strength (positive or negative) is same.

All methods were applied for comparison. In the Table 3 there are calculated and quantified values of deviations of each component ratios according to five chosen methods used for quantification of deviation under the multiplicative operation. Data from the scenarios MGCH_1 was used for analysis and comparing according to MGCH.

Table 3 Absolute Value of Deviation – All Methods

RATIOS	MGCH	DMR	LM	FM	IM
EAT/EBT	0,215%	0,215%	0,240%	0,241%	0,218%
EBT/EBIT	1,450%	1,432%	1,542%	1,546%	1,450%
EBIT/R	3,577%	3,266%	3,356%	3,357%	3,307%
R/A	0,698%	0,537%	0,593%	0,578%	0,510%
A/E	-1,561%	-1,165%	-1,351%	-1,361%	-1,106%
Σ	**4,379%**	**4,285%**	**4,379%**	**4,361%**	**4,379%**
Residue		0,094%			

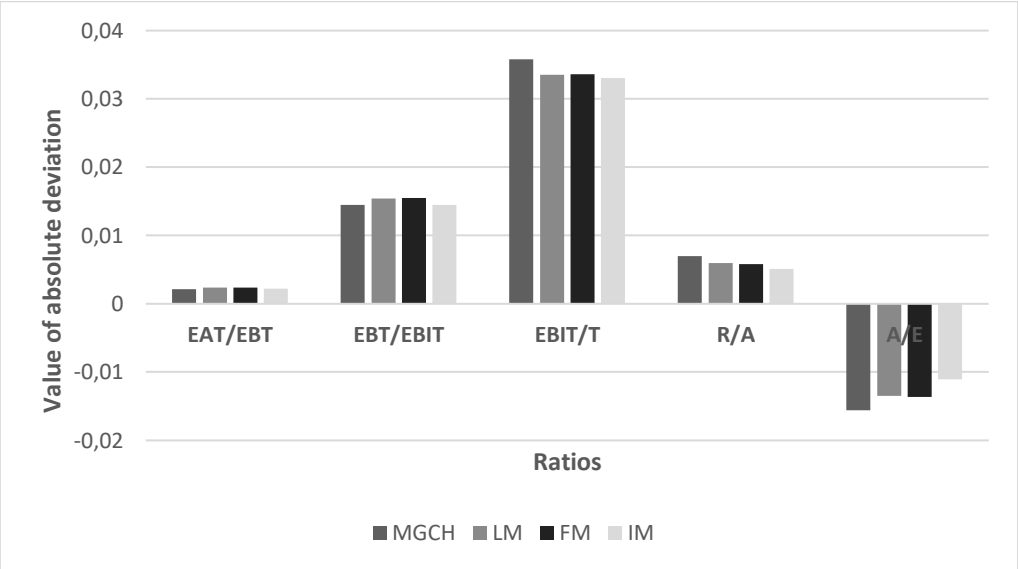
Source: own calculation

From the Table 3 it is clear that the total value of influence of component ratios is same for all methods. There are highlight values of deviations of component ratios, which have the biggest influence according to used methods. The value of deviation of each component financial ratio is different when different methods are used. One of the disadvantage of DMR is creation of residue and attributability of this residue to any component ratio. When the residue is small this method can be used, otherwise the analysis can be distorted.

Discussion

In the Figure 3 there are shown resulted values of absolute deviation of component ratios to ROE indicator according to MGCH, LM, FM and IM. Results of DMR method were excluded because of the existence of residue.

Figure 3 Absolute Value of Deviation



Source: own calculation

For the analysis all methods used for quantification of influence under the multiplicative operation were applied. According to analysis return on equity of manufacturing industry of the Czech Republic between 2015 and 2016 is influenced mainly by the EBIT/R. This indicator has highest positive influence and financial leverage has the highest negative influence.

Strength (positive or negative) of the influence of component ratio calculated according to different method is same. The value of deviation of each component ratio is different, only.

When analysis of deviation is applied it is important to respect advantage and disadvantage of all methods, for example LM is not possible to apply when index of logarithm of component ratio is negative. In such situation, in next level of decomposition it is suitable to use different method for quantification of influence.

4 Conclusions

This paper was dedicated to comparing of methods used for quantification of an influence of component financial ratios to base financial ratio under the multiplicative relationship. In this paper method of gradual changes, decomposition method with residue, logarithmic method, functional method and integral method were compared. These five method were applied to return on equity ratio of manufacturing industry of the Czech Republic.

The aim of this paper was to compare analysis deviation methods for the multiplicative operations used for quantification of the influence of the component financial indicators to base financial indicator and verify if using of these five methods leads to the same results.

Financial performance of manufacturing industry of the Czech Republic was analyzed according to ROE indicator. Financial performance was analyzed between 2015 and 2016. Method of pyramidal decomposition was applied to return on equity indicator and main influencing factors of financial performance of manufacturing industry were found. Influences were calculated according selected deviation analysis methods. From the analysis of deviation of component ratio was found that the values of deviation of component ratios are different, otherwise the strength of the influence is same according to all methods.

Acknowledgments

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Beliefs in Cryptocurrency: Exploring the Relationship between Sentiment and Bitcoin

Zuzana Rakovská

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 60200 Brno, Czech Republic
E-mail: zuzana.rakovska@mail.muni.cz

Abstract: *The rise of the Internet changed the way how financial markets work. Due to user generated content, quite everybody might contribute to the large set of information and the exchange of news happens faster than ever. An important variable in such new era is sentiment, which causes market participants to act on noisy signals from Internet as they were valid inputs. Importantly, sentiment is considered the crucial ingredient in price formation of now increasingly attractive digital currencies. Investors' beliefs affect exchange rates of those currencies considerably simply because of lack of fundamentals and regulation. In this paper we will examine the relationship between sentiment and price of the most popular cryptocurrency, Bitcoin. We will employ three measures of sentiment constructed by Sentix survey with aim to explore the effect of both institutional and individual investor's sentiment as well as overall sentiment of the community.*

Keywords: Bitcoin, sentiment, Sentix, cryptocurrency, impulse-response

JEL codes: G40, G41

1 Introduction

Bitcoin is the most popular cryptocurrency which has been receiving increasing attention since its inception in 2008. It is decentralized and is not controlled by any respected institution or government, it is connected to organized crime and money laundering, it caused significant losses for its owners after repeated hacker attacks, but still, this digital currency is being adopted by increasing number of retailers and the amount of investor accounts in Bitcoin exchanges expands year-to-year.

It seems that public belief in Bitcoin is capable of overcoming any problems and what is important, Bitcoin prices seems not to be affected by performance or socio-political changes in any country. But what determines Bitcoin price? Since there are hardly any fundamentals linked to it, answer to this question is becoming an emerging topic in the current (not only academic) literature.

Many authors argue, that Bitcoin is more asset than a currency (Yermack, 2014; Gomez-Gonzales & Parra-Polania, 2014). In fact, it is hard to assign any fundamental value to it, similarly as it is hard to assign a fundamental value to stocks of young start-up companies with highly uncertain future. Price of such assets is subject of speculation and trend chasing driven by expected profits of holding it or selling it with a profit. Baker & Wurgler (2007) in their famous study showed that such assets are prone to investors' beliefs and preferences, and hence sentiment represents a crucial factor in their price dynamics.

Up until now, several papers have addressed the relation between sentiment and price of Bitcoin or other cryptocurrencies. Those articles used various measures of sentiment, such as Google search query volume, Twitter sentiment or sentiment mined from dedicated blogs. None of those articles, however, studied effects of directly measured sentiment towards Bitcoin. This paper uses the unique sentiment data provided by company Sentix[17] that captures investors' sentiment via monthly survey. Sentix distinguishes between

[17] Sentix is a leading provider of services in the field of Behavioral Finance in Europe. It has been established in 2001 and since this year, sentix surveys on weekly basis around 5000 investors from more than 20 countries. One of the important characteristics of sentix is the fact that it distinguishes between institutional and individual investors (the ratio between individual and institutional participants is approx. 4 to 1) and hence provides an unique opportunity for data analytics (www.sentix.com).

individual and institutional investors and this fact offers the possibility to estimate effects on Bitcoin for those two groups separately. This paper represents the first attempt in the academic literature to model the relation between sentix Bitcoin Sentiment and price of this popular cryptocurrency. Moreover, we are not aware of any other article which would study the effects of individual and institutional sentiment separately.

The first study of effect of sentiment on Bitcoin exchange rate was conducted in Kristoufek (2013). Author examined how investor attention measured by Google search volume and frequency of visits on the Wikipedia page for term "Bitcoin" affect the currency. Results showed bidirectional relationship: not only search queries drove prices but also prices were shown to encourage attention about the term on the internet. In his second study, Kristoufek (2014) showed that along the speculative nature of Bitcoin, standard fundamental factors such as money supply, play a role in Bitcoin price formation in the long run. McAteer (2014) employed the standard financial proxy for sentiment – trading volume, and analyzed whether sentiment obtained from Twitter via sentiment analysis could serve as a proxy for Bitcoin sentiment as well. Author showed strong correlation between the two sentiment measures and showed that tweets are capable of predicting Bitcoin exchange rates in the long run. Trading volume together with Google search volume was also examined in Cretarola *et al.* (2017) who incorporated investors' beliefs into newly built valuation model for Bitcoin price. Relationship between Twitter sentiment and Bitcoin prices was further explored in Georgoula *et al*. (2015) or Matta *et al.* (2015) who besides social media sentiment also studied effects of Google search volume and Wikipedia search. An interesting study was conducted in Bukovina & Marticek (2016) who processed social data sentiment from www.sentdex.com and studied its effect on Bitcoin price which was decomposed into rational and less rational part. The most recent papers demonstrated that sentiment gathered from Bitcoin forums such as www.bitcointalk.org might also serve as a significant predictor of future Bitcoin prices (Mai *et al.*, 2017; Kim *et al.,* 2017).

The goal of this paper is to analyze how sentiment towards Bitcoin measured by unique sentix-survey data affects price dynamics of this popular cryptocurrency. We will enrich the analysis by investigating effects of individual and institutional sentiment separately. Following results from existing literature and speculative nature of Bitcoin we expect significant effect of all three sentiment measures on currency exchange rate.

The present paper is organized as follows. Section 2 describes data we processed in our analyses and proposes methodology to be employed. The central part of the present study is formed in Section 3 in which we examine the results of our study and offer a general discussion of the analyzed phenomenon. Finally, Section 4 delivers conclusions of this article.

2 Data and Methodology

We employed monthly time series data capturing dynamics of Bitcoin prices and investor sentiment measured by Sentix survey in period from December 2013 to April 2018. We decided to process monthly series because Bitcoin Sentiment measure is available only in monthly frequency.

Bitcoin prices, used in this study were downloaded from www.bitcoinity.org, an internet page managed by Kacper Cieśla, which offers free analysis of various Bitcoin data such as prices, volumes, market capitalization, etc. We denoted it as *BTCPrice and this* variable represents monthly weighted average of Bitcoin - US dollar exchange rates (BTC-USD) published by the biggest and best established Bitcoin exchanges up to date[18].

Measures of sentiment towards Bitcoin were gathered from sentix database accessed via Bloomberg terminal. Sentix (www.sentix.de) collects various sentiments on weekly basis through e-mail survey which consists of three parts: Equity Markets; Bonds, FX and

[18] www.bitcoinity.org page summarizes high frequency data obtained from exchanges such as bitfinex (www.bitfinex.com), bitflyer (www.bitflyer.com), bitstamp (www.bitstamp.net), coinbase (www.coinbase.com), kraken (www.kraken.com), hitbtc (www.hitbtc.com), itbit (www.itbit.com), and others.

Commodities; and Theme of the Week. Bitcoin sentiment has been captured in the Asset classes section of the last part, Theme of the Week since December 2013 with monthly frequency. On each second Friday of a month, survey participants are asked to express their willingness to invest in Bitcoin in medium term of 6 months by selecting a category from range of 1 to 5, with category 3 indicating neutrality. Resulting index[19] fluctuates between -100 and 100. Respondents are divided into two groups: individual investors and institutions based on their registration preferences and subsequent validation process in case of institutional investors. As of May 2018, there were more than 5 000 investors registered for the survey and therefore called for their investment opinions.

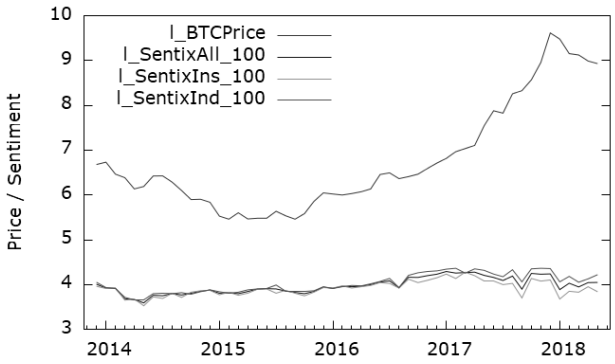
Bitcoin sentiment measured by sentix could be viewed as a representation of investors' rising (falling) preferences or beliefs about Bitcoin which is then translated into their willingness to buy (willingness to sell). With a certain time lag, this willingness might result in corresponding transaction on the market and subsequent price movements. In extreme areas, this index might switch from direction indicator to contrarian and might represent an alarm for increased probability of future trend reversals. In this paper we will study all three sentiment measures: overall sentiment (*SentixAll)*, sentiment of individual investors (*SentixInd*) and institutional sentiment (*SentixIns*). The history of sentix Bitcoin sentiment however, witnessed only negative values (with minimum of -63.75 for overall sentiment of investors). In order to perform statistical inference, we decided to adjust the series by adding 100 to each observation so as the range is shifted to 0 to 200 array. Having the time series defined only in space of positive numbers is of great importance for possible logarithmic transformation. Table 1 shows summary statistics for all four time series.

Table 1 Summary Statistics

	BTCPrice	***SentixAll***	***SentixIns***	***SentixInd***
Mean	2068.8	53.99	50.82	57.15
Minimum	234.81	36.25	34	38.5
Maximum	14973	73	72	78.5
Standard deviation	3388.1	9.86	8.34	12.2

Source: Author's calculation

Figure 1 Dynamics between log Bitcoin prices and log sentiment



Source: Author's calculation

Dynamics between sentiment measures and Bitcoin prices is best captured by their logarithmic transformations. Figure 1 depicts their evolution in time. In "non-extreme" areas such as period between February 2015 and July 2015, or January 2016 and April 2016, Bitcoin sentiment (its logarithmic transformation) represents direction indicator

[19] Bitcoin sentiment is calculated as:

$$sentix\ Bitcoin\ Sentiment = \left(3 - \frac{\sum_{i=1}^{n} k(i)}{n}\right) * 50$$

where *n* represents number of survey participants and *k(.)* represents the given category of answer ranging from 1 to 5 (Source: www.sentix.de).

which informs about rising beliefs in Bitcoin. In comparison, in extreme events such as those in April 2014 or August 2017 when Bitcoin price rose by 26 % and 43 %, respectively, compared to previous month, our sentiment indicators demonstrate its contrarian nature. In those periods, investors revealed falling preferences for buying Bitcoin.

The econometric analysis employed in this study consists of several steps that arise from the nature of time series data. First of all, we tested stationarity of our variables and also of their logarithmic transformations in order to assess preferred bivariate model representation. Stationarity is crucial when analyzing time series as inclusion of non-stationary data in regression model might lead to incorrect inference of causality where no relationship exists (Granger & Newbold, 1974). The usual way how to address this problem of *spurious regression* is differencing. Time series which became stationary after the first differencing is integrated of order one (*I(1)*) and time series which become stationary after *d* differencing is integrated of order *d* (*I(d)*). We used two test for stationarity: KPSS test (Kwiatkowski *et al.*, 1992) with the null hypothesis of stationarity (*d=0*) against the alternative of unit root (*d*=1); and Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979) for which the null hypothesis is on the contrary, that the series possesses a unit root and hence is not stationarity[20]. Table 2 summarizes. Results showed that both, original series and their logarithmic transformations, exhibit non-stationarity while their first differences where proved to be stationary and hence available for valid statistical inference.

Table 2 Testing for Stationarity

		ADF test [p-value]	KPSS test [p-value]
BTCPrice		0.206 [>0.10]	0.838 [<0.01]
	Log	-2.457 [>0.10]	1.259 [<0.01]
	Diff	-6.257 [<0.01]	0.117 [>0.10]
	Log-Diff	-5.126 [<0.01]	0.16 [>0.10]
SentixAll		-2.4 [>0.1]	0.99 [<0.01]
	Log	-2.632 [>0.1]	1.018 [<001]
	Diff	-5.864 [<0.01]	0.111 [>0.1]
	Log-Diff	-6.022 [<0.01]	0.113 [>0.1]
SentixIns		-1.2 [>0.1]	0.71 [0.012]
	Log	-1.227 [>0.1]	0.723 [0.01]
	Diff	-6.474 [<0.01]	0.112 [>0.10]
	Log-Diff	-6.848 [<0.01]	0.108 [>0.10]
SentixInd		-1.695 [>0.10]	1.122 [<0.01]
	Log	-3.019 [>0.10]	1.148 [<0.01]
	Diff	-10.95 [<0.01]	0.121 [>0.10]
	Log-Diff	-10.42 [<0.01]	0.133 [>0.10]

Source: Author's calculation

However, the negative feature of differencing time series and its subsequent use in regression is loss of possibility to infer long-run relationship between variables. Engle & Granger (1987) argues that level variables might still be used for valid inference if they are represented by time series integrated by same non-zero order *d* (non-stationary) and there exists their linear combination which is integrated of order *0* (stationary). In other words, valid statistical inference might be assessed if non-stationary series are cointegrated. While all our time series exhibited unit root, the next step of the analysis was to test each pair of *BTCPrice - sentiment measure* and *Log-BTCPrice – log-sentiment measure* for cointegration using Engle-Granger two-step method (Engle & Granger,

[20] Optimal lag p for ADF tests was determined according to Schwert (1989) as $p = 12 * (T/100)^{1/4}$, where T represents the number of observations.

1987)[21]. Cointegration was not detected for any of six studied pairs (*BTCPrice – SentixAll, BTCPrice – SentixIns, BTCPrice – SentixInd* and their logarithmic counterparts), therefore we opted for stationary Log-differences of our time series and the standard procedure for analyzing multivariate series, Vector autoregression – VAR (Sims, 1980).

VAR model for two time series $\{x_t\}$ and $\{y_t\}$ could be written as:

$$\Delta x_t = \alpha_1 + \sum_{i=1}^{p} \beta_{1i} \Delta x_{t_i} + \sum_{i=1}^{p} \gamma_{1i} \Delta y_{t_i} + \varepsilon_{1t} \quad (1)$$

$$\Delta y_t = \alpha_2 + \sum_{i=1}^{p} \beta_{2i} \Delta x_{t_i} + \sum_{i=1}^{p} \gamma_{2i} \Delta x_{t_i} + \varepsilon_{2t} \quad (2)$$

w*here p* denotes the lag which is usually selected according to some information criteria, such AIC (Akaike Information Criteria); $\{\varepsilon_{1t}\}$ and $\{\varepsilon_{2t}\}$ denotes error terms that are possibly correlated; and $\{\Delta x_t\}$ and $\{\Delta y_t\}$ represent the first differences of non-stationary time series that are *I(0)* and hence stationary. Parameters β_1, β_2, γ_1 and γ_2 thus, could be estimated using ordinary least squares (OLS).

Since in such a model all variables depend on each other, individual parameter values only provide limited information. Following Kristoufek (2013) we will use impulse-response analysis in order to get a better understanding of the model's dynamic. Impulse responses show how response variable reacts to a one-time impulse or shock in another variable and this reaction could be observed in a plotted trajectory (Sims, 1980).

3 Results

In this part of the paper we will examine dynamic relationship between investor sentiment measured by sentix survey which uniquely captures beliefs of both, individual investors and institutions; and price of the most popular cryptocurrency – Bitcoin.

Based on the results from previous section (both original and logarithmic series are I(1) while their differences are stationary together with rejecting cointegration hypothesis for all six pairs) we decided to employ the first logarithmic differences of our variables of interest in Vector autoregression (VAR) framework. We performed three VAR regressions, each for our three sentiment measures: overall sentiment of investors, sentiment of individual investors and institutional sentiment. Based on the Akaike Information Criteria (AIC) we applied lag *p=1* in VAR approach (VAR(1)) for the first two sentiment variables and lag *p=3* (VAR(3)) for institutional sentiment. To control for potential autocorrelation and heteroscedasticity in error terms we used heteroscedasticity and autocorrelation robust (HAC) standard errors when estimating VAR. We tested regression results for autocorrelation and normality of residuals. We detected non-normality of residuals in the first and the second regression (we rejected the normality hypothesis at 10 % confidence level). Therefore, we conducted additional analysis to find out which equation residuals are causing the problem and by plotting those problematic residuals we were able to identify outliers[22]. Subsequently, we added observation range dummies for those outlying points as exogenous variables to our problematic models.

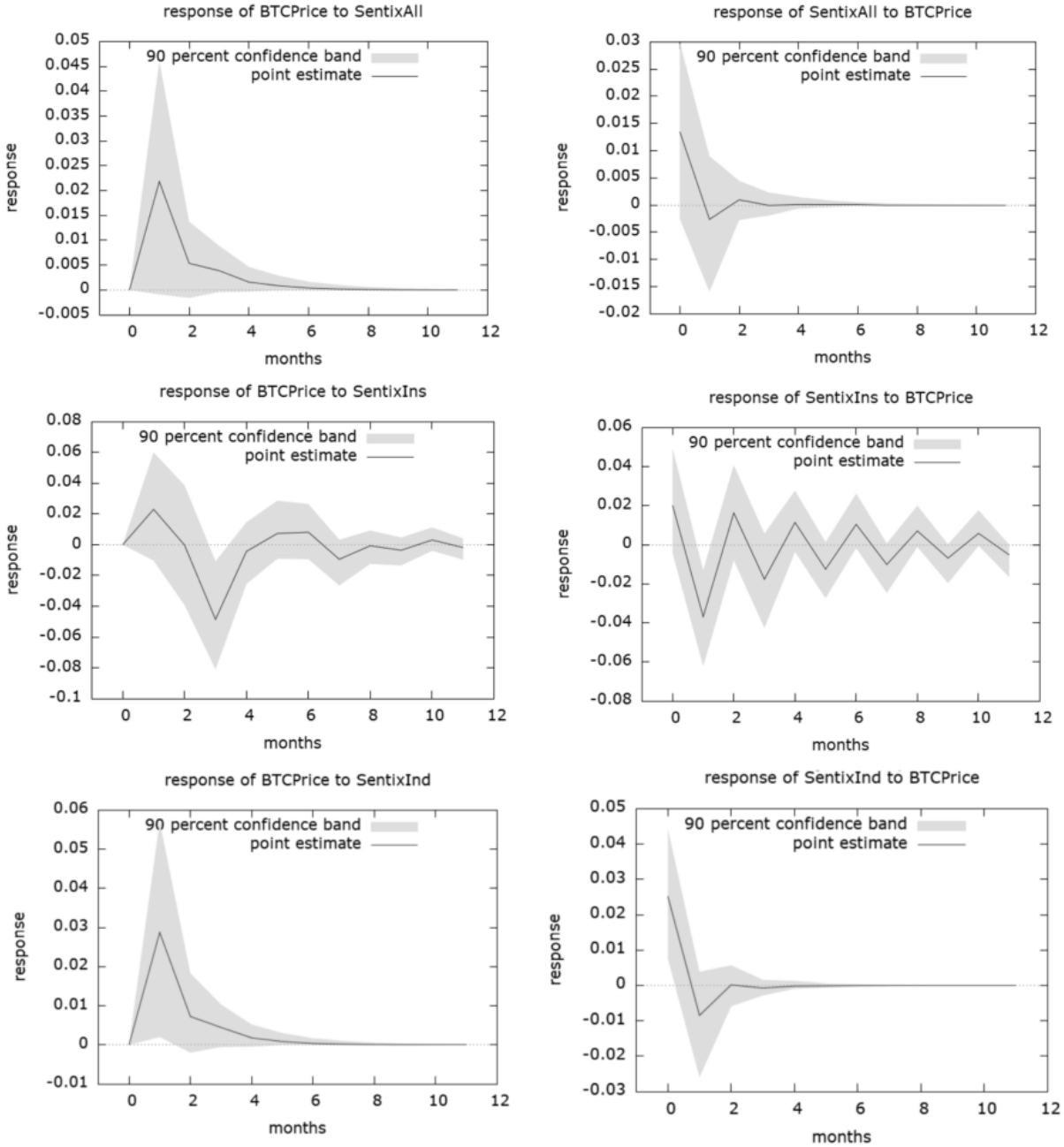
We summarized results using impulse response functions (IRF). Since we used logarithmic differences our IRFs show what is the impact of unanticipated 1 % change in one variable (impulse) on another variable (response) over the next several periods. Figure 2 displays

[21] Engle-Granger cointegration test is based on testing residuals from OLS estimation of our variables of interest (BTCPrice and respective sentiment measure) for stationarity using well known ADF test (Dickey & Fuller, 1979). If we reject the null then there is no unit root and the series are cointegrated (even though both series are integrated of order 1, there is a linear relationship that is integrated of order 0).

[22] In both studied pair: *BTCPrice – SentixAll* and *BTCPrice – SentixInd* we detected the same outlying observations: February 2014, September 2017, October 2017 and January 2018.

the expected level of a shock surrounded by 90 % confidence interval (low estimate and high estimate) in 12 month timeframe.

Figure 2 Impulse Response Functions for Logarithmic BTCPrice and Logarithmic Sentiment Measures



Source: Author's computation

The first studied pair show significant results only in direction from *SentixAll* to *BTCPrice* and up to the first period: 1 % shock in overall sentiment of investors causes immediate 2.2 % reaction of Bitcoin price and this reaction lowered to 0.4 % in the next period (the first period). Causality in opposite direction was not proved significant. Similar results follow from our third model: 1 % shock in sentiment of individual investors propagated immediately to 2.8 % increase of BTC prices. This reaction decreased to 0.7 % in the subsequent month and the reaction vanished completely afterwards. Response of *SentixInd,* similarly to *SentixAll,* to shocks in Bitcoin price was not significantly different from zero at 10 % confidence interval (see *response of SentixAllto BTCPrice* and *response of SentixInd to BTCPrice* in Figure 2).

Lastly, we studied dynamics of institutional sentiment and Bitcoin prices. We found significant impulse response relationship in direction from sentiment to Bitcoin price in the third period. Namely, 1 % shock in institutional sentiment caused decline in Bitcoin prices by 4.8 % after three months. The effect of sentiment in the first two months as well as in periods after third month were not significantly different from zero at 10 % confidence interval (see *response of BTCPrice to SentixIns* in Figure 2). Causality in opposite direction, from Bitcoin price to sentiment, was compared to previous two pairs found significant in the first month after the change. This means that 1 % increase in Bitcoin price triggers negative response of institutional investors by almost 3.6 % in the first period. Moreover, graph which captures impulse response function for *BTCPrice – SentixIns* pair seems to have longer memory than the other two examined pairs.

4 Conclusions

This paper studied the dynamic relation between Bitcoin price and investor sentiment towards this currency as measured by company sentix. We are the first who employed this unique dataset in analysis of Bitcoin prices and we are the first authors who attempted to estimate the effect of individual and institutional sentiment separately. We built three vector autoregressive (VAR) models, each to estimate dynamics between one of our sentiment measures and price of Bitcoin.

To sum up, our analysis showed that investors' beliefs as measured by sentix Bitcoin Sentiment do affect the price of cryptocurrency. Interestingly, there is a difference between effect of individual and institutional investors' sentiment. On the one hand, increased sentiment of individual investors towards Bitcoin increases price of this popular cryptocurrency immediately and the response of prices is weaker but still remains positive also in subsequent month. This result is intuitive as it is quite easy for any individual investor to join the bandwagon – everybody can start trading at the dedicated exchanges within a few days after registration and one does not need to have large capital to start investing. Therefore, once there is increasing sentiment about Bitcoin, investors can easily act on this sentiment as it was information and their increased preference towards Bitcoins then shifts the prices up. In other words, individual investors might be considered as noise traders (Kyle, 1985; Black, 1986) who when got overly optimistic, push prices above their intrinsic values. The opposite causality, which would mean that increasing Bitcoin price positively affects individual investors' beliefs about the currency, was not shown.

On the other hand, when institutional sentiment rises, Bitcoin prices tend to response by subsequent decrease three months after the change. This result is not straightforward. The possible explanation might be the fact that institutions are more rigid when they form their perceptions about new technology. As a result, their optimism might come too late – just before the prices would start falling. Alternatively, individual investors might fear they lose high margins once big institutions join the Bitcoin market. Therefore, they lower their sentiment toward Bitcoins which would subsequently cause adverse price shifts. Reaction of institutional preferences towards Bitcoin to changes in currency price were shown to be negative in the first period after the change. This could be interpreted by firms' skepticism about cryptocurrencies and their fear that sharp increases would be followed by rapid loses as it was observed in the past.

There are several recommendations for future research. First of all, a larger dataset should be used in order to check validity of results. Secondly, other sentiment measures and possibly other fundamental variables could be added to improve the model fit.

Acknowledgments

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The Current Problems of the Eurozone and the Future Transformation of the European Union

Oldřich Rejnuš

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 601 00 Brno, Czech Republic
E-mail: rejnus@econ.muni.cz

Abstract: *The paper deals with the problems of contemporary management of the European Union, with focus on economic development of countries, associated in the European Economic and Monetary Union, using common currency. Its goal is to evaluate the ways of fiscal management of the European Union and monetary regulation, carried out by the European Central Bank, with focus on their efficiency and achievements. As there are, apart from economic problems, a number of other problem zones, directly or indirectly connected with analyzed economic problems, they are briefly specified in the paper, too. In conclusion, the influence of current way of management of the European Union on the development of individual states, with special focus on European Economic and Monetary Union states, so called "Eurozone" is evaluated. We are not going to evaluate only economic situation of individual countries; we want to assess a number of other factors, interconnected with economic development and significantly influencing compactness of European Union countries.*

Keywords: European Union, Eurozone, fiscal and monetary regulation, central banks

JEL codes: E58, F36, G15, G18, O11

1 Introduction

With regard to „Brexit", which has already been under way, as well as with strengthening expectations of EU disintegration, a number of serious topics on the future of Europe arose. These are really serious topics, related to a number of troubled fields. In agreement with an opinion of former US Secretary of State, Henry Kissinger, who said in 1974, that: *„who controls money can control the world"* (Engdahl 2016) it is clear that one of the most important topics, connected with the future of Europe, is, before all, its economic future. This is tightly connected with the effort of individual countries, corporations or individuals to gain strong control and acquire wealth. This is why the economic future of Europe is tightly connected with issues of preservation of individual European countries, as well as preservation or possible loss of national identity of traditional European population.

2 Methodologies and Data

When speaking about the development of the European Union, special focus must be given to the problems of the currency union (monetary union), or Eurozone. The reason is that the European Union is not a single entity; it is economic community of many countries, setting up currency union, so called "Eurozone" little by little. Currently, the members of the currency union are Belgium, Estonia, Finland, France, Ireland, Italy, Cyprus, Luxembourg, Latvia, Lithuania, Malta, Germany, Netherlands, Portugal, Austria, Greece, Slovenia, Slovakia and Spain. Functionality, or malfunction of this system, based on the principle of single currency, has decisive influence on the development of the European Union as a whole.

Current problems of the European Union have grown into such dimensions that the founder, Euro creator and the very first senior economist of the European Central Bank (ECB), Otmar Issing, said: *„the euro is a ticking time bomb which will soon blow up and wipe out the whole EU project*". This is why we are going to analyze, before all, the reasons of contemporary economic decay of the European Union, with main focus to the role of the Eurozone.

The methodology used represents a combination of qualitative and quantitative analysis. Qualitative part of the research will be represented by economic theory findings; we are going to analyze whether basic theoretical rules and principles are met in the process of European Union management. Before all, it is important whether they are abode by the European Union authorities and the governments of individual European states in their fiscal policies and the European Central Bank in its monetary policy. As far as interest rates are concerned, principles *„Classical theory of interest rates*", *„The loanable funds theory*", and *„The rational expectations theory of interest rates*" will be taken into account. When analysing so called „printing money", *„Fischer´s quantity theory of money"* will be considered. Quantitative component (segment, sector) will be based on economic data that will be taken from databases Tradingeconomics, Eurostat, European Central Bank a DebtClocks.eu.

3 Results and Discussion

There are lots of economic problems in contemporary Europe, mainly in the Eurozone. Several of them have overgrown into dimensions that threaten the heart of Eurozone existence, and consequently the whole European Union.

Extreme indebtedness of many EU countries, especially Eurozone members

European Union was established in February 1992, when the Maastricht Treaty was signed. At the same time, so called „convergence criteria" were adopted; meeting them was assumed to be obligatory for the monetary union members and institutional form of the Eurozone was conceived, with newly established European Central Bank (ECB); its primary task was to care of price stability. Subsequently, on January 1st, 1999, cashless Euro was introduced in the first 11 countries, while banknotes and coins were introduced three years later, on January 1st, 2002.

As the European Union founders were aware of the fact that common currency adoption would result in loss of possibility of the member states to perform their own monetary policy, they were concerned about the possibility of high deficit of public budgets in economically weaker countries. This was why EU member states adopted mechanism „Stability and growth pact" (SGP) in 1997; this pact was supposed to prevent fiscal indiscipline. Beside other things, it stated with binding effect that meeting budgetary targets must be balanced and states that will not meet this requirement will have to undergo „Excessive deficit procedure" which might result in financial sanctions. On the other hand, the problems of financial crises solutions were not dealt with. It did not deal with the possibility of helping countries that might get into insolvency or possibly decide to leave the Eurozone.

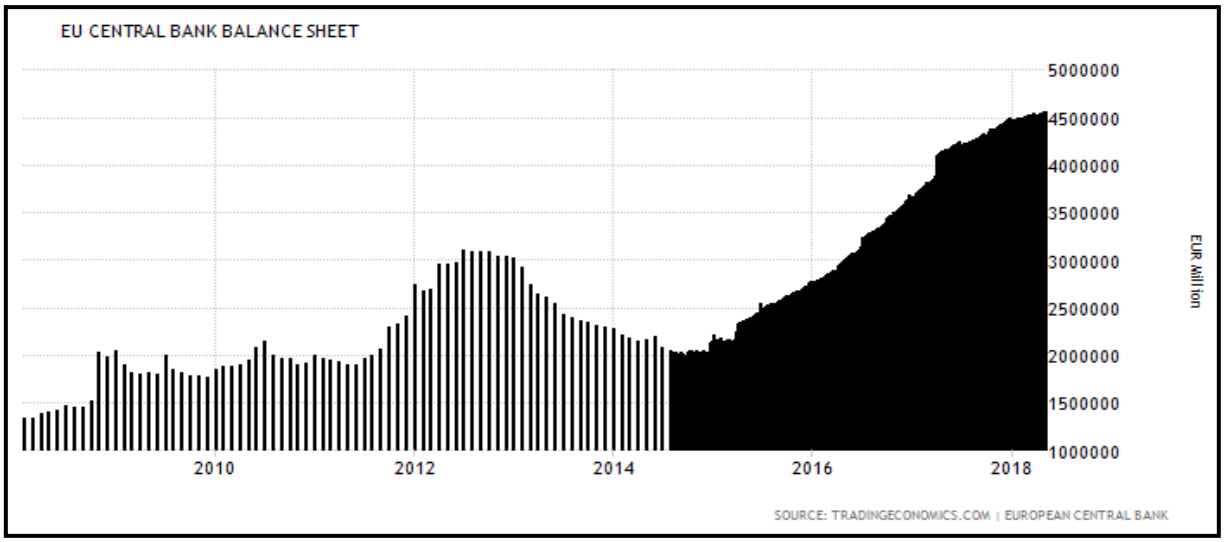
The prerequisite that the Eurozone membership would lead to discipline of economic policies proved to be wrong; in 2002, when the European Commission suggested to penalize France and Germany for their immoderate deficits, these two strongest European countries not only persuaded the authorities that they would not pay any sanctions, but, on top of that, they persuaded them to „soften" original principles. This led to gradual indebting of a number of Eurozone countries and resulted in current catastrophic situation, described in 2016 by the founder of EU and Euro creator Otmar Issing as follows: *„The Stability and Growth Pact has more or less failed. Market discipline is done away with by ECB interventions. So there is no fiscal control mechanism from markets or politics. This has all the elements to bring disaster for monetary union*" (Gutteridge 2016).

Danger for the functionality of European bank system

Nowadays, in connection with extreme indebtedness of many European countries, issues connected with possible Eurozone bank system breakdown, bank systems of Italy and Greece respectively, are discussed more and more often, where there are problems in many other countries, too. In view of this, we would like to know what the European Central Bank has been doing all the time and how it responded to this situation.

After the outbreak of financial crisis in 2008, the bank released its monetary policy (which was correct) and provided banks with very cheap and almost unrestricted amount of money; it resulted, according to Sulík (2012), to non-systematic management of European bank system. Concrete examples of ECB practice can be seen in gradual decrease of required warranties when purchasing bonds (debentures) from commercial banks up to debentures without investment rating, permission to „print money" by Eurozone national banks, legally unauthorized purchasing of treasury bonds of Eurozone countries, enabling banks to create Asset Backed Securities (ABS) and subsequently to accept them as warranties and later even to possibility to purchase them. And it also does „Quantitative Easing" (QE), based on intensive purchase of state and corporate bonds, the quality of which is often substandard, from commercial banks. This means nothing less but extreme „printing of money" (which definitely means breach of theoretic rules, namely *Fischer´s quantity theory of money*). This fact is proved in following picture; the development of ECB balance for the last ten years is shown, the value of which exceeded 4.55 trillion EURO in May 2018.

Figure 1 The Development of European Central Bank Balance Sheet in the Last Ten Years



Source: Tradingeconomics.com

In connection with the use of this nonstandard tool of monetary policy, topped up with extreme decrease of interest rates, it is necessary to evaluate its efficiency, which seems to be problematic; it can be seen in following Table 1.

Table 1 The Current Development of GDP and Indebtedness within "Eurozone"

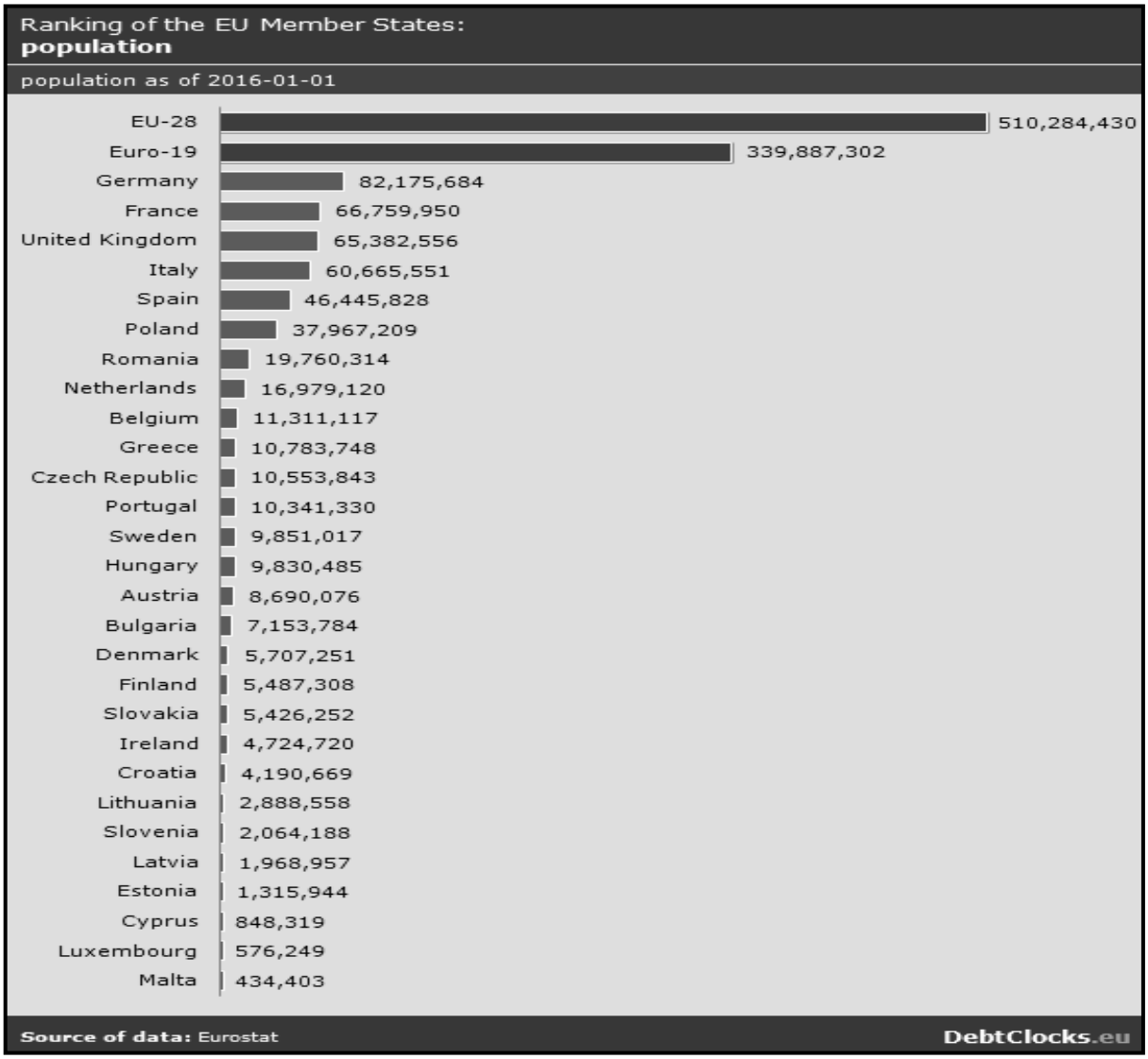
Absolute nominal GDP p.a.	11 277 billion EURO
Absolute amount of public debt	10 009 billion EURO
Public debt to GDP ratio	88.8 %
Change of absolute nominal GDP p.a. (+/−) per second	+ 11 053 EURO
Change of public debt (+/−) per second	+ 4 195 EURO

Source: DebtClocks.eu (May 2018)

Above mentioned Table shows that the GDP of the Eurozone has been growing; at the same time absolute amount of public debt has been increasing. As far as rather decreasing relative measure of public debt towards GDP is concerned, it is rather unstable and in case of possible decrease of GDP will grow fast. It follows that the realization of very intensive QE and extremely low interest rates by ECB only keep economy of the Eurozone moving and postpones solutions of growing problems towards the future.

Within the framework of the analysis, it is necessary to take into account the size and importance of individual countries.

Figure 2 Ranking of EU States and Eurozone States According to Their Number of Inhabitants



Source: Eurostat and DebtClocks.eu

Above mentioned picture shows that after „Brexit", the most influential countries, from the point of view of the number of inhabitants, are Germany, France, Italy and Spain. These four countries have 256 million inhabitants, which means almost three fourths or 75 % from the total number of 340 million inhabitants in the Eurozone. This predetermines, which states influence the Eurozone the most, both in political and economic field.

What was the economic development of these four most important Eurozone countries in the last years, is in the time of extremely expansive ECB policy, and how is the Eurozone economy, or the economy of the whole EU influenced? Following table 2 shows the development of their GDP and their indebtedness in the last three years, compared with the development of the whole Eurozone or the EU, respectively. It is clear that three of these four most important Eurozone countries – France, Italy and Spain, have been in long term economic problems. This is proved by their very slow economic growth (given in common prices) accompanied (with the exception of Germany) with constantly growing public debt.

Table 2 The Development of GDP and Indebtedness in the Eurozone, Germany, France, Italy and Spain in 2008 and 2016 – 2017.

GEO	INDICATOR	YEAR 2008	YEAR 2016	YEAR 2017
Eurozone 19 countries	GDP/1	9 636 073	10 790 077	11 168 630
	DEBT/2	6 610 346	9 601 612	9 685 501
	DEBT/3	68,6 %	89,0 %	86,7 %
Germany	GDP/1	2 561 740	3 144 050	3 263 350
	DEBT/2	1 669 035	2 145 473	2 092 643
	DEBT/3	65,2 %	68,2 %	64,1 %
France	GDP/1	1 995 850	2 228 857	2 287 603
	DEBT/2	1 370 326	2 152 523	2 218 436
	DEBT/3	68,8 %	96,6 %	97,0 %
Italy	GDP/1	1 632 151	1 680 948	1 716 935
	DEBT/2	1 671 401	2 219 546	2 263 056
	DEBT/3	102,4 %	132,0 %	131,8 %
Spain	GDP/1	1 116 225	1 118 522	1 163 662
	DEBT/2	440 621	1 107 220	1 144 298
	DEBT/3	39,5 %	99,0 %	98,3 %

Source: Eurostat

GDP/1 – GDP at market (current) prices [millions EURO]
DEBT/2 – Consolidated gross debt of general government [millions EURO]
DEBT/3 – General government gross debt in percentage of GDP

The fact that economic situation of France, Italy and Spain is exceptionally serious is evidenced by other macroeconomic data, especially the unemployment rate, surpluses or deficits of their state budgets, and the yield of their state bonds (debentures) – in this particular case ten years obligations.

Table 3 Selected Macroeconomic Indicators of the Most Important Eurozone Countries

COUNTRIES	Jobless rate	Budget surplus/deficit in percent of GDP	Budget surplus/deficit in percent of government revenue	Government bond 10Y yield
	[March 2018]	[2017]	[2017]	[May 30, 2018]
	[1]	[2]	[3]	[4]
Eurozone	8,50 %	−0,9 %	−1,9 %	−0,36 % p.a.
Germany	3,40 %	+1,3 %	+6,7 %	+0,37 % p.a.
France	8,90 %	−2,6 %	−4,8 %	+0,69 % p.a.
Italy	11,00 %	−2,3 %	−5,0 %	+2,92 % p.a.
Spain	16,75 %	−3,1 %	−8,2 %	+1,53 % p.a.

Source: Tradingeconomics, Eurostat

As we can see, the data from chart 3 make previous original conclusion even deeper. The first indicator shows huge problems Spain, Italy and France have been experiencing with unemployment. In case of Spain the value is so extremely high that it clearly contradicts frequent purpose built statements of politicians, who say that Spain has just bounced from the bottom". The second indicator evidences both surpluses and deficits of state budgets in 2017 towards GDP. Their size shows that Spain and France still do not follow valid EU rules. When the deficits of their state budgets compare with the size of state revenues (the third indicator), it is obvious that this is a difficult problem. The fourth indicator shows artificially decreased return of state bonds (debentures) that is artificially decreased by ECB. As far as negative

return of Eurozone bonds, emitted by the European Financial Stability Facility (EFSF) is concerned, it can be considered to be absurdity, contradicting not only economic rules, but all above mentioned interest theories.

EU system of rescue measures

There are two so called „EU rescue measures" - „European Stability Mechanism" (ESM) and „Banking Union" (Rejnuš 2016). ESM is an institution, performing the function of rescue fund of financial help for countries paying with Euro, where Eurozone member states are obliged to pay any fund requirement that is raised towards them. As far as „Banking union" is concerned, its goal is to solve important financial problems of the Eurozone „together" and based on solidarity, while applying the rules of single bank regulation, single bank uniform bank supervision and single system of deposit insurgence. Firstly, its goal is to promote the principle of self-help (bail-in) towards only essential involvement of public resources into bank restructuring, while costs of their recovery should be preferably shared by their shareholders and creditors. Secondly, responsibility for results of bank supervision should be moved to the EU level; sufficient financial capacities for financial rehabilitation of banks have to be created.

It is clear that this system denies fair solution of financial problems of individual Eurozone countries and forces responsible countries to donate or even rescue countries that are irresponsible; for example, in case of possible bankruptcy of Italy, the Eurozone would not be rescued, anyway. We can expect that the inhabitants of those European countries at whose expense the reallocation would be done (including Germany) would show massive dissatisfaction; this would result in the termination of the Eurozone.

Export dominancy of Germany

As a result of single European currency, economically strongest Germany is more and more competitive, when speaking about prices; as a result, the deficits of current accounts of south European countries, are more and more balanced by surpluses of current accounts of Germany (Singer 2012). George Friedmaman says that in the last fifteen years, Germany eliminated their competitors in other Eurozone countries and became an export power with the highest surplus since unification of Germany. (Dubnová 2016). German policy is focused on export and it creates growth of imbalance across Eurozone. When it entered the Eurozone, Germany managed to gain markets even in economically risky countries such as Portugal, Ireland, Italy, Greece, Spain etc. But it is necessary to pay for products and services and when the economy is in crisis, it results into debts and the debt wheels start to turn around. Jan Beňák describes it as follows: a car is made in Germany, it is bought by Spain; Spain does not have money and this is why they make a loan. Germany exported a car and got money and as a result was able to provide a loan to Spain. But it is not possible to suck from neighbouring countries over and over again. According to Friedman, the markets where Germany exports are getting smaller. Unless Germany has enough revenues from export, it will not be able to lend money to other countries; subsequently, these countries will not be able to buy goods from them. It means that other countries will not be able to buy German goods unless Germany voluntarily slows down their export. Germany will not slow down their exports, as this would lead to unemployment. This shows a major problem in Europe, the victim of which is, for example, Italy. Their banking system has started to collapse (Lišková 2017) due to the indebtedness of the country and due to importunity of bank loans. (This is the case of other Eurozone countries, too). And Germany will have to support Italy, as its bankruptcy would result in breakdown of the whole Eurozone.

Subsidy mechanism of the EU

All EU member countries are obliged to pay money into EU budget; the money is subsequently administratively divided and sent back to individual states in the form of „EU funding". In fact, the citizens pay taxes, part of which is paid to the European Union. This money is „redistributed" and individual member countries can „ask to receive them back" with the condition the money will be used to support exactly given project approved by the European Union. (It means that instead of a scooter, the parents would buy for their child,

their town will have a waterpark and the parents involuntarily contributed to it.) This is the way how things, sometimes various sorts of „rubbish" are funded; things that were decided „on higher level". Moreover, EU funds never pay the whole project, the countries always have to pay the rest. The worst thing is the fact that the system of EU funding is practically indestructible, as a huge number of officers depend on it. Eliminating this system would probably result in the collapse of the whole European Union system.

Existence of European tax paradises

According to non-governmental organization Oxfam International (2016) four of fifteen the most harmful tax paradises are in the EU. These include Netherlands (3rd), Ireland (6th), Luxembourg (7th) and Cyprus (10th). This list is based on the measure to which individual countries apply zero company tax, do not cooperate in the fight against tax evasion, are non-transparent, how often unfair tax incentives that do not create new job opportunities are applied. The above mentioned status evidences hidden activity of a number of European politicians who spend money of „European tax payers" to covertly support their home countries.

4 Conclusions

It has been commonly proven that the main problem of the Eurozone is based in its heterogeneity, in forced connection of economically weak countries with the strong ones, that can, as we have already mentioned, break European Union valid rules almost without punishment, while small countries cannot do the same. Before all, common currency is in crisis. The reason is that single currency policy resulted in distinctive deepening of difference between the countries in the southern wing and the core EU countries, so that the survival of the Eurozone depends solely on „crisis" measures, made by ECB; these include non-standard loans, fiscal transfers and „political solidarity" of the European states. The common Schengen Area has been collapsing, too. According to Janáček and Janáčková (2017), these two pillars were to foreshadow a way from economic and monetary union to political union; as they are currently weakening, they are becoming the "accelerator of the European Union disintegration".

The European Union, originally intended to be an expedient alliance of cooperation of independent European countries, turned into extraordinarily complicated bureaucratic system, dominated by big countries. Meaningless bureaucratic decisions, incompetence, enforcing one's own interests and arrogance of EU leading representatives, disputes between individual countries, long-term wrong and goal-directed policy of ECB and enforced single currency resulted to contemporary crisis that might turn into collapse. The problem is not solely based on stagnating economy, but, before all, in extremely high indebtedness of the whole union, mainly of the most important Eurozone countries; it has already reached such dimensions that it cannot be solved by standard economic tools. It means that the persistence of the Eurozone is becoming more and more dependent crisis measures of the European Central Bank and on enforced „political and economic solidarity" among European countries. There are further risk factors, e.g. extreme growth of questionable legislation and its common ignorance, corruption and systematically meaningless system of subsidies, further meaningless growth of the European Union and non-regulated migration, bringing not only problems with the immigrants, but with some ethnic groups, too (before all with Muslims). And last but not least, there is growth of elitism and restricting of democracy for traditional Europeans, who are quite poor in some countries. In 2016, a study was performed by ECB in 84 000 European households; according to it, ten per cent of the richest households in the Eurozone owned possessions bigger than 496 000 EURO. Families in Luxemburg are the richest, with median of their income reaching 437 500 EURO, while in Lithuania, the median is only 14 200 EURO (Aktuálně.cz 2016).

In conclusion, we can say that due to unusual number of crisis factors, there are many reasons that might initiate serious economic, social, political, ethnical, religious or other shocks. The level of confidence in EU is historically the lowest and there is a possibility that other countries might decide to leave it as well as threat of its decay (disintegration) and

chaos, which may lead to the end of the existence of national states and the end of democracy (Klaus 2012).

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Comparative Analysis of Financing Sources in Domestic and Foreign Enterprises in Poland

Jerzy Różański

University of Lodz
Faculty of Management
Department of Finance and Strategic Management
Matejki 22/26, 90-237 Łódź, Poland
E-mail: jerzy.rozanski@uni.lodz.pl

***Abstract**: Scope of activity of domestic enterprises and foreign enterprises is different. The foreign enterprises act in more than only one country and that is why they have specific capital structure and specific sources of financing. It confirms polish and international literature. The aim of this article is to compare sources of financing in domestic and foreign small and medium enterprises in Poland. The point is whether the differences between the structure of the financing sources of enterprises operating on an international scale and enterprises operating only within the borders of one country give the first group of enterprises a competitive advantage over the latter. The research was conducted in years 2008-2017 in 300 branches of international enterprises in Poland and in 300 domestic enterprises, using documents prepared by enterprises and questionnaire of inquiry. The research procedure was as follows. After a random selection of enterprises (stratified random sampling with division into small and medium enterprises) and collecting basic data on the selected enterprises from the register of enterprises, a specialized unit dealing with interviews and surveys of enterprises was engaged. Next, employees of this unit met with the managers appointed by the management board of the selected companies and helped them to complete the questionnaire prepared by the author in each company's headquarters. This resulted in 100% of responses in the selected companies that were representatives of the larger group. The empirical findings suggest the differences between sources of financing. The average, in this period, foreign enterprises used mainly two basic sources of financing bank credit and funds created by mother enterprise. They took into account financing by retained profit and venture-capital funds. Two main sources of financing in domestic enterprises, the most popular were bank credit and leasing. So we noticed some typical differences. First of all, branches of foreign enterprises very seldom use leasing as a source of financing, in contrast, in polish enterprises this form is very popular. Secondly, additional support for these branches is financing by mother – enterprises – it gives possibilities of faster development and more flexible financing position of their enterprises in host country. Finally the foreign enterprises prefer using alternative sources of financing, rather than traditional ones.*

Keywords: financing sources, domestic and foreign enterprises, parent company, daughter company, criteria for financing sources

JEL code: F20, F21, F23, F30, F65

1 Introduction

There are significant differences between enterprises operating within one country and those running their activity internationally. They concern not only the organizational structure, which in the case of enterprises operating internationally must anticipate the presence of the enterprise's headquarters in the home country (mother company) and the functioning of company branches in the host countries. It also involves more multifactorial systems of mutual financing of individual units included in such an organizationally complex enterprise. Admittedly, enterprises operating on one national market may take various forms as well, for example, a multi-plant enterprise, and the flow of funds between individual plants, often located in different regions of the country, can be quite complicated, but the scale of problems related to financial flows in an enterprise operating internationally is much more profound.The aim of the article is to compare sources of financing in domestic enterprises and branches of foreign small and medium enterprises in Poland. The point is

whether the differences between the structure of financing sources of enterprises operating on an international scale and enterprises operating only within the borders of one country give the first group of enterprises a competitive advantage over the latter.

2 Theoretical bases for financing enterprises operating nationally and internationally

The differences between financing an enterprise operating on the domestic market and enterprises functioning on the international market are noticed in the literature on the subject. A. Duliniec states that "in enterprises operating within the international corporation, there is a much greater diversity of forms and places (markets) in terms of obtaining financing compared to enterprises operating independently (without capital ties with other companies in the country and abroad). Diversification of financing sources on an international scale allows not only for the selection of the cheapest sources and forms of financing, but also for the reduction of currency risk, which inevitably accompanies financing with debt denominated in foreign currencies" (Duliniec, 2007, pp. 161-162).

The international nature of the company's activity means that capital providers are more willing to involve their resources in financing the current and development activities of such an enterprise. While operating in different countries, such an enterprise has a better chance of choosing sources of financing that are not only characterized by low costs of raising capital, but are also more easily available, and the procedures related to obtaining them are as simple as possible.

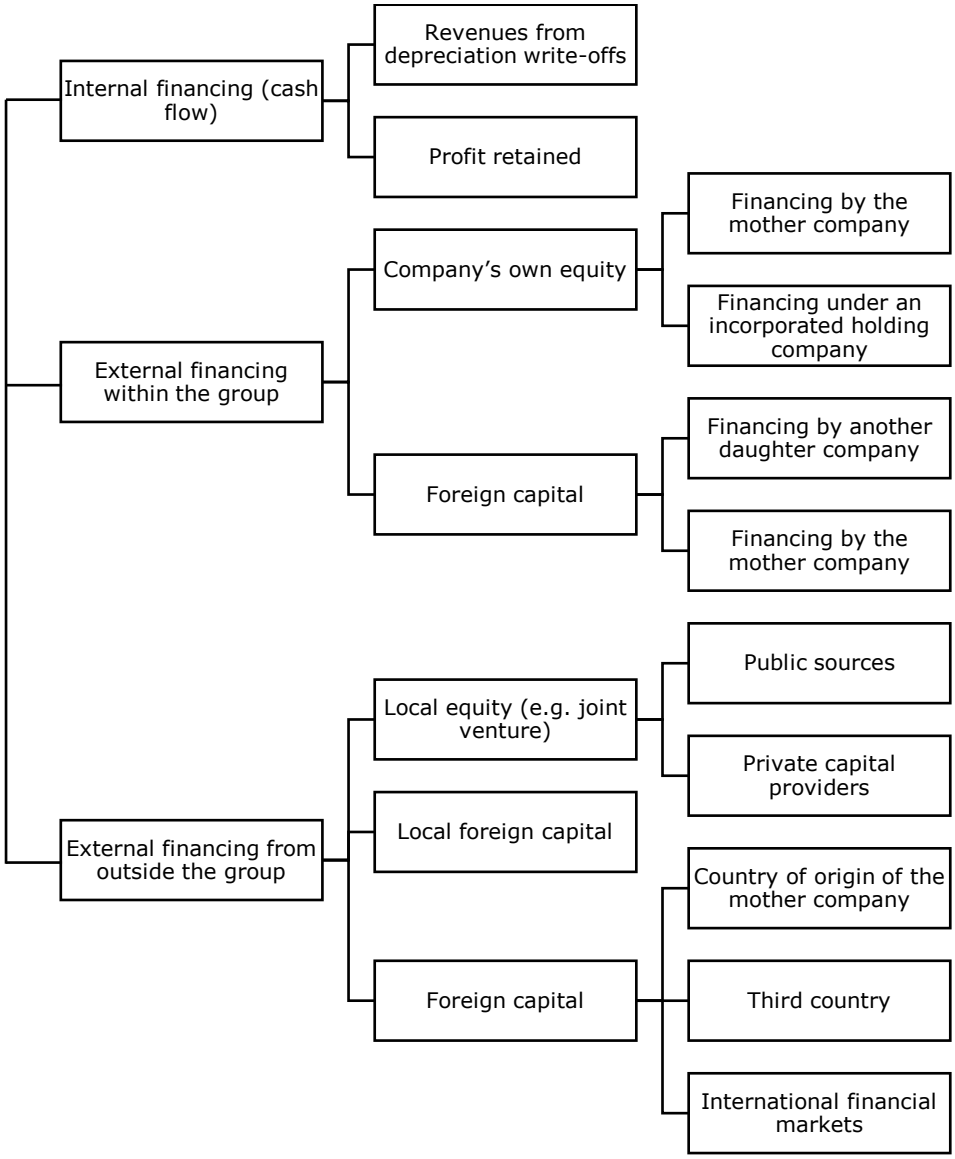
Naturally, an international company must also be vary of the possibility of occurrence of certain dangers that may be associated with the use of financing by capital providers from different countries, often with a different legal or tax system, or with high interest rate changeability in such countries.

It also needs to consider the possibility of money transfer problems occurring between host countries and the home country, and between individual host countries.

In the literature on the subject the greatest attention is paid to the financial flows occurring on the line the parent company - the daughter company, and the specificity of financing the daughter company as a subsidiary in relation to the parent company.

Two models of financing branches of international enterprises were presented in a similar time by M. Perlitz (2000) and L. Kruschwitz (1999).

Figure 1 The Perlitz's Model



Source: M. Perlitz, "Internationales Management", Lucius and Lucius, Stuttgart 2000, p. 509

The Perlitz's Model shows that alongside the classic forms of financing such as:

- internal financing;
- external financing, using foreign capital,

there is also financing, which M. Perlitz called "external financing included within the group." It refers to the financing of branches, which is launched (from the company's own or foreign funds) by the parent company for subsidiary companies grouped in an international enterprise.

An enterprise operating in one country does not have such possibilities. It must use domestic sources of financing. There are, of course, possibilities of transferring money between individual plants in a multi-plant enterprise, as well as financial transfers within the created capital groups. However, the possibilities of controlling capital flows are incomparably smaller than in an international enterprise, which has the capability of using mutual financing of its units within the whole enterprise and also has better access to international capital markets and the international banking system. Also L. Kruschwitz (Kruschwitz 1999, p. 524) highlights the diversity of sources of financing at the disposal of an enterprise operating internationally.

Most often, the analyses of the advantages and disadvantages associated with financing an enterprise operating internationally list the following benefits (Block and Hirt, 1992, pp. 644-646):

- more chances of raising capital, which is associated with a greater variety of ways to finance the company;
- opportunity to find cheaper sources of raising capital;
- possibility of flexible financing within an international enterprise (flow of shares and loans from one company to another);
- stronger bargaining position of the companies (the entire group is responsible for the financial and loan credibility of the companies).

The disadvantages associated with financing enterprises operating internationally include:

the need, occurring sometimes, to finance the activity with foreign capital offered on local money and capital markets, with high volatility of these markets …;

occurrence of additional costs related to raising capital (transfer costs, currency exchange costs, increased capital commissions);

the dangers connected with cooperation with a local enterprise with which a joint-venture has been established.

Therefore, for enterprises operating internationally, the economic, social and political stabilization of the countries in which they invest is of fundamental importance. The lack of such stabilization makes it very difficult for these enterprises to operate effectively. Unfortunately, domestic enterprises do not have the choice regarding the investment location and they need to operate in their country, regardless of its economic and social situation. A foreign investor, though, can always transfer the business to a country where there are better operating conditions than in another host country.

3 Results of research on the financing of foreign and domestic enterprises in Poland

The research was conducted in a group of 300 foreign enterprises that have their branches in Poland and 300 enterprises, which are domestic companies operating only on the Polish market.

In order to ensure comparability of these two groups of enterprises, stratified random sampling was applied, taking into account two factors:

- size of the enterprise,
- sector of the economy in which the enterprise operates.

The random nature of the selection of companies for research ensured the representativeness of the results of this study.

A questionnaire survey on the sources of financing of foreign enterprises operating in the Łódź region, launched in 2008, included 300 foreign enterprises (their branches). The method of random sampling was used. The largest group were micro-enterprises - employing up to 9 people (117 enterprises) - 38.9% of all companies surveyed, following that were small enterprises - employing from 10 to 49 people which accounted for 32.2% of all enterprises, next were medium enterprises (from 50 to 249 people employed) that accounted for 18.9% of the respondents, and large companies with 250 and more employees - which made only 8% of the total sample. In the majority of cases these were enterprises either with 100% of foreign capital (51%) or in which the greatest share of capital was of foreign origin (29.9%). Only 17% of enterprises had a share of foreign capital below 50%. This was related to the next characteristic of these enterprises. Namely, about 80% of the surveyed foreign enterprises in Poland were established as a new business entity built from scratch (greenfield), and only 8.10% of the surveyed enterprises were established as a result of taking over a local enterprise (brownfield). 9.1% of enterprises were established as a joint-venture company of foreign capital with a local entrepreneur.

Hence, the overwhelming predominance of foreign capital in the companies created in Poland was revealed. The research concerned the funding associated with the formation of subsidiaries in the host country and the financing of the already existing foreign companies in Poland.

The paper will discuss the second case. The research also included preferences related to financing, which were explored in the surveys. The results of the research are presented in Table 1.

Table 1 Sources of Financing of a Foreign Enterprise (% of responses)

SPECIFICATION	I PLACE	II PLACE	III PLACE
Bank loan - bank in the home country	24.9	0.7	-
Bank loan - bank in the host country	10.0	3.3	-
Bank loan - third-country bank	1.0	-	0.2
Investment funds created by the parent company	32.6	6.6	-
Foreign investment funds	3.3	1.0	0.7
Profit retained	16.6	13.0	3.4
Depreciation write-offs	0.3	3.3	1.0
Sale of unnecessary assets	1.7	1.3	-
Issue of shares	0.3	0.3	-
Other	7.6	-	-

Source: Author's own study based on surveys

According to the survey results, the most common source of financing subsidiaries were special funds created by the parent company and bank loans. It is noteworthy that regardless of when a branch was established (and the research showed that most of the branches had already had several years of activity in Poland), the banks located in the home country (mother companies) enjoyed the greatest trust, and the banks operating in the host country were used as the second option. Loans using the capital from third-country banks were rare. On the other hand, retained profit, significantly lower depreciation write-offs and the sale of unnecessary assets were of great importance.

The use of share issues as a source of capital was sporadic. However, foreign investment funds were used as the source of external financing, usually in the form of venture capital funds.

The financial support of the subsidiary by the parent company is a factor that is very important for the financing of branch development and its competitiveness. The scale of this support poses a threat to domestic enterprises that are potential competitors for a foreign enterprise.

Analogous surveys concerning sources of financing were conducted on a larger group of domestic enterprises operating in the Łódź region. Of this group, 300 were selected for comparison - namely companies of similar size structure to the structure of foreign enterprises.

The following criteria were included in the list of the basic criteria for selecting the financing sources of the company - in the order of importance of these criteria:

- costs of raising capital,
- credibility of financial institutions;
- availability of information about a given source of financing;

- extent of the proposed financing;
- burdensome procedures associated with financing;
- ability to obtain funds quickly.

These considerations resulted in the following sources of enterprise financing being used in the studied group of enterprises, as presented below:

- loans and credits from financial institutions - 51.5% of cases;
- leasing - 50.6% of cases;
- depreciation write-offs - 44.3% of cases;
- retained profit - 37.8% of cases;
- aid programs (subsidies) - 36.4% of cases;
- trade credit - 31.5% of cases;
- additional payments of shareholders - 20.7% of cases;
- financial support of family, friends - 17.7% of cases.

The research results indicate that most often domestic enterprises use credit and leasing as the sources of financing, i.e. foreign sources of financing. A slightly smaller share was that of the internal sources of financing, such as depreciation write-offs and retained profit. Aid funds still play a large role in financing. Since the research involved mainly small and medium enterprises, the participation of such financing sources, for instance additional contributions from partners or loans from family and friends, is quite characteristic.

A specific form of financing is trade credit, which is a hidden form of incentive to deal with the supplier of materials, parts, but also finished products.

Comparing the sources of financing of domestic and foreign enterprises, we see both similarities and differences. In both cases, the most popular source of financing is a bank loan, while foreign enterprises do not use leasing. Internal financing sources play a significant role in both groups of enterprises.

In the case of domestic enterprises, the equivalent of investment funds launched by the parent company for the branch were aid funds, additional contributions of partners, or family support.

The presented research results are not much different from the results of studies carried out in Poland in the years 1999-2002 as part of a project of the Scientific Research Committee.

The research carried out then (with the participation of the author of the article) covered 24 enterprises with foreign capital and 26 domestic enterprises. Statistical data of the State Foreign Investment Agency, the Ministry of Economy and the Central Statistical Office were used, as well as surveys conducted in randomly selected enterprises.

The study showed that internal sources were the basic sources of financing in domestic enterprises:

- retained profit,
- depreciation write-offs,

and among external sources:

- bank credit,
- leasing,
- trade credit.

In enterprises with foreign capital (branches located in Poland), fear of excessive use of equity was evident - hence the vast majority of foreign resources (primarily bank credits). This was connected with worse assessment of the prospects for the development of the Polish economy and, in particular, its stability than in the studies conducted in 2008-2017, when the Polish economy was assessed better.

The results of both surveys confirm the author's opinion that in national enterprises conservatism still prevails in the selection of company's own and foreign sources of financing, while foreign enterprises are more bold in choosing their sources of financing.

The research also showed that small and medium enterprises, regardless of the form of ownership, are characterized by a less diversified capital structure than large enterprises, and this does not change over the years.

4 Summary

The results of the research conducted among foreign and domestic enterprises operating in Poland (on the example of the Łódź region) showed that both kinds of companies use traditional sources of financing, foreign (credit), and their own (retained profit). The domestic companies also used depreciation write-offs. Foreign enterprises used foreign investment funds (mainly venture capital). However, the share of less traditional sources of financing is small.

All this causes that the capital structure of both groups of enterprises is quite limited, which reduces their development opportunities. The research conducted in the group of domestic enterprises indicated several reasons explaining why less traditional sources of financing are not used. The reasons enumerated included:

- too high costs of raising capital;
- lack of knowledge of the given sources of financing;
- too complicated procedures accompanying the acquisition of a given source of financing.

The reasons why such sources of financing as private equity funds, venture capital, business angels, and issue of shares or bonds were not used in foreign enterprises in general or were used to a very small extent could be similar.

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Profitability of Selected Technical Analysis Indicators

Pavla Říhová[1], Milan Svoboda[2]

[1]University of West Bohemia in Pilsen
Faculty of Economics, Department of Economics and Quantitative Methods
Univerzitní 22, 306 14 Plzeň, Czech Republic
divisova@kem.zcu.cz

[2]University of West Bohemia in Pilsen
Faculty of Economics, Department of Economics and Quantitative Methods
Univerzitní 22, 306 14 Plzeň, Czech Republic
svobodm@kem.zcu.cz

Abstract: *This empirical study is another part of our long-term research that deals with stochastic modelling of a short-term share price development. We use Markov Chain Analysis (MCA) to predict the share price development. The principal of this method consists in finding such states in which there is a high probability of changing the tertiary trend. These states are then used to generate buy and sell signals. The aim of this study is to compare the profitability of a business strategy using MCA with varying state space with the selected indicators of technical analysis. The indicators that are often recommended in traders´ articles, i.e. MACD, RSI and OBV, have been selected for this comparison. The basic success rate of individual methods is to overcome the profitability of the Buy & Hold (B&H) passive strategy, profitability of which is calculated as well. The study was performed using historical daily prices (open and close) of the ČEZ´s shares for a period of 12 years; from the beginning of 2006 until the end of 2017 (3 010 trading days). Based on the results of some selected technical indicators it can be stated that none of them outperforms the B&H strategy in the long term, while the models based on MCA are able to outperform the B&H strategy. If we include fees, the trading strategy using the MCA is unprofitable. Only trading based on the RSI would bring a positive appreciation and slightly outperform the B&H strategy.*

Keywords: Markov chain analysis, technical analysis, MACD, OBV, RSI

JEL codes: C53, G17

1 Introduction

A technical analysis (TA) may be one of the approaches used by traders for predicting the future development of share prices, exchange rates or commodities. TA is an extensive set of methods that predict future prices from past prices and trade volumes. Principles and methods of TA are described, for example, by Murphy (1999). The basis of TA can be summarized by the following three theses:

- The share price is determined only by a mutual interaction between supply and demand. Supply and demand are influenced by fundamental and psychological factors.
- Share prices move in trends which are inertial. A trend change is caused by a change of ratio between the selling and buying parties. These trend changes must be identified in time by studying historical prices and trade volumes. Technical analysts distinguish three types of trends. A primary trend which lasts from one year to several years, a secondary trend which lasts for several months and a minor trend which lasts for several days to weeks.
- Development cycles and formations are repeated. It is caused by the nature of human behaviour that tends to react in a similar way under the same circumstances. This fact allows us to predict the future share price development.

TA is based on some scientific theories; however, it is, above all, based on a number of empirical findings. Based on these findings, individual methods are created and their number is practically unlimited. There are many forms of technical analysis which can be divided into 2 main groups:

- Graphical methods that rely on regularly repeated chart patterns. Chart patterns are a valuable part of technical analysis. Based on historical data, analytics have created standardized graphical patterns of share price development. They use them to identify signs of future share price movements.
- Methods based on technical indicators. Indicators represent a statistical approach to technical analysis. These indicators are calculated on the basis of historical market data (price or volume). The role of an indicator is to provide a secondary measure to the actual price movements and reveal the trend change. There are many types of technical indicators. One of the most popular group are methods based on moving averages.

Methods based on the Markov chain analysis (MCA) belong to the neglected group of indicators. The MCA is used very little for a stochastic description of the behaviour of stock markets. The infrequent application of MCA is probably also caused by some studies (Zhang and Zhang, 2009), (Doubleday and Esunge, 2011) and (Vasanthi at al., 2011). The common feature of these studies is the fact that they define the state space very simply. The state space is defined on the basis of the intensity of daily changes and it does not allow for suitable applications. Indicators based on this study were not able to beat the Buy&Hold (B&H) passive strategy. Contrary to the above, the study (Svoboda, 2016) defines the state space on the basis of the intensity of daily cumulative changes in share prices. Indicators based on this approach have managed to overcome the B&H strategy. However, the empirical study (Říhová and Svoboda, 2017) has proved that trading models with the varying state space, calculated as a moving standard deviation, on the average, outperform trading models with the unvarying state space.

The aim of this study is to compare the profitability of a business strategy using MCA with varying state space with the selected indicators of technical analysis. According to traders the frequently recommended indicators, e. g. (Mitchell, 2018) have been selected for this comparison. According to this author, MACD, RSI and OBV rank among the most common indicators. The basic success rate of individual methods is to overcome the profitability of the Buy & Hold (B&H) passive strategy, profitability of which is calculated as well.

2 Methodology and Data

MCA

The MCA indicator (Markov chain analysis) focuses on the estimate of tertiary trend change. The MCA indicator is described for example in (Svoboda, 2016) or (Říhová and Svoboda, 2017). The design of the MCA indicator is based on the assumption that a share price moves in short term trends and during the trend the share price accumulates a certain profit or a loss in relation to the price at the beginning of the trend. The probability of this trend change grows with an increasing accumulated loss or profit. One of eight states is assigned to each trading day based on the accumulated profit or loss. The state when the share price increases (decreases) is labelled G_i (D_i). A general model of the state space is defined by the following principle:

$$D_4: y_t < -3\Delta_t \qquad G_1: 0 \le y_t < 1\Delta_t$$

$$D_3: -3\Delta_t \le y_t < -2\Delta_t \qquad G_2: 1\Delta_t \le y_t < 2\Delta_t$$

$$D_2: -2\Delta_t \le y_t < -1\Delta_t \qquad G_3: 2\Delta_t \le y_t < 3\Delta_t$$

$$D_1: -1\Delta_t \le y_t < 0 \qquad G_4: 3\Delta_t \le y_t$$

where Y_t is a cumulative change of price and is interpreted as short basic indexes of daily closing prices where the basic period is the day of the minor trend change, i.e. the transition from a decrease into a growth or vice versa, y_t is the percentage expression of Y_t and Δ_t is the width of the interval and is calculated as a moving standard deviation of length 20.

The above-mentioned parameters can be calculated according to the following relations:

$$Y_t = Y_{t-1}\frac{P_t}{P_{t-1}} \text{ if } \left(P_{t-2} \le P_{t-1} \le P_{t-1}\right) \text{ or } \left(P_{t-2} \ge P_{t-1} \ge P_{t-1}\right) \text{ else } Y_t = \frac{P_t}{P_{t-1}}, \quad (1)$$

$$y_t = Y_t - 1, \quad (2)$$

$$\Delta_t = \sqrt{\frac{1}{20}\sum_{i=0}^{19}\left(y_i - \bar{y}_t\right)^2}, \quad (3)$$

where P_t is the daily closing price in time *t,* P_{t-1} is the daily closing price in time *t-1* and P_{t-2} is the daily closing price in time *t-2*.

According to Říhová and Svoboda (2017), good results are achieved when trading signals are generated by the following states:

Sell signal: in state G_3 or G_4

Buy signal: in state D_3 or D_4

MACD

Indicator MACD (Moving average convergence divergence) is one of the most used technical indicators. Traders give it the greatest attention. The professional studies, for example (Anghel, 2015), have stated that traders using the MACD could sometimes obtain abnormal profit. This is because markets are mostly inefficient. It is a trend-following indicator that shows the relationship between two exponential moving averages of prices (EMA). EMA is calculated according to the following formula:

$$EMA_{t,M} = \lambda P_t + \left(1-\lambda\right) EMA_{t-1,M}, \quad (4)$$

where $EMA_{t,M}$ represents exponential moving average in time *t* of the length *M*, P_t is the daily closing price in time *t* and λ is a weighting multiplier calculated by the equation $\lambda = 2/\left(M+1\right)$. The initial EMA ($EMA_{t=0}$) is usually a simple moving average of the last *M* share prices, thus from price $P_{t=-1}$ to $P_{t=-M}$.

The MACD is usually calculated by subtracting the 26-day exponential moving average from the 12-day EMA. MACD can subsequently be calculated according to the following formula:

$$MACD_t = EMA_{t,12} - EMA_{t,26} \quad (5)$$

The MACD can be interpreted using three different methods (crossovers, divergence and dramatic rise). The first method (crossovers) is used in this study. It means that it is important when the MACD crosses the signal line, which is usually calculated as 9-day exponential moving average of the MACD line. Signal line can be expressed as follows:

$$SIGNAL_t = EMA(MACD_t)_{t,9} \quad (6)$$

The buy and sell signal is generated when the MACD crosses the signal line. Trading signals are subsequently generated by the following relations:

Sell signal: $MACD_{t-1} > SIGNAL_{t-1}$ and $MACD_t < SIGNAL_t$

Buy signal: $MACD_{t-1} < SIGNAL_{t-1}$ and $MACD_t > SIGNAL_t$

RSI

The RSI indicator (Relative strength index) belongs to the types of indicators that are called leading indicators. There are not many studies dealing with it. As stated for example in (Halilbegovic at al., 2018), the reason for this may be the fact that it is not able to generate a sustainable profit. The indicator moves between zero to 100, plotting recent price gains

versus recent price losses. To calculate it, positive U_t and negative D_t share price changes during the specified time period were used. U_t (up period, gains) and D_t (down period, losses) can be calculated according to the following relations:

$$U_t = P_t - P_{t-1} \text{ if } P_t > P_{t-1} \text{ else } U_t = 0, \tag{7}$$

$$D_t = P_{t-1} - P_t \text{ if } P_t < P_{t-1} \text{ else } \mathrm{D}_t = 0. \tag{8}$$

And the RSI is formally calculated as follows:

$$RSI_t = 100 - \frac{100}{1 + RS_t}, \tag{9}$$

where RS is calculated according to the following relation:

$$RS_t = \frac{\frac{1}{n} \cdot \sum_{i=t-n+1}^{t} U_i}{\frac{1}{n} \cdot \sum_{i=t-n+1}^{t} D_i}. \tag{10}$$

The default time period for comparing up to down periods is 14 (n = 14) and we follow it in this study. The important fact for traders is when the RSI reaches values of 70 and of 30. If the RSI exceeds the value of 70, it indicates that a market is becoming overbought and it is expected that the share price will decrease in a short time. The RSI value below 30 indicates that a market is oversold and the share price will increase in a short time. Trading signals are generated by the following relations:

Sell signal: $RSI_{t-1} < 70 \quad \text{and} \quad RSI_t > 70$

Buy signal: $RSI_{t-1} > 30 \quad \text{and} \quad RSI_t < 30$

OBV

Indicator OBV (On-balance volume) belongs to the indicators that measure positive and negative volume flow. The volume may be represented as a daily total number of traded shares or as a turnover (a number of traded shares multiplied by price). According to (Tsang and Chong, 2009), there are not many empirical studies that are concerned with the profitability of volume-based technical indicators, although business strategies using the OBV can reward investors with notable yields. The OBV value is calculated according to the following relations:

$$\begin{aligned} OBV_t &= OBV_{t-1} + V_t \quad \text{if} \quad P_t > P_{t-1}, \\ OBV_t &= OBV_{t-1} - V_t \quad \text{if} \quad P_t < P_{t-1}, \\ OBV_t &= OBV_{t-1} \quad \text{if} \quad P_t = P_{t-1}, \end{aligned} \tag{11}$$

where OBV_t is the the value of OBV indicator in time t, $V_0 = 0$, V_t is a trading volume in time t (we use the number of traded shares in this study) and P_t is the daily closing price in time t.

The OBV is used to confirm the price trend and look for divergences between the OBV and price to predict price movements. The rising OBV reflects a positive volume pressure that can lead to higher prices, the falling OBV reflects a negative volume pressure that can lead to lower prices. Weaknesses of the increasing (decreasing) trend are signalled by the situation when the growth (decrease) of share price to the new high (low) is not confirmed in the increasing (decreasing) value of the indicator in the same direction. In this situation it is possible to expect a turn in the trend to decreasing (increasing). Literature does not unambiguously mention when the buy and sell signal should be generated. For the

purposes of this study, buy and sell signals are generated as follows. The sell (buy) signal is generated in the situation when the new high (low) of price is not related to the new high (low) point of the OBV indicator. It can be formally described as follows:

$$P_{\min,i} = P_{t-1} \quad \text{if} \quad P_{t-2} > P_{t-1} < P_t \qquad OBV_{\min,i} = OBV_{t-1} \quad \text{if} \quad OBV_{t-2} > OBV_{t-1} < OBV_t$$

$$P_{\max,i} = P_{t-1} \quad \text{if} \quad P_{t-2} < P_{t-1} > P_t \qquad OBV_{\max,i} = OBV_{t-1} \quad \text{if} \quad OBV_{t-2} < OBV_{t-1} > OBV_t \qquad (12)$$

Trading signals are therefore generated by the following relations:

Sell signal: $P_{\max,i-1} < P_{\max,i}$ and $OBV_{\max,i-1} > OBV_{\max,i}$

Buy signal: $P_{\min,i-1} > P_{\min,i}$ and $OBV_{\min,i-1} < OBV_{\min,i}$

Data and invested capital value

The profitability of the selected indicators of technical analysis has been verified on the ČEZ´s shares for a period of 12 years; from the beginning of 2006 until the end of 2017 (3 010 trading days). The data were provided by Patria Direct. During this period, the company paid out dividends. Trading is executed according to the following rules:

- One trade (transaction) means the buying and subsequent selling of shares.
- If a buy or sell signal is generated on one day, the trade is implemented for the opening price from the following day.
- The whole capital is always invested (it means that it is theoretically possible to buy a part of a share).
- We do not take any transaction fees into consideration.
- We count and reinvest the paid out dividends after tax in case that we obtained the shares on the record day.
- A short selling is not taken into account.
- Two consecutive purchases are not possible.

The invested capital value is calculated according to the following relation:

$$C_n = C_0 \prod_{i=1}^{n} \frac{S_i + D_i}{B_i}, \qquad (13)$$

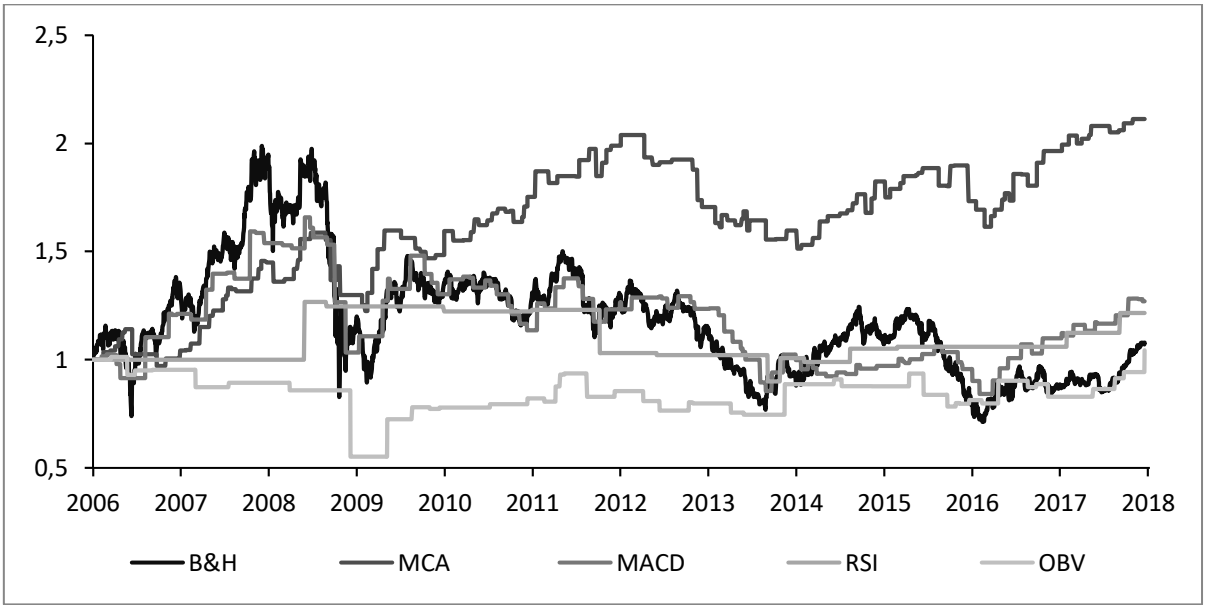
where C_0 = 1.000 is the initial value of the capital, C_n is the value of the capital after the n^{th} transaction, S_i is the selling price in the i^{th} transaction, D_i are dividends after taxation in case that during the i^{th} transaction there was ex dividend day, B_i is the purchasing price in the i^{th} transaction.

3 Results and Discussion

The profitability of each indicator is compared with the Buy & Hold (B&H) passive strategy. This strategy is based on the fact that shares are purchased at the beginning of the period and then they are no longer traded (regardless of fluctuations in the market). As for this study, we only buy some more shares for paid dividends. If we invested one unit of capital in ČEZ shares at the beginning of 2006 and reinvested the dividends paid, the value of capital would be 1.079 the end of 2017.

Figure 1 shows the development of the average value of invested capital over time if we buy and sell shares according to trading signals of all the selected indicators (and in comparison to the B&H passive strategy).

Figure 1 Development of Capital Value



Source: authors, own calculation

The value of invested capital is recalculated when the share is sold (it is not calculated continuously). Only at the end of 2017, if we had shares bought, we valued them at the current price. This was the case of the OBV indicator. The Figure 1 shows the rapid rise in the OBV value at the end of the period. As it is also evident from the Figure 1, except for the OBV, all the other indicators have outperformed the B&H strategy. The MCA indicator is the most successful of them. The indicator detects the trend change best. It has constantly outperformed the B&H strategy since 2009. As we assumed, it has generated the largest number of trades. Its ratio between profitable trade and a trade at a loss is also the best one. The other indicators have not outperformed the B&H strategy until 2016. None of them was able to react to a rapid rise in a share price between 2006 and 2007.

However, the period of 12 years is too long. Investors are more interested in the performance of indicators in a shorter period. Therefore, we divided the defined period into tree-years periods (the recommended investment horizon for investment in shares is 3 years). The profitability of the particular method was explored in these sub-periods and therefore tree-year yields were calculated. The results of the calculations are given in Table 1.

Table 1 Three-year Yields

Date	B&H	MCA	MACD	RSI	OBV
2015 - 2017	-2.8%	15.8%	30.7%	15.7%	19.0%
2014 - 2016	-6.2%	23.0%	7.4%	5.2%	-6.5%
2013 - 2015	-27.2%	1.6%	-22.5%	3.8%	1.9%
2012 - 2014	-13.7%	-8.3%	-21.2%	2.0%	2.6%
2011 - 2013	-24.5%	-8.9%	-9.9%	-17.6%	8.0%
2010 - 2012	-12.6%	15.0%	-5.2%	-18.1%	2.4%
2009 - 2011	11.4%	53.2%	19.3%	-17.3%	54.9%
2008 - 2010	-34.9%	21.0%	-26.2%	22.3%	-8.1%
2007 - 2009	-2.4%	47.7%	7.5%	24.6%	-18.3%
2006 - 2008	-2.8%	15.8%	30.7%	24.6%	-44.8%
2006 – 2017	**7.9%**	**111.3%**	**27.0%**	**21.6%**	**4.4%**

Source: own calculation

We can conclude from the results in Table 1 that the MCA was the most successful indicator also in the tree-year period. It was able to outperform the B&H strategy for the whole

period as the only one. Unfortunately, the excessive investors´ optimism of the MCA was dampened down by the last analysis of selected indicators. The analysis focused on the characteristics of selected indicators.

For each indicator, these characteristics were calculated for the whole period: total yield, average annual yield, total number of trades, total number of profitable trades, total number of trades at a loss, average yield on a transaction, average yield on a profitable trade and average yield on a trade at a loss. All averages are calculated as geometric means and expressed as a percentage. The aforesaid characteristics are given in Table 2.

Table 2 Characteristics of Selected Indicators

Characteristics	MCA	MACD	RSI	OBV
Total yield (%)	111.3	27.0	21.6	4.4
Average annual yield (%)	6.43	2.01	1.64	0.36
Total number of trades	140	115	13	45
Total number of profitable trades	92	48	7	25
Total number of trades at a loss	48	67	6	20
Average yield on a transaction (%)	0.54	0.21	1.52	0.1
Average yield on a profitable trade (%)	2.62	5.26	8.36	5.64
Average yield on a trade at a loss (%)	-3.35	-3.26	-5.92	-6.43

Source: own calculation

As is obvious from the results, total yield of all indicators was positive. Nevertheless, the most important characteristic for the practical trading is the average yield on a transaction. Stockbrokers charge a brokerage fee for services such as purchases, sales and other services connected to trading with shares. For example, the company Fio is the favourite broker in the Czech Republic. Its trade transaction fee is 0.4 %.

It means that the average yield on a transaction (buy and sell) must be 0.8 % or higher, if we want to generate a profit on a transaction. At this point the dream of trading strategy using the MCA is over. If we include fees, the trading strategy using the MCA is unprofitable. Only trading based on the RSI would bring a positive appreciation and slightly outperform the B&H strategy.

4 Conclusions

This study shows that trading using the technical analysis indicators is advantageous mainly for brokers who charge brokerage fee for each transaction. This is also proved for example in (Tharavanij at al., 2015). If we don´t include the brokerage fee, the trading strategy using the MCA is the most successful one (compared to the other 3 strategies).

However, it is possible that the MCA indicator may outperform the B&H strategy in case of its different parameters (different length of moving standard deviation or different states to generate trading signals) even after including transaction fees. The promising results of this study are the reason why we are going to continue in the research in this field in the future. We intend to concentrate on the following areas:

- to find the best length of the moving standard deviation;
- to confirm the results of this study by applying them to other shares;
- to perform a detailed analysis of successfulness of the trading strategies based on growth, digressive and sideway primary trends.

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The Influence of Accounting for Goodwill on the Bottom Line of Business Corporations

Jaroslav Sedláček, Filip Hampl, Elena Láncošová

Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 603 00 Brno, Czech Republic
E-mail: sedl@econ.muni.cz; filip.hampl@mail.muni.cz; lancosovaelena@gmail.com

Abstract: *The paper is dedicated to methods of accounting for goodwill and their relationship to the bottom line of business corporations. Methodically it is based on the comparison of Czech and international accounting rules. Empirical research is conducted on business companies operating in the Czech Republic in the period from 2007 to 2016. Differences and connections between intangible assets including goodwill and performance indicator represented by earnings before interests and taxes (EBIT) reported in accordance with the Czech Accounting Standards (CAS) and the International Financial Reporting Standards (IFRS) are examined. Particularly, Spearman's correlation coefficient and F-test are used for hypothesis testing. It was identified a lagged relationship between EBIT and the index indicator of acquired intangible/tangible assets and concluded that approach of CAS and IFRS regarding revaluation of goodwill is not comparable in terms of variability and predictability.*

Keywords: correlation, Czech Accounting Standards (CAS), goodwill, intangible assets, International Financial Reporting Standards (IFRS)

JEL codes: M21, M41, G32

1 Introduction

The first mentions of goodwill can be found in the 18th century. In that time some authorities recognized and evaluated the existence of business owner's attributes who was a respected and trusted member of the community. This personal value was considered neither transferable by selling a company nor declining within successful operations of a business entity. In accordance with this opinion, goodwill could not be purchased – it had to be obtained through proper actions and good moral character of the owner (Yang, 1927). At the beginning of the twentieth century, corporate goodwill was recognized as an asset of a business company in case of its selling for the price exceeding the sum of the market values of entity's tangible and intangible assets. This surplus was considered a payment to the former owner for business goodwill. For purposes of the initial recognition of the total amount paid, goodwill was entered as an asset into the new owner's accounting books. However, it was a common practice to immediately account goodwill against owner's capital account(-s) – perhaps in agreement with the earlier belief that goodwill does not represent a real business benefit due to its personal character.

The importance of goodwill consists in its capability of increase revenues. The price above the value placed in other assets is paid for goodwill because there are expected higher profits in comparison to ordinary investment earnings. The company is purchased not primarily as a tool for securing a group of assets but as a tool for generating future cash flows. Implicitly, this concept admits that underlying intangible attributes contribute to the goodwill of the company which cannot be measured separately – thus, its verifiable existence consists in the surplus between the value of the corporation as a whole and the value of its net assets. According to Gynther (1969), the value of goodwill is the sum of existing assets that are not included in the balance sheet of business corporations such as special skill and knowledge, high managerial ability, social and business connections, good name and reputation, monopolistic situation, excellent staff, favourable situation, trade names and established clientele.

For decades there has been a discussion among accounting theorists about a dilemma whether goodwill should not be amortized in public companies because its value does not

change by using (Catlett and Olson, 1968), or on the contrary should be amortized against future income, paid-up capital or undistributed profits (Esquere, 1914). In 1970, the Accounting Principles Board in the United States of America accepted the recognition of goodwill as an asset at acquisition cost with the requirement to its amortization against future incomes from acquired assets. Therefore, it is not a primary goodwill, which the company creates by its own business, but a derived (secondary) goodwill, that the company obtains by acquiring (merging) another company. Derived goodwill then includes both the primary (internally generated) goodwill of acquired company and the goodwill arising from the synergy obtained as a result of the combination of net assets of acquirer and acquiree (or merging companies).

Present accounting standards do not allow to account for primary goodwill because it is not reliably measurable and therefore it does not meet one of the elemental assumptions for its disclosure in the balance sheet. On the other hand, the secondary goodwill might be recognized as an asset, even though it does not meet, in contrast to other assets, the requirement of the separate existence. It cannot be traded itself for another asset or used for meeting the liabilities. The measurement of the future economic benefits arising from goodwill might be considered questionable because goodwill contributes to the creation of certain values (the most frequently measured by future net cash inflows) only in conjunction with other assets, not in itself. Goodwill itself is not separately appraised on the market – it is another distinguishing factor from other assets. Therefore, goodwill is the subject of exchange only within business combinations (Zelenka, 2006).

According to International Financial Reporting Standards (IFRS 3) and the United States Generally Accepted Accounting Principles (SFAS 141) goodwill is measured as the excess of the acquisition-date fair value of acquiree over the net of the acquisition-date amounts of acquired identifiable assets and liabilities. A similar approach to determining goodwill is embedded in the Czech Accounting Standards (CAS 13), except some differences affecting financial position and performance of the accounting entity. In this context, some issues need to be answered, in particular:

- Goodwill is a part of non-monetary and long-term intangible assets; according to Samuelson and Nordhaus (1992) for the first time, it appeared separately in the balance sheets of US capital companies in 1970. What relationship can be identified between intangible assets (including this relatively new asset category) and performance of companies in the Czech Republic?
- Are impairment (IFRS) and amortization (CAS) comparable regarding randomness and variability?
- Is there a relationship between goodwill (expressed as index indicator) reported in accordance with CAS and IFRS?
- Is there a connection between goodwill and performance of companies reporting in accordance with CAS and IFRS?
- The equation of goodwill calculation suggests that determination of fair value of acquiree and its identifiable net assets is an important factor to goodwill calculation. Which valuation models can be used if the fair value cannot be applied?

Positively formulated hypotheses represent answers to these questions. Their testing and assessment are objects of our research and content of this paper.

2 Methodology and Data

Goodwill is probably the only kind of corporate asset that is individually measurable but not tradeable. It occurs in the intangible assets category which is considered to be a strategic investment and mainly lies within owners' decision authority. Goodwill brings future economic benefits by contributing to the creation of new values for the business company (often measured by future net cash inflows) but only in conjunction with other assets (even with ones that are not reported in the balance sheet). These values are reflected in the company's financial situation – they are related to the structure of strategic assets (Brealey, Myers and Allen, 2006) and performance measured by EBIT or EAT (Horváthová and Mokrišová, 2017).

Our first null hypothesis supposes that the growth of EBIT in one year is not correlated to the growth of the index indicator of acquired intangible assets against acquired tangible assets in the next year. To test this hypothesis, mean values for each year of EBIT and acquired intangible/tangible assets were computed based on ten-year data of Czech industrial corporations (MIT, 2016). Testing of the hypothesis is performed by Spearman correlation coefficient because the assumption of normality is not met.

- **H_0:** the correlation of the growth of EBIT in one year and the growth of the index indicator of acquired intangible assets against acquired tangible assets in the next year is equal to zero.
- **H_1:** the correlation of the growth of EBIT in one year and the growth of the index indicator of acquired intangible assets against acquired tangible assets in the next year is not equal to zero.

The correlation coefficient r_s of index indicators is tested at the significance level of $\alpha = 0.1$ by the hypothesis H_0: $\rho = 0$, against the alternative H_1: $\rho \neq 0$. The test criterion is as follows:

$$r_S = \frac{cov(rg_X, rg_Y)}{\sigma_{rg_X}\sigma_{rg_Y}} \tag{1}$$

where:

r_s	– Spearman correlation coefficient
$cov(rg_X, rg_Y)$	– covariance of the rank variables
σ_{rg}	– standard deviations of the rank variables

The test statistics is computed by the following equation:

$$t = r\sqrt{\frac{n-2}{1-r^2}} \tag{2}$$

The test statistic is compared with the critical region which has the form:

$$W = -\infty; -t_{1-\frac{\alpha}{2}}(n-2)) \cup (t_{1-\frac{\alpha}{2}}(n-2); \infty) \tag{3}$$

Publications of accounting and auditing multinationals show that there is a significant amount of differences between IFRS/US GAAP and the Czech Accounting Standards. About recognising and reporting of goodwill, there are important differences in the preparation of the financial statements when goodwill is revaluated in accordance with the accounting principle of true and fair view. IFRS and US GAAP consider goodwill as an asset with an unlimited useful life and require its testing for impairment at least once per accounting period. On the other hand, the Czech regulation (Decree no. 500/2002 Coll.) requires a straight-line amortization mostly over the period from 60 to 120 months, as decided by the entity. Because the impairment and amortization affect cost and revenue accounts, the different approach for the revaluation of goodwill can be reflected in the reported bottom line.

The second hypothesis tests the difference in variability of impairment (IFRS) versus amortization (CAS). Different methods used by those standards would suggest that amortization will have linear character while impairment will show high volatility with

unpredictable development. To test this hypothesis, means of amortization values and impairment values (for each year from 2007 to 2016) were calculated based on data from 32 companies. In addition, percental differences from the previous year were created because we are interested in their time development.

- **H_0:** Variability of IFRS is lower or equal than the variability of CAS.
- **H_1:** Variability of IFRS is greater than the variability of CAS.

This hypothesis will be tested using the F-test, where

- **H_0**: $\sigma_{Czech} \geq \sigma_{IFRS}$
- **H_1:** $\sigma_{Czech} < \sigma_{IFRS}$

The F-test will be computed using the statistics:

$$F = \frac{S_{Czech}}{S_{IFRS}} \sim F(n_{Czech} - 1, n_{IFRS} - 1) \quad (4)$$

where:
S – variance of each data sample
n – the number of observations in each data sample

The third and the last hypothesis will be test the existence of a correlation between goodwill/EBIT ratio created in accordance with Czech Accounting Standards and goodwill/EBIT ratio based on IFRS. To compute these ratios, sums of 32 business companies were used.

- **H_0:** correlation of goodwill/EBIT ratio (CAS) and goodwill/EBIT ratio (IFRS) is equal to zero.
- **H_1:** correlation of goodwill/EBIT ratio (CAS) and goodwill/EBIT ratio (IFRS) is not equal to zero.

To test the third hypothesis, the same methodology as in case of the first hypothesis is used.

Goodwill calculation according to the definition incorporated in the accounting standards is as follows:

$$GT = FT - (A - L)_{I,F,D} = (CT + SP + MS)_{F,DA} - (A - L)_{I,F,D} \quad (5)$$

where:
GT – total goodwill
FT – acquiree's fair value
A – acquiree's assets
L – acquiree's liabilities
CT – fair value of the consideration transferred by the acquirer
SP – fair value of the acquirer's previously held equity interest in the acquiree
MS – non-controlling (minority) interest in the acquiree
I – acquiree's amounts of the identifiable assets and the liabilities
F – fair value valuation
D – acquisition-date or merger-date

It is clear from the equation above that from the acquirer's point of view, all acquiree's assets and liabilities have to be revaluated at fair value. For this purpose, an expert opinion or one of the many valuation methods are applied to determine the value of intangible assets. If the total price paid for the acquiree would not meet the criteria for setting the fair value (for example there is an evidence that the market participants are not knowledgeable, independent of each other and willing to enter into a transaction, or they are forced or compelled to do a transaction), then an expert opinion should be requested again, or an appropriate valuation method should be used. Given the absence of an active market, measurement of fair value creates a problem that is the topic of professional discussions (see for example Cochran, 2005, or Dieter and Ludenbach, 2013) which will probably never end. Especially, the lack of reliable data and the number of estimates to be used indicate a problem. Mielcarz and Wnuczak (2011) consider the revenue approach as

a suitable valuation model if inefficiencies in the company operations will be eliminated. Although, there are no simple or complex models, that would be able to determine the fair value unequivocally and impartially, many theorists are inclined to revenue approach and submit their own applications, for example Mařík (2007), Kislingerová et al. (2010) and many others. For that reason, the quote analysis will be performed, and the principle and the use of the models will be pointed out.

3 Results and Discussion

To test the first hypothesis, Spearman's rank correlation coefficient was computed and tested. There seems to be a relationship between lag of one year of acquired intangible/tangible assets and EBIT on a significance level of 0.1 (the null hypothesis was rejected). Therefore, we may conclude that higher EBIT in one year causes higher acquired intangible/tangible assets in the next year. Results are shown in Table 1.

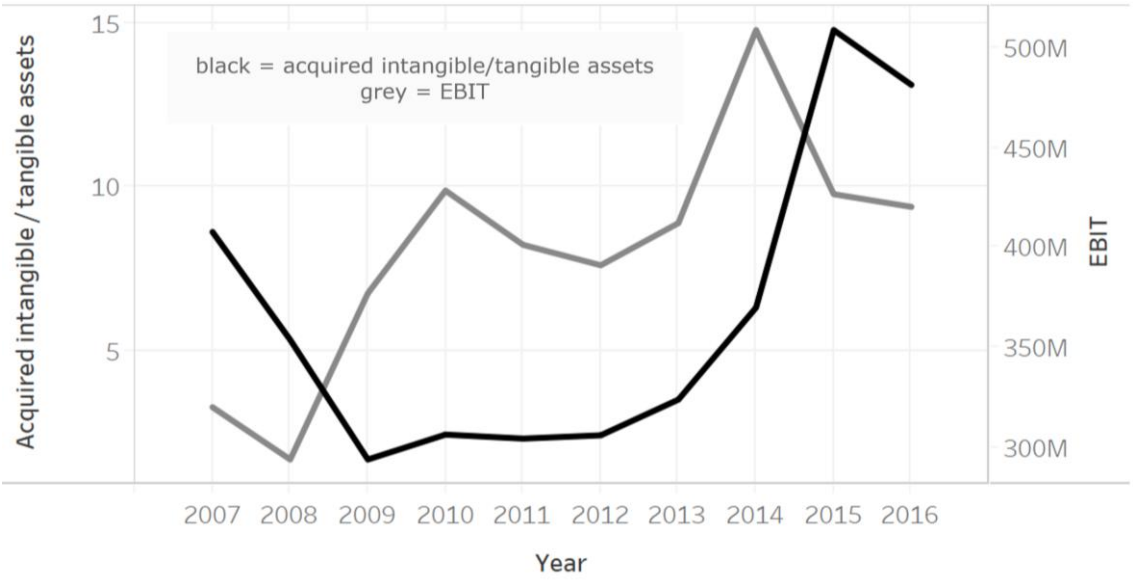
Table 1 Results of Spearman's Rank Correlation (the first hypothesis)

t-statistics	28
p-value	0.08309
r	0.6666667

Source: own calculation based on the data from financial statements

The time-series showing the indicators development within the ten-year-period are graphically represented in Figure 1. They provide graphical confirmation of our findings from testing of hypothesis one as they suggest that there is a lag in the reaction of acquired intangible/tangible assets of one year.

Figure 1 Development of Index Indicator (acquired intangible/tangible assets) and EBIT in the Period 2007-2016



Source: own calculation based on the data from financial statements

The second hypothesis is dealing with the difference in variability of amortization (CAS) and impairment (IFRS). The hypothesis is tested by F-test.

Table 2 Results of F-test (the second hypothesis)

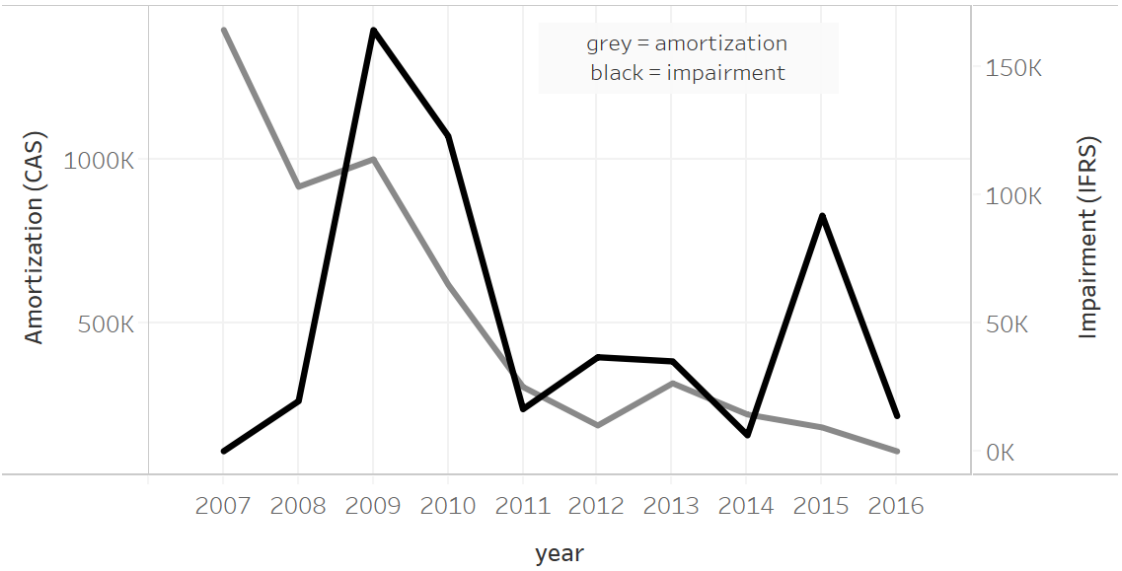
F-statistics	91.91
Number of degrees of freedom	8
p-value	4.577e-07

Source: own calculation based on the data from financial statements

P-values are lower than our significance level of 0.1. Thus we reject the null hypothesis and accept the alternative hypothesis. Therefore, we conclude that variability of impairment is significantly greater than the variability of amortization. Namely, the variability of impairment differences is 3.57 and variability of amortization is 0.37.

Figure 2 portrays the development of impairment (IFRS) and amortization (CAS). It graphically confirms our findings from statistical testing as it is obvious that while amortization has rather regular character, impairment shows high variability with evidently unpredictable development.

Figure 2 Development of Means of Amortization (CAS) and Impairment (IFRS) in the Period 2007-2016



Source: own calculation based on the data from financial statements

The last hypothesis suggests a correlation between goodwill/EBIT created in accordance with CAS and goodwill/EBIT in accordance with IFRS. This hypothesis was again tested by Spearman's correlation coefficient. Table 3 shows our results.

Table 3 Results of Spearman's Rank Correlation (the third hypothesis)

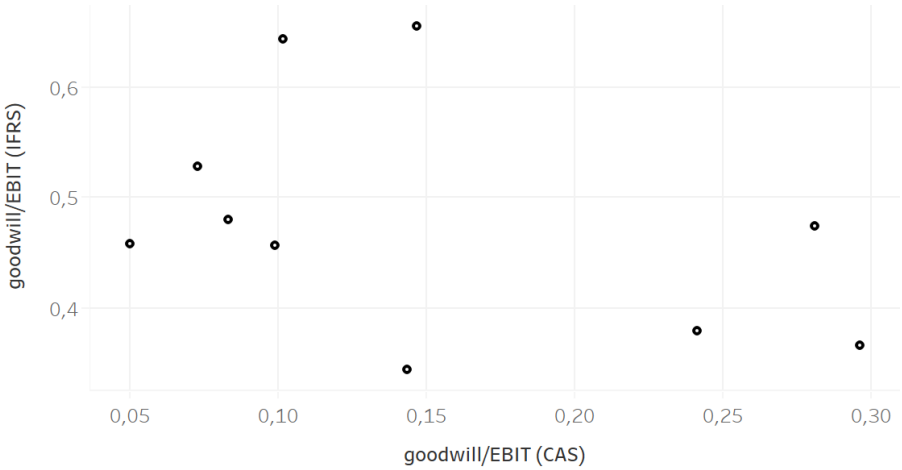
t-statistics	216
p-value	0.3871
r	-0.3090909

Source: own calculation based on the data from financial statements

Spearman's rank correlation suggests that there is a negative relationship between the proportion of goodwill and EBIT by IFRS and Czech Accounting Standards, but this relation is not statistically significant on a significance level of 0.1. Therefore, we are not able to reject the null hypothesis.

For better visualization, time series graph and scatterplot were created (Figure 3). Figure 3 suggests a negative relationship between goodwill/EBIT ratio created according to these two approaches, but it is obvious that this relationship is very weak as data are rather scattered in space.

Figure 3 Scatterplot Expressing Correlation of Ratios Goodwill/EBIT (CAS) and Goodwill/EBIT (IFRS)



Source: own calculation based on the data from financial statements

We've also wanted to find out which valuation models can be used if the fair value cannot be applied. In cases when the fair value cannot be reliably measured, the income approach represented by the discounted free cash flows (DCFF) method is used to determine the market value of corporations according to following formula:

$$V = \sum_{t=1}^{n} \frac{CF_0(1+g)^t}{(1+WACC)^t} + \sum_{t=n}^{T} \frac{FCFF_t}{(1+WACC)^t} + \frac{FCFF_{T+1}}{(WACC-g_T)(1+WACC)^T} \quad (6)$$

where:

V	– the market value of the firm
$FCFF_t$	– free cash flow to the firm in year t
$FCFF_0$	– starting level of FCFF
WACC	– weighted average cost of capital
g	– constant expected growth rate iv FCFF
n	– number of years planned
T	– contemplated period length

Alternatively, the equivalence method (Damodaran, 2000) based on economic value added (EVA) can be used:

$$V = OE_0 + \sum_{t=1}^{T} \frac{EVA_t}{(1+r_e)^t} + \frac{EVA_{T+1}}{r_e(1+r_e)^T} + A_0 \quad (7)$$

$$V = OE_0 + \sum_{t=1}^{T} \frac{P/L_t - r_e \cdot OE_{t-1}}{(1+r_e)^t} + \frac{P/L_{T+1} - r_e \cdot OE_t}{r_e(1+r_e)^T} + A_0 \quad (8)$$

$$r_e = r_f + r_{la} + r_{po} + r_{fi} \quad (9)$$

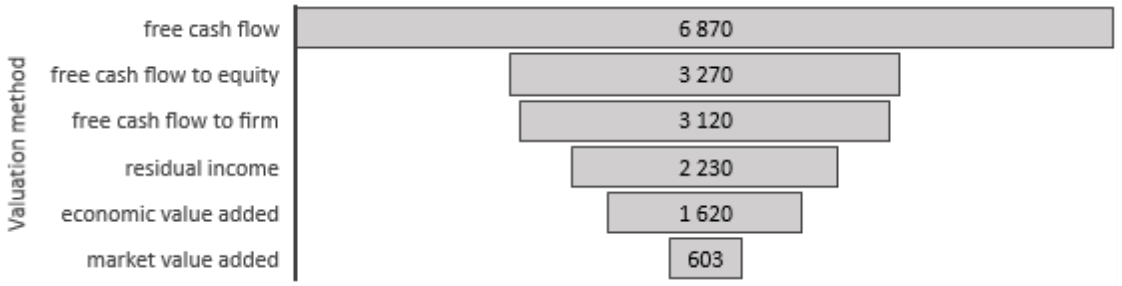
where:

V	= market value of the owners' equity
OE_v	– value of the owners' equity as at the valuation date
EVA_t	– economic value added in year t
T	– number of years planned by EVA
P/L_t	– net profit or loss of monitored enterprises in year t
r_e	– owners' equity expenses
r_f	– risk-free assets return
r_{la}	– risk surcharge for lower liquidity of a share at the market
r_{po}	– risk surcharge for entrepreneurial risk

r_{fi} – risk surcharge for financial risk
A_0 – other non-operating assets

Residual income models based on book value of company's equity, expected net profit and cost of capital (for more details see Feltham and Ohlson, 1995, or Begley et al., 2006) are recommended as simpler models for measuring of goodwill. Figure 4 shows the results of quote analysis.

Figure 4 Quotes Frequency of Valuation Models of Business Corporations (thousands)



Source: own calculation based on the data from citation analysis

From the Figure 4, it is obvious that in case of the value determination of companies, methods based on expected free cash flow are preferred to residual income models. That is the answer to our last research question.

4 Conclusions

The notion of goodwill is particularly interesting because it is something abstract, unthinkable but today more and more significant. Its importance is essential primarily for measuring company's market value. Goodwill is perceived as an intangible asset in the financial sector, but its precise and reliable quantification is relatively difficult and requires appropriate professional attitude. Goodwill represents the amount that is the difference between the company's accounting valuation and its market valuation. Goodwill is recognized in the final accounts within acquisitions and mergers which amount has increased steadily as a result of globalization in the recent years.

We have identified the relationship between the ratio of acquired intangible/tangible assets and EBIT representing the performance of companies in the Czech Republic. It seems that acquired intangible/tangible assets react to changes in performance with a lag of one year, which was confirmed using Spearman's rank correlation. Based on our findings, we can conclude that impairment and amortization are not comparable regarding variability and predictability. Impairment has significantly higher variability than amortization. Amortization shows fluency and regularity while impairment does not manifest regular pattern. It follows that users of IFRS financial statements cannot predict with sufficient reliability the impact of impairments on the bottom line. The accounting treatment of goodwill incorporated in IFRS and CAS differs, each set of regulation offers its own rules for revaluation of goodwill which was shown by the low correlation between goodwill/EBIT (CAS) and goodwill/EBIT (IFRS). In cases when fair value cannot be measured reliably, we find out which alternative methods are used the most frequently. Based on the quote analysis we discovered that methods based on expected free cash flow are preferred to residual income models.

Acknowledgement

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General Data Protection Regulation in the Context of Municipalities

Pavel Sedláček, Miroslav Svoboda

Masaryk university
Faculty of Economics and Administration, Department of Finace
Lipová 41a, 602 00 Brno, Czech Republic
Corresponding authors' email: 369947@mail.muni.cz

Abstract: *The aim of this paper is to analyse the impact of General Data Protection Regulation (GDPR) and implementation costs concerning municipalities. This regulation enforceable on 25th May 2018 aims primarily to provide control to EU citizens over their personal data, unifying the regulation within all EU members. This regulation aggregates new costs and duties for all subjects gathering personal data. This paper depicts the duties and changes newly commencing and possibilities of their implementation. Changes are demonstrated on an example of one municipality, particular needs of change and total costs of implementation are estimated for this subject. Comparing this subject to others, we can make an assumption of total costs of GDPR implementation in Czech Republic in the field of municipalities.*

Keywords: GDPR, data protection, EU, regulation, municipality

JEL codes: G30, K19, K24

1 Introduction

GDPR (General Data Protection Regulation) has become recently a "bubble", frequently discussed in the media. There are hundreds of approval consent requests received in the mail boxes crosswise EU. The intention of this regulation is to protect rights of its citizens (all over EU + EFTA (Iceland, Norway, Lichtenstein) against unauthorized treatment of their personal data. The reason for the introduction was the need for better data protection for citizens in today's world, where marketing databases are being sold for marketing purposes on daily basis. GDPR protects against unauthorized systematic processing of personal data (Žúrek, 2017)

By personal data is understood any data about a person, that can be identified (with an identifier). Identifier can be anything, for example name, date of birth and personal identification number, student or employee number, phone number, bank account number, location data, network identifier, dynamic IP address or some information concerning physical, physiological, genetic, psychic, economic, cultural or social identity of a person (Nulíček, 2017). Also if the person is identifiable by gathered information combined with publicly accessible data, it is still considered as personal data. GDPR is not applicable to artificial person, dead or not born natural person, and anonymized data. Special category of personal data is sensitive data, such as racial or ethnical background, information about religion, political and philosophical mindset, health, sexual information, labor unions membership, genetic or biometric information or children' personal data. (Janečková, 2017)

Information can be anonymized (information become anonymous and lost status of personal data) or pseudonymized (some information were split into parts and coded, it is not possible to identify the person without merging and decoding the information, but it might be still possible, thus it remains personal data).

This new regulation establishes easier access to data, new right on data transmissibility, right to be forgotten and right to be informed in case of data theft or leakage (regulation 2016/679).

2 Methodology and Data

By effective date of GDPR every personal data processing have to be based on a legal title. As mentioned in chapter 2 article 6 in GDPR, legal title can be contract fulfillment,

compliance with legal obligation, protection of vital interests, performance of a task carried out in the public interest or in the exercise of official authority, legitimate interest (if not overridden by exemption, such as fundamental rights and freedom) or consent (if none of the mentioned apply). Consents have to be expressive, clear, under no pressure, informed, revocable, demonstrable. (Nezmar, 2017)

As this is crucial for the text below, I will state some more facts concerning every legal title. Contract fulfillment is quite common title, valid while the contract is valid. If there is another usage of the data afterwards, e.g. recovery of debts, it is on basis of another title – in this case legitimate interest. Compliance with legal obligation (e.g. as data transfer to health insurance company) is another common legal title. It is legal duty (not option) to fulfill this data processing. This title also covers right to fulfill duty of archiving data as stated by the law (in Czech legal system it is 10 years for annual reports and final accounts, 5 years for accounts and records and 30 years for all documents concerning employee data and wages). Protection of vital interests covers for example the rights of unconscious person or proceedings taken while monitoring epidemic disease spreading. Performance of a task carried out in the public interest or in the exercise of official authority covers the right to process data by institutions such as vehicle technical inspection institutions, forest guards etc. Legitimate interest can be almost anything, so it is the most questionable title. It can be camera recording of street for property protection purposes, employee attendance software, creation of internal list of debtors etc. Legitimate interest is assessed by proportionality test – is it legal and justified? Is it necessary? Is my gain above the restriction of others' rights? If yes, we can use this title without consent.

Concerning the municipalities, consent should be the least used title, as the position of a municipality and a resident are not equal. Therefore, consent should be used only in cases such as processing of data whilst public property ownership transfers or collecting employee or citizen contact details for some purposes. In other cases should be always found other legal title.

Principle of necessary data minimization should be always taken into account – only necessary data should be collected and used only for the entitled purpose (if data are collected for contract fulfillment, there is no possibility to use them for marketing purposes or pass the data to other entity. Consent has to be separated from the contract.)

All entities in public sector and municipalities (as well as in private sector) have to be in compliance with GDPR. I would like to demonstrate on an example, what has to be done and figure out the total costs of implementation of GDPR within the municipality.

Initial point of GDPR compliance is data audit. Frequently it is not only audit of the bureau itself, but also of institutions established by municipalities, such as schools or the municipal police. Audit evaluates that only necessary data are collected, processed and used only for purposes entitled and IT audit regarding data leakage, loss risks and data safety. GDPR commands the duty of prevention against data loss and leakage caused purposely, by neglectfully acting or inevitably by accident, such as natural disaster.

After this audit, necessary proceedings can be measured as well as estimation of total costs of GDPR implementation for this particular case. There are many assumptions about total cost of implementation, in range from millions to billions of Czech crowns. Even though GDPR educational courses are currently the most demanded *(source legal company Křížka Kuckirová Legal s.r.o. and educational company 1.VOX s.r.o. management)*, most of the municipalities rather select the option to order services of a legal company for this purpose. Only the initial audit costs vary from 3 000 to 90 000 Czech crowns.

Another obligation for municipalities is to name a DPO (Data Protection Officer). DPO is an advisory and supervisory authority as well as contact point for the subjects. DPO must be independent, so it is highly recommended to elect an external person; it must be assured, that the person will have no conflict of interests.

It is required, that DPO must be familiar with information technologies and data security, with national and EU law (especially GDPR and data protection), the organization itself,

has empirical experience with application data protection measures and data processing operations and must be able to promote data protection policy, precautions and measures within the organization.

In the sample municipality, new guidance concerning response for events that may occur regarding to GDPR and some changes in unified fields – new employee discretion statement, consent with photocopy of ID, overall organization regulation with answer for personal data access, change, limitation, transfer or deletion request, announcement of prolonging the period to provide a response to the request.

Starting point for estimation of the total cost of GDPR implementation for municipalities is ČSÚ (Czech statistic bureau). In the Czech republic there is 6258 municipalities, out of which is 393 with delegated municipal offices (or so called municipalities of second level) and out of those, there is 205 municipalities with extended field of activities (or so called third level). The rest of municipalities (5865 are common municipalities).

Table 1 Municipalities in The Czech Republic

Code of district, region	*Name of the district, of the region*	*Number of municipalities*	*Number of cadastral districts*	No. Of districts	No. of inhabitants		
				Total	*Total*	*Municipal. average*	*Average/ mun. part*
CZ010	Capital City of Prague	1	112	112	**1 280 508**	1 280 508	11 433
CZ020	Central Bohemian Region	1 144	2 074	2 803	**1 338 982**	1 170	478
CZ031	South Bohemian Region	624	1 623	1 990	**638 782**	1 024	321
CZ032	Pilsen Region	501	1 396	1 537	**578 629**	1 155	376
CZ041	Karlovy Vary Region	134	571	527	**296 749**	2 215	563
CZ042	Usti Region	354	1 061	1 153	**821 377**	2 320	712
CZ051	Liberec region	215	508	768	**440 636**	2 049	574
CZ052	Hradec Kralove region	448	961	1 076	**550 804**	1 229	512
CZ053	Pardubický kraj	451	790	991	**517 087**	1 147	522
CZ063	Highlands region	704	1 263	1 402	**508 952**	723	363
CZ064	South-Moravian region	673	892	905	**1 178 812**	1 752	1 303
CZ071	Olomouc region	402	781	768	**633 925**	1 577	825
CZ072	Zlín Region	307	443	438	**583 698**	1 901	1 333
CZ080	Moravian-Silesian Region	300	616	623	**1 209 879**	4 033	1 942
	Czech Republic	**6 258**	**13 091**	**15 093**	**10 578 820**	**1 690**	**701**

Source: ČSÚ (https://vdb.czso.cz/vdbvo2/faces/cs/index.jsf?page=statistiky)

In this calculation, we try to calculate the total cost of achieving the GDPR compliance status of all municipalities, not how much was actually spent. This means, that the percentage of GDPR ready municipalities, which is accordingly to KKL estimation cca 40 % is not counted with.

Another trigger for GDPR bubble and fear from the majors are the penalties for noncompliance. The amounts are enormous and Czech Republic did not manage to process adaption regulative regarding fines and municipality prosecutions. Though, it is necessary to realize, that the same people from ÚOOÚ (Czech bureau for protection of personal data) who are responsible for reporting and punishing the municipalities. In addition, it was announced by ÚOOÚ, that there will be only 30 revisal of GDPR compliance per year. If they would split the controls to public and private sector half by half, the probability, that that particular municipality will be controlled is 0,0024 %. This might be also the reason, why only 40 % did meet the GDPR criteria.

To sum up, new duties for municipalities are assignment of DPO, preparation (written regulative) for data leakage situation and all event that might happen regarding to GDPR citizen requests and have IT security regulative. Municipalities have to go through all

gathered data, think about the legal title of their possession and in case that no legal title is applicable, a consent has to be gained and stored. They should also implement technical and organizational measures for ensuring highest protection, but as this is not further specified, it is not any radical change.

3 Results and Discussion

Total costs can be divided into several fraction: costs of analysis and initial audit (in Table 2 stated as initial methodic guidance and consulting), costs of implementation (stated as Komplex GDPR services) and costs of DPO, process specification after GDPR measures and their changes – initial and monthly fees. Some municipalities did the implementation by themselves – they studied the matter or bought some online tutorial or tool, that helped them understand the matter and they appointed the DPO by themselves. This was usually case of middle size municipalities – major competent to understand the matter, trying to save some money from the budget and not avoiding work and responsibility. Huge helping hand is from SMOCR ("svaz obcí a měst ČR" - Czech municipality alliance), offering the municipalities help in this matter (most of the agenda is common for all municipalities) and shared DPO. In other cases, a company was hired.

We have asked 5 companies offering GDPR solution for quote for every type of municipality (first, second third level). The explicit list of chosen companies is Křížka Kuckirová Legal s.r.o., CATANIA GROUP s.r.o. (project SPMO - služby pro města a obce), MCS Consulting, s.r.o., 1. VOX a.s., Data Protection Services, s.r.o). Then we have done an average cost for an average municipality in respective level.

Table 2 Average Cost of GDPR Agenda

Level	No.	Methodic guidance and consulting[2]	Komplex GDPR services[2]	DPO, process specification and actualization[1]
1st level municipalities	5 865	4 955	9 000	346 800
2nd level municipalities	188	29 670	75 000	584 400
3rd level municipalities	205	89 890	191 900	924 000

[1] monthly fees, in this model we calculate expected costs in 10 years.

[2] Average cost per unit

Source: prepared by author

4 Conclusions

With information gained in previous chapter, we can compare total costs from the model with costs estimated in the media. As it is difficult to combine initial one-off costs with monthly fees paid afterwards, we have decided to quantify the costs in ten years period. If done so, total costs of GDPR regulation for municipalities in the Czech Republic is **2,493 billion Czech crowns**. Even though, there is not many estimations of GDPR impact on municipalities, we can compare this number with the few available. Mr. Jiránek (former major of Kladno, now working as GDPR specialist for SMOČR) in Ekonomický deník assumes at least 1 billion Czech Crowns for the third column of Table 2 (DPO and monthly fees for management regarding GDPR). Study quantifies amount this as 1,855 billion, which proves his statement.

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Syndicated Loan Market Germany: Deep Dive into Role Allocation

Ilja Schaab[1], Eric Frère[2], Alexander Zureck[3]

[1] Masaryk University / FOM University of Applied Sciences
Department of Finance at Faculty of Economics and Administration
Flakering 68, 45277 Essen, Germany
E-mail: ilja.schaab@gmx.de

[2] FOM University of Applied Sciences/Masaryk University
isf Institute for Strategic Finance/Faculty of Economics and Administration
Leimkugelstraße 6, 45141 Essen, Germany
E-mail: alexander.zureck@fom.de

[3] FOM University of Applied Sciences
Department of Finance at Faculty of Economics and Administration
Leimkugelstraße 6, 45141 Essen, Germany
E-mail: alexander.zureck@fom.de

Abstract: *The selection and mandate of capable partners in a syndicate loan transaction is essential to a successful realization. However, financial managers have not only to decide which banks but also how many banks should be involved in the transaction at hand to generate an optimal cost-benefit-ratio. While other studies have investigated the impact of arranger reputation on the syndicate structure, this paper focuses on the identification of significant transaction-related determinants of mandate allocation on the syndicated loan market in Germany. The analysis of the 2,161 data sets from transactions between 2001 and 2017 is conducted by the ordinary least squares method. The findings show that the transaction volumes have a significant positive impact on the number of mandated banks, whereas the complexity of the transaction, represented by the number and type of facilities as well as the total allocation of arranger titles, has a significantly negative impact on the mandate allocation. Furthermore, the study reveals a structural break in the strategy of role allocation in the market which occurs in the year 2009 during the financial crisis. Ever since, the allocation of MLA and Bookrunner titles increased significantly.*

Keywords: Syndicated Loan Market, Mandated Lead Arranger, Bookrunner, Determinants Role Allocation

JEL codes: G30, G32

1 Introduction

With a record transaction value of 56.9 billion dollars, Bayer AG caused a sensation on the German syndicated loan market during the acquisition of Monsanto Inc. Large, listed companies in Germany have already used the syndicated loan, which was utilized as a bridging facility in the Bayer-Monsanto transaction, for decades as a stable, capital market near funding source. The borrower receives funding from different lenders under a joint, multilateral credit facility agreement. Despite the complex contractual documentation, this form of financing brings many advantages for borrower (e.g. eligibility of termination rights) and lender (e.g. risk spreading), so that in addition to such large transactions, which were primarily placed on the bond market in the past, more and more medium-sized enterprises decided to use this source of funding (e.g. debut transactions in 2017 by Kirchhoff Automotive or MANN+HUMMEL).

If a company chooses to pursue the syndicated loan as a funding option, it assigns the management of the transaction to one or more Mandated Lead Arrangers (MLA). For example, a total of 26 banks were mandated in this role in the above mentioned Bayer-Monsanto transaction. Among the MLA, Bookrunner are designated to assume a central task in the process by approaching potential lenders and controlling the credit book. The roles of the MLA and the Bookrunner are particularly desirable in the bidding phase, as they are not only endowed with additional fees in the internal relationship, but also generate a positive external outreach for the respective bank (e.g. Miller, 2008). This

external effect manifests itself within League Tables, which are provided by several data service companies (especially Bloomberg and Thomson Reuters). The more of these titles a market participant is able to achieve, the easier it is to stand out against the competition with a good ranking in the League Tables.

Choosing several MLA and Bookrunner banks usually means a higher level of transaction security for the borrower, which is especially important in case of high transaction volumes. At the same time, however, the borrower's transaction costs also increase, since lead arranger expect higher fees due to their structuring efforts (e.g. Miller, 2008). Cost-benefit balancing is therefore essential. League Tables are eligible to show financial managers, which bank has received an MLA or Bookrunner title in how many transactions and which volume has been disbursed. However, an indication of how many mandates were allocated at which transaction size is only available quite opaque at the single transaction level. Therefore, a conclusion, whether the volume or other criteria of transactions are decisive for the number of mandated banks, would be linked with considerable research effort for financial managers.

Based on this practice-oriented problem, the following study focusses on the identification of significant transaction-related determinants of mandate allocation on the syndicated loan market in Germany between 2001 and 2017.

2 Literature Review and Hypotheses Development

In order to concretize the research hypotheses, first, a review of empirical literature in this field is necessary. Even though recent empirical studies primarily focus on the US market, the main conclusions are outlined and projected on the available dataset.

Sufi (2007) found in his empirical study that information asymmetries could have a significant effect on syndicate structures. The study shows that MLA banks sign higher credit shares at transactions with opaque companies in order to signal careful data analysis, which, however, scales down the total syndicate participants. Other lenders are primarily determined by the geographic proximity to the borrower and, in particular, the duration of their credit relationship. The reputation of the MLA banks can reduce the information asymmetries and thus the syndicate consolidation. Chaudhry and Kleimeier (2015) found similar results in their study. Banks with a particularly high reputation, measured by their market share, can overcome the moral hazard and adverse selection problems, and reduce the scaling down of the syndicate.

The results imply that the borrower can use League Tables at least to identify banks with a high reputation, measured by their market share, to choose these for the transaction and thus benefit from the mentioned advantages. Gopalan et al. (2011) found in their study that insolvency of borrowers did not have a significant effect on the reputation of MLA with particular sector dominance (market share greater than 25% in the respective sector). Cumulatively, the results suggest that participating banks orient themselves towards the MLA's reputation, although it is not a reliable indicator of the borrower's solvency.

Bae et al. (2014) have shown in their multinational study that the number and the credit share of the arrangers relative to the participating lenders have a significant negative impact on credit risk premiums. The study confirms the results of Ivashina (2009), which has also shown the effect based on the relative credit share of the arrangers. The authors suggest the higher competitiveness and the diversified credit portfolio of arrangers as possible explanations for the lower credit risk premium.

Ferreira and Matos (2012) investigate the effects of a governance structure between lenders and borrowers. The results show that banks that are able to exert influence on a company (e.g. through a seat on the supervisory board) are selected more frequently for an MLA title, and impose higher credit risk premiums in times of normal markets. Bushman et al. (2016) found evidence that media reporting about a company can also have an effect on the syndicate structure. Thus, positive reporting leads to a higher probability that banks

with no previous credit connection will assume an MLA role or participate in the syndicate, and furthermore that credit risk premiums will also be reduced.

Summing up the empirical results, the higher transparency of a company or the reputation of MLA banks can reduce ex ante information asymmetries within the syndicate, resulting in a higher granularity of lenders in the transaction. Empirical studies have shown that company size usually correlates positively with disclosure (e.g. Khlif and Souissi, 2010). Thus, it is expected that the volume of a transaction has a positive effect on the number of MLA and Bookrunner banks since it can be associated with company size (e.g. Byoun, 2008). Vice versa, it is expected that opaque companies or transactions are exposed to a lower granularity of the syndicate.

Taking the data availability into account, which is described in the following chapter, the consistence of the described expectations will be tested with the German syndicated loan market. The study focuses on the two following hypotheses (see table 1), which are tested respectively with the MLA and Bookrunner roles.

Table 1 Research Hypotheses

No.	Hypothesis
H_{1A}	Transaction volume has a significant positive impact on the number of MLA.
H_{1B}	Transaction volume has a significant positive impact on the number of Bookrunner.
H_{2A}	The transaction complexity has a significant impact on the number of MLA.
H_{2B}	The transaction complexity has a significant impact on the number of Bookrunner.

Source: Own representation

3 Empirical Analysis

Data and Variables

In order to test the defined hypotheses, information about the syndicated loan market Germany is necessary. These are provided by the two data service companies Bloomberg and Thomson Reuters insofar as banks report syndicated loan transactions to receive League Table scores. For the period between 2001 and 2017 data about 2,161 transactions was taken from the Bloomberg database and verified in samples by the Thomson Reuters database. One transaction from 2006 was removed from the data due to very low volume and missing verification records in the second database. Furthermore, there are 17 transactions with missing maturity dates. However, these were not removed from the sample, since the transaction data was otherwise complete.

According to Bloomberg (2017), when the issuer's country of risk is Germany, all reported and signed transactions are included into the German League Tables (four factors decision model: management location, country of primary listing, country of revenue, reporting currency of the issuer). Hence, the data sample is presumed as representative for the German syndicated loan market.

The information about the individual transaction includes borrower, loan amount, number and type of facilities, maturity as well as the distribution of roles within the syndicate. Information about the entire composition of the syndicate, the signed loan amounts of each bank in the syndicate and the agreed credit risk premiums are only available if the borrower approves the publication. In 2017, for example, credit risk premiums are only available for approx. 28.5% of the transactions, so the consideration of this variable does not appear to be appropriate. For the majority of transactions only the mandatory data is available so that the test variables for the study are specified as follows in table 2. The extraction of the *MLA* and *BR* variable from the database is only possible with an intermediate step. The information about role distribution in the syndicate is provided in text form. Based on this text form, the variables are manually catalogued for each individual transaction.

Table 2 Definition of Variables

Variable	Definition
MLA	Number of Mandated Lead Arrangers
BR	Number of Bookrunners
VOL	Transaction Volume
GA	Total Number of Banks with a Reported Arranger Title
TR	Number of Facilities
LFZ_w	Volume-Weighted Transaction Term in Months
FX	Facility in Foreign Currency (binary variable: available / not available)

Source: Own representation

The low degree of disclosure within the German syndicated loan market leads to the conclusion that many of the hypothesis tests conducted in US empirical research cannot be applied. For example, the granularity of a syndicate cannot be ascertained, since not all lenders and credit shares are disclosed. Further, it is also only indirectly possible to draw conclusions on the type of transaction (club deal vs. syndication), in example when all MLA banks sign the same share, and when the total sum of these shares then corresponds with the total transaction value. Furthermore, the effects on the credit risk premium cannot be tested, since the agreed spreads remain undisclosed for the majority of transactions. Therefore, the focus of the following analysis lies on the two defined hypotheses, which can be tested from the given data set.

Methodology

The descriptive statistics provided in table 3 indicate a market change over time. On the one hand, it seems that since the financial crisis the market participants established a new standard regarding the role allocation. On the other hand, the syndicated loan market became more granular than in the beginning of the noughties. In order to obtain relevant results for theory and practice from the study, the first step is to test whether all available samples should be included into the following testing.

Table 3 Descriptive Statistics

Year	n	*VOL*	Mean *VOL*	Median *VOL*	Mean *MLA*	Median *MLA*	Mean *BR*	Median *BR*
2001	40	EUR 46.129 bn	EUR 1.153 bn	EUR 0.428 bn	2.45	2.00	1.70	1.50
2002	47	EUR 59.100 bn	EUR 1.257 bn	EUR 0.324 bn	2.13	2.00	1.79	1.00
2003	55	EUR 75.977 bn	EUR 1.381 bn	EUR 0.500 bn	2.45	2.00	1.85	2.00
2004	97	EUR 94.256 bn	EUR 0.972 bn	EUR 0.400 bn	3.22	3.00	2.11	2.00
2005	120	EUR 126.740 bn	EUR 1.056 bn	EUR 0.488 bn	3.43	2.00	2.07	2.00
2006	153	EUR 152.181 bn	EUR 0.995 bn	EUR 0.320 bn	2.67	2.00	1.92	2.00
2007	114	EUR 119.160 bn	EUR 1.045 bn	EUR 0.400 bn	3.16	2.00	1.99	2.00
2008	58	EUR 45.749 bn	EUR 0.789 bn	EUR 0.290 bn	3.05	2.00	2.07	2.00
2009	42	EUR 59.113 bn	EUR 1.407 bn	EUR 0.699 bn	6.43	4.00	3.71	2.00
2010	109	EUR 81.662 bn	EUR 0.749 bn	EUR 0.250 bn	5.57	3.00	3.84	2.00
2011	160	EUR 80.053 bn	EUR 0.500 bn	EUR 0.203 bn	5.31	4.00	3.10	2.00
2012	159	EUR 74.723 bn	EUR 0.470 bn	EUR 0.170 bn	4.30	3.00	3.07	2.00
2013	190	EUR 106.780 bn	EUR 0.562 bn	EUR 0.250 bn	5.16	3.50	3.61	2.00
2014	215	EUR 141.861 bn	EUR 0.660 bn	EUR 0.180 bn	5.05	3.00	3.33	2.00
2015	217	EUR 125.520 bn	EUR 0.578 bn	EUR 0.167 bn	4.61	3.00	3.10	2.00
2016	192	EUR 124.019 bn	EUR 0.646 bn	EUR 0.145 bn	3.85	2.50	2.44	2.00
2017	193	EUR 121.384 bn	EUR 0.629 bn	EUR 0.201 bn	4.80	4.00	3.56	2.00

Source: Own calculations

The approach to identify a possible structural break in the data consists of multiple mean value comparisons with the respective year as factor variable. After performing the Shapiro-Wilk test, the normal distribution assumption is rejected at a significance level of 0.1% for both dependent variables *MLA* and *BR*. Thus, the Kruskal-Wallis test for

nonparametric independent samples is used in combination with the Benjamini-Hochberg α correction. The Kruskal-Wallis test is in this case superior to the ANOVA model since the normal distribution assumption is unnecessary and the α correction resolves the multiple testing problem (Bühner and Ziegler, 2017).

Table 4 Kruskal-Wallis Test with Benjamini-Hochberg α Correction

		Dependent Variable: Mandated Lead Arranger																
	Year / Year	’01	’02	’03	’04	’05	’06	’07	’08	’09	’10	’11	’12	’13	’14	’15	’16	’17
Dependent Variable: Bookrunner	’01				■	■				■	■	■	■	■	■	■	■	■
	’02				■	■				■	■	■	■	■	■	■	■	■
	’03									■	■	■	■	■	■	■	■	■
	’04									■	■	■		■	■	■		■
	’05									■	■	■		■	■	■		■
	’06									■	■	■	■	■	■	■	■	■
	’07									■	■	■	■	■	■	■		■
	’08									■	■	■	■	■	■	■		■
	’09	■	■	■			■	■									■	
	’10	■	■	■		■	■	■	■								■	
	’11	■	■	■			■	■									■	
	’12	■	■	■			■	■										
	’13	■	■	■		■	■	■	■								■	
	’14	■	■	■		■	■	■	■								■	
	’15	■	■	■			■	■									■	
	’16									■	■		■	■	■	■		
	’17	■	■	■		■	■	■	■								■	
Coloration of respective cell corresponds to a p-value < 0.05																		

Source: Own calculations

Based on the statistical results shown in table 4, the dummy variable *SB* will be included into the dataset starting with the year 2009 to model a possible structural break. It should be noted at this point that the mean values for 2016 also differ significantly at the 5% level from the mean values of most of the years following 2009. An explanatory approach could be that the crisis, triggered in 2009, resulted in a higher need for transaction security, which started to abate in 2016. Therefore, the year 2016 could rather be compared with the years before the crisis and gets marked with the dummy variable as well.

For further analysis, the variable *VOL* is converted by a natural logarithm transformation to *logVOL* and the variable *FX* is converted into a factor variable. For the first hypothesis, only the influence of the transaction volume on the number of *MLA* and *BR* titles is tested. For the second hypothesis, further operationalization is necessary to transform the abstract construct of complexity of a syndicated loan transaction into a testable model. The achieved data from Bloomberg offers several variables for this purpose. On the one hand, the number of facilities can be considered as an element of complexity. The more facilities are agreed upon, the higher the documentation efforts and the higher the transaction complexity. This analogy is also applicable to foreign currency facilities. The term of the transaction can also be described as an element of complexity since long-term transactions usually require a stricter due diligence to document the borrower’s creditworthiness (e.g. with strategic long-term planning documents). Finally, the status of competition within the banking circle can also be included through the number of passive arranger titles (lead arranger or arranger but not MLA) as one possible explanatory variable. The more banks are competing for leading positions, the more attractive the transaction should be and the greater the number of total mandates. For the second hypothesis, the effect of the explanatory variables *logVOL* (positive relationship), *ΔGA* (difference between *GA* and *MLA*; positive relationship), *TR* (negative relationship), LFZ_w (negative relationship) and *FX* (negative relationship) as factor variable is tested on the dependent variables. The full regression models are presented in the following equations (1) and (2).

$$MLA = \beta_0 + \beta_1 * logVOL + \beta_2 * \Delta GA + \beta_3 * TR + \beta_4 * LFZ_w + \beta_5 * FX + \beta_6 * SB \quad (1)$$

$$BR = \beta_0 + \beta_1 * logVOL + \beta_2 * \Delta GA + \beta_3 * TR + \beta_4 * LFZ_w + \beta_5 * FX + \beta_6 * SB \quad (2)$$

The testing is performed with the Ordinary Least Squares method. Since heteroscedasticity is present in the dataset, White's heteroscedasticity-consistent covariance matrix estimator (HC_0) is used to optimize standard error estimation.

4 Results and Discussion

The estimated regression models are presented in table 5, where t-statistics are shown in parentheses below the coefficient estimates, and 1% statistical significance is indicated in bold. The results point out that most transaction parameters have a significant effect on the number of MLA and Bookrunner mandates.

In the first hypothesis test, only the transaction volume is modeled as an explanatory variable. Both tests showed that the transaction volume (*logVOL*) has a significant positive effect on the number of allocated mandates so that the hypotheses H_{1A} and H_{1B} could be confirmed.

Table 5 Results of Regression Analysis

	MLA			***BR***		
	H_{1A}	H_{2A}	*SB* Model	H_{1B}	H_{2B}	*SB* Model
(Intercept)	**-28.6401** (-18.79)	**-31.0269** (-19.34)	**-33.9022** (-20.97)	**-16.2437** (-13.83)	**-17.9077** (-14.03)	**-19.9275** (-15.15)
logVOL	**1.6977** (20.77)	**1.8862** (21.36)	**1.9365** (22.71)	**0.9856** (15.63)	**1.0963** (15.66)	**1.1316** (16.53)
ΔGA		**-0.1161** (-6.06)	**-0.0618** (-3.39)		**-0.0584** (-4.03)	-0.0203 (-1.49)
LFZ_w		-0.0013 (-0.68)	0.0023 (1.18)		0.0031 (2.19)	**0.0057** (3.70)
TR		**-0.3792** (-7.54)	**-0.2947** (-6.32)		**-0.2155** (-6.65)	**-0.1561** (-5.32)
FX		**-1.1485** (-4.09)	**-1.0510** (-4.05)		**-0.7631** (-4.21)	**-0.6945** (-4.16)
SB			**2.3255** (14.47)			**1.6335** (13.64)
R^2	0.3041	0.3421	0.4032	0.2129	0.2393	0.3022
Adj. R^2	0.3037	0.3405	0.4015	0.2126	0.2375	0.3002

Source: Own calculations

The second hypothesis test, however, is not exactly corresponding with the predicted relationships. While rising transaction volume still has a positive impact on the mandate allocation, the *ΔGA* variable shows a significant negative influence. Thus, with more passive arranger titles less MLA and Bookrunner mandates are granted. A possible explanation could be that a company allocates passive arranger titles to important banks so that they don't leave the tender empty-handed although the important MLA and Bookrunner roles were assigned to a small group of other applicants. Regarding the number of facilities (*TR*) as well as the existence of a facility in foreign exchange (*FX*), the predicted significantly negative relationships were confirmed. The volume-weighted transaction term (LFZ_w), on the other hand, has no significant impact on the role allocation. Taking the coefficient of determination into account, the additional explanatory variables cause only a marginal improvement. The goodness of fit is majorly impacted by the transaction volume. Although the hypotheses H_{2A} and H_{2B} can be confirmed based on the given results, the model of complexity should be reconsidered in further research.

The third analysis, including the structural break dummy (*SB*), provides an unexpectedly proficient model improvement. The role allocation in the German syndicated loan market has been significantly affected by a structural break in 2009 which led to higher numbers

in MLA and Bookrunner mandates. A possible explanation could be the already discussed necessity for transaction security caused by the financial crisis.

The research results from the German market are partially consistent with the US market-based studies of Sufi (2007) as well as Chaudhry and Kleimeier (2015). Usually, large, listed companies have a higher degree of transparency due to disclosure obligations than small- or medium-sized enterprises. According to the authors, a lower degree of information asymmetries should lead to a higher degree of granularity in the syndicate. On the assumption that large-scale transactions are primarily initiated by larger companies, this thesis is confirmed since the transaction volume has a significant positive impact on the number of mandates. Furthermore, if it is assumed that large companies have more professional investor relation and press offices, and thus are able to influence the media reporting in their favor, the results of Bushman et al. (2016) are also confirmed.

5 Conclusions

The study shows that the syndicated loan market in Germany has developed dynamically regarding the allocation of MLA and Bookrunner titles and the average transaction volume. In particular, the effects of the financial crisis could have led to a sharp increase in the allocation of mandates creating a structural break in the dataset. On the other hand, the market has opened more and more for smaller transactions over the last few years, so mid-sized enterprises can also increasingly use this market segment and thus the benefits from a syndicated loan transaction.

The regression analysis reveals that transaction-related variables significantly affect the allocation of MLA and Bookrunner mandates. For example, it has been shown that the transaction volume has a significant positive effect on the number of mandated banks, whereas the complexity of the transaction, represented by the number and type of facilities as well as the total allocation of arranger titles, has a significantly negative impact on the mandate allocation. The weighted transaction term, on the other hand, could not be identified as significant determinant of role allocation. Projecting the results on practical application, financial managers should not only focus on the transaction volume, but also take the transaction complexity into consideration while determining the optimal cost-benefit-ratio resulting from role allocation in the transaction at hand.

Nevertheless, further research is necessary to improve the explanatory power of the model. In the next step, business-related indicators (e.g. leverage, EBITDA margin, and fixed-assets-ratio) could also be added to the explanatory variables. In addition, the significant difference of the year 2016 should also be further analyzed with data sets from the years 2018 et seq.

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Backtesting Expected Shortfall – Is There a Method Suitable for Middle-sized Banks?

Eugenia Schmitt

FinRiskConsult
Hammersbacher Str. 18, 81377 Munich, Germany
E-mail: eugenia.schmitt@finriskconsult.de

Abstract: *The financial crisis 2008 revealed weaknesses in the valuation and capital backing for market risks. The new regulatory requirements, the Fundamental Review of the Trading Book (FRTB), is a reaction of the Basel Committee on Banking Supervision and should create transparency based on a unification of market risk criteria to be met by all banks. One of the novelties is the move from Value at Risk (VaR) to Expected Shortfall (ES) as the standard for measuring risk and calculating capital. It is motivated by better theoretical properties of ES as a risk measure. Especially, VaR doesn't account for "tail risk". ES in contrast captures high-value low-probability events and has other advantages too. At the same time, ES has been criticized for unavailability of simple tools for its validation, for possibilities of backtesting. Because backtesting is one of the key quantitative tools used to assess the conservativeness of the risk measurement methodology, estimation techniques are being constantly improved. This article shows the current, new methods for backtesting ES reviewed in literature and discuss which methods are appropriate to implement in middle-sized banks. ES will be necessary for internal validation and for regulatory control. Hence, practical methods for backtesting the ES are of particular interest.*

Keywords: risk management, regulation, expected shortfall, backtesting, tail risk

JEL codes: G18, G21, G32, C18

1 Introduction

Measurement of risk is the core task of the risk management in financial institutions. The most popular method is the calculation of the Value at Risk (VaR). Even if it has many advantages, as f. e. an intuitive interpretation because it expresses the loss in the amount of money, or applicability to any financial instrument or to all risks in the portfolio, it has been criticized for some shortcomings. To the most important ones count its lack of subadditivity and its inability to include the tail risk. (Artzner et al. (1999), Acerbi, Tasche (2002)). It shows the amount of money a bank can lose with a pre-determined level of confidence within a given time period if a tail event doesn't occur.

These restrictions led to the application of an alternative risk measure. Expected Shortfall (ES) is a risk measure, which has the important property of coherence and it counts for the tail risk too. I. a. for this reason, in its consultative document on the Third Basel Accord, dated May 3, 2012, the Basel Committee on Banking Supervision (BCBS) recommends to replace VaR with ES in internal market risk models as a standard for measuring risk and calculating capital. On January 16th 2016, the BCBS published standards for minimum capital requirements for market risk where the VaR at level 1% is replaced with ES at level 2.5%. The implementation of the revised market risk standards is expected to be finalized by January 2019, and banks will be required to report under the new standards by the end of 2019. The ES calculation is calibrated on a stress period. Only sufficiently liquid risk factors may be used.

In addition to the determination of an appropriate risk measure, its validation is one of the central issues in market risk management. Statistical comparison of the predicted risk with the actually realized profit and loss has been established as an essential building block of backtesting procedure in banks. (Jorion, 2007) It is also one of the key quantitative tools used by the regulators to judge, how conservative is the risk measurement methodology. Beyond the regulatory requirements, backtesting also plays an important role in the

analysis of risk indicators. It provides useful information about the model and the input data used too. Practical methods for backtesting the ES are therefore of particular interest.

A debate about the unavailability of simple tools for ES-evaluation has been started very soon. The study by Gneiting (2011) pointed out that ES is not elicitable. This finding led to the belief, that ES could not be backtested efficiently at all. But, Acerbi and Szekely (2014) show, that this condition is not necessary for backtesting, it is rather connected to model comparision than to model testing. Fissler and Ziegel (2016) show that ES is jointly elicitable with VaR. Hence, it is possible to adopt the elicitability testing techniques for ES.

In recent years, a number of different backtesting ES frameworks have been proposed. For example, the quantile-space Coverage Test of Costanzino & Curran (2015, 2018) for the family of spectral risk measures. Backtest for ES based on cumulative violations as analogue to the common test for VaR by Du and Escanciano (2016). Acerbi & Szekely (2014) develop three price-space tests and show that elicitability is not a necessary condition for backtesting ES. Emmer et al. (2015) approximate ES by using VaRs with different levels and applying of standard backtesting tools. Righi and Ceretta (2013) propose the truncation-based ES backtests and use Monte Carlo simulation for significance. The approach of Wong (2008) who introduce a parametric saddle-point method and focusses the average of the portfolio-losses realized magnitude that breach the VaR level is close to the backtesting VaR. There are also a lot of works which use alternative methods as f. e. Berkowitz (2001), Kerkhof and Melenberg (2004) among others.

Many methods require advanced mathematical modelling, assumptions or large data samples. Middle-sized banks, which often have limited possibilities to establish and refine sophisticated procedures are interested on transparent, easy interpretable and easy implementable backtesting framework. Therefore, as a part of the literature review work, this article shows the new statistical methods for backtesting ES reviewed in current literature focusing two questions:

- What does elicitability mean and can the not-elicitabilty of ES hinder the backtesting?
- Is backtesting ES then more difficult as backtesting VaR?
- Are there methods suitable for implementing it in middle-sized banks, both in terms of performance and complexity?

The main finding is, that ES can be considered as a good risk measure and it is backtestable by existing backtest frameworks which display superior power to the standard methodology of Basel for VaR backtesting.

2 Methodology and Data

This paper provides an explanatory framework for a link between the risk measure and the procedure how to backtest the model results in the new light of the current regulatory environment based on a literature review. The aim of this paper is to offer a better understanding of possibilities for backtesting in middle-sized banks and the role which certain characteristics of risk measures play in backtesting. For this reason, the methods of description, analysis, synthesis and deduction are used.

Basic properties of Expected Shortfall

The limitation of VaR led to the implementation of an alternative, the coherent risk measure ES. The axioms of monotonicity, homogeneity, translation invariance and subadditivity define the known class of coherent risk measures. (Artzner et al., 1999) It also counts for the tail events of the loss distribution. Hence, ES is regarded as a suitable measure to substitute VaR. ES is formally defined as follows: (Yamai, Yoshiba, 2002; Chen, 2014)

Suppose L is a random variable denoting the loss of a given portfolio and $VaR_\alpha(L)$ is the VaR at the confidence level $100*(1-\alpha)\%$. Then $ES_\alpha(L)$ is defined by the following equation:

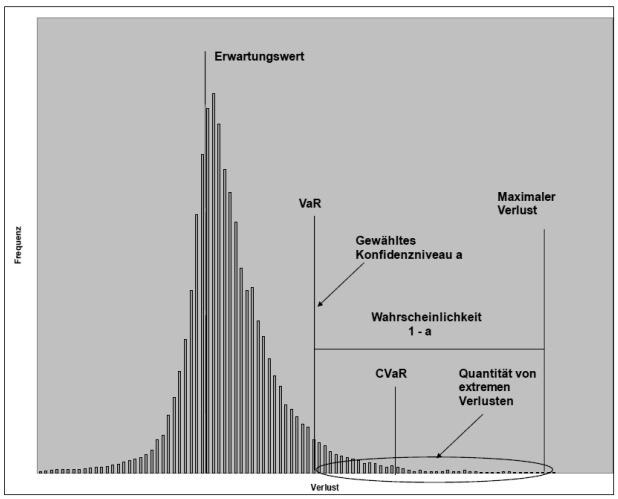
$$ES_\alpha(L) = \frac{1}{\alpha}\int_0^\alpha VaR_t(L)dt \quad (1)$$

If *L* is a continuous loss distribution, then ES is the expected loss conditional on the loss lying beyond the threshold *a*:

$$ES_{\alpha}(L) = E(L|L \geq VaR_{\alpha}(L)) \quad (2)$$

As shown in the figure 1, ES can be interpreted intuitively as the mean of all losses exceeding the VaR quantile, so it accounts for the tail risk. (Acerbi, Tasche, 2002).

Figure 1 Value at Risk and Expected Shortfall



Source: Schmitt E. (2014)

As can be seen in the figure 1, ES deals with extreme losses or losses of low probability but a possible high impact. Therefore, the number of such losses observed in the available data sample can be very small. Hence, it is necessary to design a backtest which deals with this problem.

Backtesting and backtestability

Jorion (2007, p. 139) defines backtesting as "*a formal statistical framework that consists of verifying that actual losses are in line with projected losses. This involves systematically comparing the history of VaR forecasts with their associated portfolio returns*.". He points out, that this process should be an integral part of all VaR systems.

The current work of Acerbi and Szekely (2017) proposes i. a. a formal definition of backtestable statistics. It is motivated by the revisions in regulatory requirements, the Fundamental Review of the Trading Book (FRTB) where the $VaR_{1\%}$ will be replaced with $ES_{2,5\%}$ as well as by the discussion if ES is backtestable in general, based on the findings by Gneiting (2011) who show that ES is not elicitable. The problem by testing of the accuracy of predictions y_t on a statistic $y(F_t)$ of the ("real") distribution F_t which is not known, is that $y(F_t)$ cannot be revealed ex post. The authors define the backtestability as follows: (Acerbi, Szekely, 2017, p. 11)

A statistic *y* is $\mathfrak{F}$-backtestable, if there exists a backtest function $Z_y = (y, x)$ such that

$$\mathbb{E}_F\left[Z_y(y, X)\right] = 0, \quad if \quad y = y(F), \ \forall F \in \mathfrak{F} \quad (3)$$

which is strictly increasing in the prediction $y, \forall F \in \mathbb{F}$

$$\mathbb{E}_F\left[Z_y(y_1, X)\right] < \mathbb{E}_F\left[Z_y(y_2\, X)\right] \quad if \ y_1 < y_2 \quad (4)$$

Backtestability allows model validation.

Is elicitability a necessary backtesting criterium?

The aim of the evaluation of a forecast is to compare estimates with observed values. Gneiting (2011) pointed out, that the mathematical property of elicitability is important for the determination of optimal point forecasts and following for backtesting. He shows, that VaR is elicitable, but generally ES does not fulfill this property. In general, a law invariant risk measure transforms a probability distribution into a single-valued point forecast. Hence, backtesting a risk measure denotes evaluating forecasting performance.

The concept of elicitability is originally introduced by Osband (1985) and formalized by Lambert et al. (2008). The definition of elicitability is linked to that of scoring functions. A scoring function assigns a numerical score to a single valued point forecast based on the forecasted point and realization. (Emmer et al., 2015, Gneiting, 2011) A standard example of a scoring function is f. e. the squared error $s(x, y) = (x-y)^2$ which is usually used for the forecasting the mean or the absolute error $s(x, y) = |x-y|$.

A forecasting statistic which can be expressed in terms of a value of a scoring function has the property of elicitability. For the property of elicitability to be valid, the scoring function must be strict consistent. The scoring function $s: \mathbb{R}x\mathbb{R} \rightarrow \mathbb{R}^+$ is consistent for the functional f relative to the class $\mathcal{P}$ of probability measures on $\mathbb{R}$ if and only if for all $P \in \mathcal{P}$, t $\in f(P)$ and $x \in \mathbb{R}$:

$$\mathbb{E}_p[s(t,L)] \leq \mathbb{E}_p[s(x,L)] \tag{5}$$

where is L a real-valued random variable with distribution P. (Emmer et. al., 2015, p. 36, Def. 2.5.) If the equality holds, the function s is strictly consistent, i.e. $x \in f(P)$. In this case it is possible to determine the optimal point forecast:

$$x = arg \min_x \mathbb{E}p[s(x, L)] \tag{6}$$

This means, that a functional can be seen as a minimization of a given scoring function. Formally, a risk measure ρ is elicitable related to the set $\mathcal{P}$ of the probability measures P given by L if a scoring function $s: \mathbb{R}x\mathbb{R} \rightarrow \mathbb{R}^+$ exists for which holds true: (Gneiting, 2011, p. 749-751.) For all $P \in \mathcal{P}$ and L P-distributed holds

$$\mathbb{E}_P s(\varrho(L), L) < E_P s(x, L) \tag{7}$$

Gneiting shows, that for ES a scoring function does not exist. But this finding does not mean, that ES is not backtestable. Even before 2011, Kerkhof and Melenberg (2004) published good performing tests using the functional delta method. The authors show that backtests for ES perform better than tests for VaR. In 2013 Emmer et al. showed conditional elicitability for ES consisting of two components which can be tested separately:

1. Calculate the quantile as $VaR_\alpha(Y)$
2. Calculate $ES_\alpha(Y)$

This property is an outcome of the elicitabilty of VaR because ES as conditional of VaR takes a subset of the outcomes for which is ES a mean. A mean is elicitable. Emmer et al. (2013) as well as Acerbi and Szekely (2014) concluded, that ES is the most appropriate risk measure. Even if it cannot be backtested by using a single scoring function, there are other suitable methods for backtesting. Some of them are presented in the next subpoint.

Common current backtesting methods

According to Emmer et al. (2015) there are three main groups of backtesting methods depending on the type of forecast.

- **The point forecast**

Value of a variable is usually represented as the conditional expectation. Mean of an error measure or a scoring function, where the scores are averaged over forecast cases, is compared with the absolute error or squared error. (Gneiting, 2011). There are well established methods, f. e. Elliot et al. (2013).

- **The probability range forecast**

It is an interval forecast for VaR and ES, where an interval is projected. Here, the value lies in with the chosen probability. VaR backtesting is well developed. Campbell (2006) shows a comprehensive review of backtesting methods.

- **The complete probability distribution forecast** or probability density function, Gneiting, Katzfuss (2014).

Current methods for backtesting ES

In the following, two different methods of backtesting ES published after 2014 will be outlined. They are parametric as well as non-parametric and with as well as without simulation required. For implementing in middle-sized banks, these properties are of the primary interest. There are more methods presented in the literature which are not mentioned here. The methods chosen here do not need large data samples and so they deal comfortably with the problem of few data availability.

1. Three unparametric methods, Acerbi and Szekely (2014)

Acerbi and Szekely (2014) presented three ES backtests which are model independent, free of distributional assumptions other than continuity and are non-parametric. They require more information but are easy to implement. The authors use the conditional elicitability of ES, define a test statistic and use simulations for significance.

The first method:

The ES is exploited as conditional on VaR and is written as:

$$\mathbb{E}\left[\frac{X_t}{ES_{\alpha,t}} + 1 \mid X_t + VaR_{\alpha,t} < 0\right] = 0 \tag{8}$$

X is a random variable, it represents returns.

The authors assume that VaR has been tested already and test separately the magnitude of the realized exceptions against the model predictions. They determine the test statistic using an indicator function of an *α*-exception and define the backtest function as:

$$Z_1(X) = \frac{\sum_{t=1}^{T} \frac{X_t I_t}{ES_{\alpha,t}}}{\sum_{t=1}^{T} I_t} + 1 \tag{9}$$

The realized value $Z_1(x)$ is expected to be 0. If it is negative, ES is underestimated. The test averages over exceptions and is insensitive to an excess of exceptions.

The second method:

This is a direct test for ES, without previously testing VaR, following from the unconditional expectation

$$ES_{\alpha,t} = -\mathbb{E}\left[\frac{X_t I_t}{\alpha}\right] \tag{10}$$

$$Z_2\vec{X} = \sum_{t=1}^{T} \frac{X_t I_t}{T\alpha ES_{\alpha,t}} + 1 \tag{11}$$

If $Z_2 < 0$ then ES is underestimated. The test averages over all days. It identifies an excess of exceptions. It is possible to extend the test to non-continuous distributions by replacing the indicator function. Frequency and magnitude of *α*-tail events are evaluated jointly.

The third method:

This method is a direct test for ES. It is inspired by Berkowitz (2001) and based on the test of the entire return distribution – the test for uniformity of the tail of empirical distribution. To each quantile its value importance is assigned. It depends on the shape of the tail of the distribution. A continuous predictive distribution P_t is assumed. It is to test whether the observed ranks $U_t = P_t(X_t)$ are i.i.d. and uniformly distributed $U(0,1)$. ES is estimated as:

$$\widehat{ES}_{\alpha}^{(N)}(\vec{Y}) = -\frac{1}{[N\alpha]} \sum_{i}^{[N\alpha]} Y_{i:N} \tag{12}$$

and it is the average of *Nα* worst results, where *N* is the number of observed returns, $Y_{i:N}$ is order statistics, $\vec{Y} = \{Y_i\}$ a vector of *N* i.i.d. draws. The test statistic the authors use is defined as:

$$Z_3(\vec{X}) = -\frac{1}{T}\sum_{t=1}^{T}\frac{\widehat{ES}_\alpha^{(T)}\left(P_t^{-1}(\vec{U})\right)}{\mathbb{E}_V\left[\widehat{ES}_\alpha^{(T)}\left(P_t^{-1}(\vec{V})\right)\right]} + 1 \tag{13}$$

where $U_t = P_t(X_t)$ are i.i.d. $U(0,1)$; $\vec{U} = \{U_t\}$, $\vec{V}$ are i.i.d. $U(0,1)$.

The hypothesis uses weak stochastic dominance. ES is underestimated if $Z_3 < 0$. ES is backtested with other quantiles jointly. This test is less natural, but very general.

2. Backtesting distribution forecast, Emmer, Kratz, Tasche (2015)

The proposed model is based on the representation of ES as an integrated VaR (Acerbi, Tasche, 2002). The authors define four supporting points and calculate VaR amounts to approximate ES linearly. In the practical use, the number of supporting points should be determined individually depending on the sample size. The authors define ES as follows:

$$\begin{aligned} ES_\alpha(L) &= \frac{1}{1-\alpha}\int_\alpha^1 VaR_u(L)du \\ &\approx \frac{1}{4}\left[VaR_\alpha(L) + VaR_{0,75\alpha+0,25}(L) + VaR_{0.5\alpha+0.5}(L) + VaR_{0.25\alpha+0.75}(L)\right] \end{aligned} \tag{14}$$

The idea is as follows: if each of the VaRs can be backtested and is appropriate, the estimate of ES is reliable. An examination of the tail of the loss data sample which is higher than 2,5% should be manually reviewed whether in the observation data are some outliers. Hence, for backtesting ES, the different VaR values are backtested jointly.

3 Results and Discussion

The backtesting of VaR tests a point forecast, the methods are based on counting exceptions. Hence, VaR is not difficult to backtest. As Acerbi and Szekely (2014) pointed out, it is not because of the elicitability of VaR, but being a quantil it is a Bernoulli random variable. ES is not directly backtestable and another approach has to be made. This issue is not connected to the lack of elicitability.

In order to compare the predicted ES with the realized one, all methods outlined in the present paper are able to reject the predicted ES if it is not accurate. The strongest performance shows Acerbi and Szekely's (2014) first method. The rejections of their second and third method as well as the ones of the model proposed by Emmer et al. (2015) are depending on the number of exceedances.

For middle-sized banks the three tests of Acerbi and Szekely (2014) seems to be the most appropriate ones, because they are non-parametric and contain no model assumption. Hence, the model risk can be omitted. Anyhow, for the statistical test, Monte Carlo simulation is necessary. Additionally, they are suited for regulatory purposes. As the authors show, they also have superior power to the standard Basel-VaR-backtesting.

The backtesting method proposed by Emmer et al. (2015) is the less complex method among the current approaches and therefore it can be implement easily by middle-sized banks. Compared to the alternative models, it is a comfortable approach because it approximates several VaR levels and combines statistical testing with manual inspections of data in the upper tail of the distribution. It does not rely on any simulation. To use this method, availability of sufficient amount of high quality data is necessary. In order to reach the same certainty level, more data are required for the ES validation compared to the VaR validation because for the calculation of ES at the level *α*, currently it is *2,5%*, just *α%* of the sample can be used. If only a few data are available, the statistical power of rejection of an inaccurate model will be low. To choose an appropriate confidence level still can be a challenge.

For banks which are already using Monte Carlo method and parametric distribution, the Acerbi and Szekely's (2014) first model is recommended for their internal model. Banks using historical simulation should choose the model of Emmer et al. (2015).

4 Conclusions

Backtesting ES will be necessary for both, internal validation and fulfilling of regulatory requirements. To find an appropriate backtesting method of ES is therefore of a great interest. The main finding is, as Acerbi and Szekely (2014) show, that elicitability is not a problem which would hinder backtesting ES. There are a number of practicable approaches which can be implemented easily by middle-sized banks. All of the here proposed backtests have a superior power to the standard VaR methodology used by Basel. To reach the same level of certainty more validation data is required for ES than for VaR. Full predictive distributions have to be stored. It should not be a technical problem any more but it is still a challenge for an audit process.

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Profitability of Sector Mutual Funds and ETFs during Market Development

Martin Sirucek[1], Jan Vystoupil[2], Petr Strejček[3]

[1] Mendel University in Brno
Faculty of Business and Economics, Department of finance
Zemědělská 1, 613 00 Brno, Czech Republic
E-mail: martin.sirucek@mendelu.cz

[2] Mendel University in Brno
Faculty of Business and Economics
Zemědělská 1, 613 00 Brno, Czech Republic
E-mail: martin.sirucek@mendelu.cz

[3] Mendel University in Brno
Faculty of Business and Economics, Department of Finance
Zemědělská 1, 613 00 Brno, Czech Republic
E-mail: petr.strejcek@mendelu.cz

Abstract: *Paper is focused on the profitability of investment into IT, finance, healthcare and consumer goods oriented active and passive mutual funds and ETFs and its profit/loss on growing, stagnant and decreasing market. Attention is also focused on purpose to set a recommendation for investors what instrument bring higher return/lower loss on growing or decreasing market and if investor can expect different results according to the sector orientation, like what sector is more sensitive on bullish or bearish trend. Our result show that ETF nor passive mutual funds wasn´t able to beat the market, where sector index brings in all situations better results than these investments. On bearish trend all sector ETFs and passive mutual funds bring same results as sector index, better results bring only active managed mutual funds. The lowest loss during this period brings healthcare active managed mutual funds. On bullish/stagnant market was pretty the situation the same, but on the growing market passive funds and ETF are more profitable than active mutual funds.*

Keywords: ETF, mutual fund, Sharpe ratio, standard deviation, tracking error

JEL codes: G11, G15

1 Introduction

Active and passive portfolio management and/or differences in the returns of the active and passive managed funds (incl. the ETFs) have long been a subject of discussion in the investment world. Conclusions of the recently performed studies have tended to suggest that the fund managers are not able to overcome the market in the long run and are lagging behind performance of the passive mutual funds and/or the benchmark copying ETFs.

Jensen (1968) examined performance of 115 mutual funds for the period 1945-1964. Results of his study show that the active fund managers were on average not able to overcome performance of the S&P 500 benchmark, as evidenced by the negative alpha coefficient. Only 39 funds had the alpha coefficient higher than 0. One further study, dealing with comparison of performance of the passive and active investment strategy of the mutual funds, was realized by Grinblatt, Titman (1989). Conclusion of their study, in principle, corresponds with Jensen's conclusion; the latter states that aggressive growth funds, growth funds and funds with a small volume of means may have the performance above average, but it is interesting that these funds at the same time reach the highest cost level and therefore their real performance, after deduction of the management costs, does not reach the performance above average. This suggests that the investors cannot benefit from capabilities of the portfolio managers managing these funds. A similar conclusion was reached by Malkiel (1995), who examined performance of the equity mutual funds in the period of 1971 and 1991. Conclusion of his study, therefore, confirms that the

analysed active funds – after deduction of the total expense ratio (TER)- lagged behind the market performance, and adds that the investor pays to invest into the low-cost index funds rather than to rely on portfolio manager capabilities of the active mutual funds. One of the more recent studies concerning this issue was performed by Solin (2015). In his study, the author presents similar conclusions like the previous authors, namely that in the long-term investment horizon, most of the active managed mutual funds lag behind the risk-weighted benchmark yield. The author also pinpoints that, when considering the taxes, the chance that an active mutual fund will beat a comparable passive mutual fund is almost zero.

Results of the Ippolito study (1989) came the conclusion opposite to that of the authors mentioned above. The Ippolito study examined 143 funds in the period of 1965-1984 and compared their performance with the S&P 500 index. His results suggest that the risk-weighted returns of the active mutual funds defeated the index even after deduction of all charges and costs. Kon (1983) states in his study that managers of the active managed funds have a certain ability of market timing. However, the other tests stress that the fund managers have little or no special information concerning unexpected market returns. Brown, Goetzmann (1995) study has contributed by the fact that, based on the past performance of specific funds, we can assume which funds to avoid in the future, but there is no indication that if some funds defeated the benchmark in the past, they will beat it in the future as well.

The study by Harper, Madura, Schnusenberg (2006) deals with comparison of performance of the international ETFs and the closed-end funds investing into the closed-end country funds. The study was performed on the basis of the monthly data for the period of 1996-2001. The authors confirm that ETFs have a low tracking error compared with their benchmark, i.e. that ETFs replicate their underlying index almost exactly. Conclusion of their study confirms the hypothesis that the ETF funds have achieved on average higher returns than the closed-end country funds. This claim is justified mainly by the fact that the ETF funds have a lower expense ratio. They author also state that the ETF funds have on average a higher Sharpe ratio than the corresponding closed-end country funds and hence the ETFs earn higher returns than the funds utilizing the active investment strategy, which the closed-end country funds are based on. Rompotis (2009) has brought an interesting study; the author compared performance of the index mutual funds and the ETFs within a single Vanguard "family". His analysis included in total 20 equity ETFs and 12 index mutual funds, and values of historical performance from the beginning of trading of the relevant fund till the end of 2006 were taken for each individual fund. Results of its study show that the ETFs and the index funds have similar average return and risk rate values. Which means that Vanguard approaches these two alternative investments in a similar way. Furthermore, ETFs and the index funds achieve lower return and risk rate than their benchmarks.

In his study, Sharifzadeh, Hojat (2011) was concerned with comparison of performance of the ETFs and the index mutual funds in the period of 2002-2010. With respect to the fact that ETFs and the index funds are very similar by their nature and are considered substitutes, the author has tried to justify why popularity of the ETFs has been growing so steeply since 2000. He included in total 34 ETFs, broken down into 12 different investment styles (U.S. Large Cap, U.S. REITS,...), and 66 index funds with the same investment styles were affixed to these ETFs. The author de facto compared performance of in total 230 different pair combinations (58% of cases). Results of this study show that in terms of the Sharpe ratio, the ETF funds defeated the index funds in 134 cases out of in total 230 pair combinations. Conclusions of this study suggest that there is no statistically significant difference in returns between ETFs and the index funds at the level of individual funds, and that the investors choose between these funds, depending on specific characteristics of individual products and the tax benefits. Agapova (2011), in her study, has investigated whether or not the traditional index funds and the ETFs can be considered substitutes. The study was performed with a sample of 171 index mutual funds and 11 ETFs in the period of 2000 and 2004. ETFs can be preferred by the investors with a higher

liquidity, higher business needs and a higher tax sensitivity, whilst the traditional index funds can be preferred by the investors with a lower liquidity, lower business needs and a lower tax sensitivity. According to this study, the traditional index funds and the ETFs can be considered substitutes, but not the perfect ones. Agapova also came to the conclusion that ETFs have on average a lower tracking error and higher post-tax returns than the index funds. Park, Jung and Choi (2014) have established that ETFs and the index funds are substitutes, as the investors choose between these instruments on the basis of their specific investment characteristics. Bello (2012) conducted a study comparing the equity ETFs and the stock index funds over a long period and on a relatively large sample of funds. In particular, he included in total 468 index funds and 337 ETFs into his study, and their performance was tracked for the period of 2001 to 2012. Bello has established that ETFs outperform the index funds, but with a higher volatility. Furthermore, ETFs have a lower expense ratio, a lower portfolio turnover and fewer shares included in the portfolio, thus being less diversified than the index funds. Bello came to the conclusion that the ETFs had a greater tracking error and tracking error volatility than the mutual funds, which contradicts the Kostovetsky study (2003) absolutely.

2 Methodology and Data

To compare performance of the ETFs, index (passive) and active managed mutual funds, funds from 4 economic sectors, having the highest representation - according to S&P Dow Jones Indices (2018) in the S&P Composite 1500 index by the GICS sector categorization - have been chosen. These sectors are as follows: Information Technology (24.4%, S&P 1500 Information Technology benchmark), Financials (15.3%, S&P 1500 Financials benchmark), Health Care (13.4%, S&P 1500 Health Care benchmark) Cons Discretionary sector (12.7 %, S&P 1500 Cons Discretionary benchmark). From each sector, 1 ETF, 1 index mutual fund, 1 active managed mutual fund (a large cap fund) and 1 active managed mutual fund (a small cap fund), were selected. Selection of the funds entering into the analysis was performed objectively with strict adherence to the following criteria.

Common criteria for selection of ETF and passive/active managed mutual funds:

- Within the examined sector, 1 ETF, 1 passive and 1 active mutual fund with the highest / lowest NAV value is always selected.
- Establishment of the fund before 2007 (i.e. adequate fund history).
- It must be a share (investment) fund.
- At least 90% of all fund assets are invested in US companies. At least 80% of all fund assets are invested in sector shares.
- ETF funds are designed, based on physical replication.
- The fund must have at least 3 star ratings by Morningstar on 28.02.2018[23].
- Option to choose automatic reinvestment of dividends or payment of dividends to the businessman account.
- Fund denominated in US$.

Performance and risk rate of the funds is assessed in context with market development and its trend. Individual phases were monitored within the following time periods:

- Decline stage - period from 01.10.2007 till 31.01.2009.
- Growth stage – period from 01.09.2011 till 31.01.2015.
- Stagnation stage - period from 01.03.2015 till 30.04.2016.

These periods were chosen according to the Chow (1960) procedure (the same approach used e.g. Rapach, Wohar (2004)), to test the null hypothesis of no structural change (H_0: $\delta = 0$) against the alternative hypothesis of a structural break at period k (H_1: $\delta \neq 0$). The Chow (1960) test is based on the Wald statistic:

[23]Morningstar assesses ETFs and mutual funds by applying a 1 to 5 star scale, based on the achieved performance (taking into account risks and charges) compared with similar mutual funds and the ETFs. Morningstar (2018)

$$F_k = \frac{(T-2)\cdot\sigma_R^2-(T-4)\cdot\sigma_k^2}{\sigma_k^2} \quad (1)$$

Where:

$\sigma_k^2 = \frac{(\varepsilon_k'\cdot\varepsilon_k)}{(T-4)}$, $\sigma_R^2 = \frac{(\varepsilon_R'\cdot\varepsilon_R)}{(T-2)}$ and ε_k is the vector of least-squares residuals from:

$$r = X\beta^0 + X_{0k}\delta + \varepsilon \quad (2)$$

and ε_R is the vector of least squares residuals from equation (2) with the restriction $\delta = 0$. Intuitively,we reject the null hypothesis of no structural break if the sum of squared residuals corresponding to the model with no breaks is significantly greater than the sum of squared residuals corresponding to the model with a break at period *k*.

The paper uses methodology of calculation of the returns applied by Sharifzadeh and Hojat (2011) in his study. Returns of individual funds are calculated in the so-called Total Return form.

$$TR_m = \left\{\frac{NAV_1*\left(\frac{1+Distribution}{Reinvestment\ NAV}\right)-NAV_0}{NAV_0}\right\}*100 \quad (3)$$

Where:

TR_m	monthly value of the Total Return
NAV_0	value of the assets per one investment certificate at the beginning of the period
NAV_1	value of the assets per one investment certificate by the end of the period
$Reinvestment\ NAV$	price of the share on the day when all capital and dividend profits are reinvested
$Distribution$	amount of dividend and capital gains that are reinvested within a given period of time

The standard deviation was used to quantify the risk rate of individual funds.

$$Q_P = \sqrt{\frac{1}{n}*\sum_{i=1}^{n}(R_i-\bar{R})^2}\ Q_A = Q_P\sqrt{12} \quad (4)$$

Where:

Q	monthly standard deviation
n	number of months
R_i	return on investment in month *i*
$\bar{R}$	average monthly e Total Return value of the investment in question
Q_A	annualized monthly standard deviation

The Sharpe ratio is used to assess performance and risk rate. According to the Morningstar methodology (2018), the arithmetic Sharpe ratio is calculated, using the following formula.

$$Sharpe\ ratio_A = \frac{[\prod_{i=1}^{n}(1+R_i)]^{\frac{m}{n}}-[\prod_{i=1}^{n}(1+RF_i)]^{\frac{m}{n}}}{StDev_A} \quad (5)$$

$$StDev_A = \sqrt{\frac{1}{n-1}*\sum_{i=1}^{n}(R_i-\bar{R})^2} \quad (6)$$

Where:

$StDev_A$	annualized arithmetic standard deviation
R_i	return on investment for the period *i*
RF_i	return on risk-free investment for the period *i* (risk-free interest rate)
m	number of periods (observations) per 1 year
n	total number of periods
$\bar{R}$	average return on investment over the reference period

One of the components of the overall risk (standard deviation) can be reduced by a suitable diversification. The second non-diversifiable component is the rate of the systematic risk beta, measuring sensitivity of the investment to the movements of the selected market benchmark.

$$\beta = \frac{Cov\,(r_{Si}, r_m)}{(Q_m)^2} \tag{7}$$

Where:

$Cov\,(r_{Si}, r_m)$ covariance between the rate of return of the investment and the rate of return of the market index

$(Q_m)^2$ spread of market index return

The Excess Return is the last indicator used for comparison of performance of individual funds. This indicator is calculated simply as the difference between the return of the fund and return of the benchmark, which the fund in question is compared with.

The coefficient of determination measures the relationship (correlation) between the fund and the selected benchmark and determines how many percent of the movements of the monitored fund can be explained by benchmark movements. According to Morningstar (2018), value of coefficient of determination 70-100% indicates a good correlation between the fund and benchmark returns, 40-70% indicates an average correlation between the fund and benchmark returns, and 1 - 40% indicates a low correlation. The coefficient of determination can also be interpreted so that in case of high values of this coefficient, the market risk represents a high share in the total market risk and the chosen benchmark is suitable for comparison and vice versa.

3 Results and Discussion

Table 1 shows that at the decline stage, outbreak of the financial crisis, a large uncertainty prevailed in the US stock market, with an average monthly standard deviation of around 5.74%. During this period, the US stock market recorded the average monthly losses of -3.40%. At the growth stage, the US stock market recorded an average monthly return of about 1.5%, with the lowest volatility compared to the decline and stagnation periods. From the results calculated for the stagnation phase, it follows clearly that during this period the US stock market recorded only negligible returns, but with a high average monthly volatility of ca 3.89%.

Table 1 Performance of the S&P Composite 1500 Index in Individual Market Stages

	Bearish market	**Bullish market**	**Stagnant market**
Total return (p.a.)	-35.32%	17.95%	0.34%
Average monthly profit	-3.40%	1.44%	0.10%
Standard deviation (p.a.)	19.89%	11.60%	13.47%
Average monthly st.dev.	5.74%	3.35%	3.89%
Sharpe ratio	-1.87	1.54	0.02

Source: own calculation

Table 2 shows the return and risk indicators of the analyzed funds and their development in the period, when the US stock market experienced a steep decline. We can say that the ETFs and the index mutual funds are developed nearly identically during the period of market decline, reaching similar monthly losses and monthly standard deviations. From the overall view, during the decline stage of the US market, the active managed mutual funds were doing better compared with the ETFs and the index mutual funds. On average, the active managed funds had lower monthly losses and lower monthly standard deviation values, which fact is also linked with a better Sharpe ratio. We can therefore say that active managed mutual funds are more suitable for a declining market than ETFs and the index

mutual funds, because they can better reallocate the assets and record lower losses. If we compare individual sectors, we can claim that the funds focused on the Financials sector were the worst. These funds reached the highest monthly losses with the highest volatility. In this case, however, the result is not surprising, as the Financials sector was at the start of the financial crisis. On the other hand, the funds from the Health Care sector reached the best results in the period when the US stock market declined steeply. The average monthly loss of the funds from this sector was only ca -1.80%, with the average monthly volatility of 5.5%, and the annualized excess return reached 14.34% on average. The ETFs, the index mutual funds as well as the active managed mutual funds developed almost identically within the Health Care sector. Interesting findings follow from the coefficient of determination. All analysed funds from the IT sector and the Cons Discretionary sector exceed 70%. Furthermore, based on the classic Beta indicator, which is higher than 1.0 for all these funds, we can state that in the declining market the funds from these sectors develop in the direction of the market, but with a significantly higher volatility. Funds from the Financials and Health Care sectors reach the absolutely opposite results; all funds from these sectors have the coefficient of determination lower than 70%, which means that the market explains less than 70% of their volatility, and hence the return on these funds is influenced and affected by other factors.

Table 2 Risk and Profit Profile of Funds on Bearish Market

Fund	Sector	Total return (p.a.)	Av. monthly loss	St. dev. (p.a.)	Av. monthly st. dev.	Sharpe ratio (p.a.)	Excess return	Beta	R^2
ETF	IT	-35.71 %	-3.36 %	25.08 %	7.24 %	-1.50	-0.38 %	1.17	85 %
	Finance	-61.19 %	-7.08 %	33.92 %	9.79 %	-1.86	-25.86 %	1.30	58 %
	Health Care	-18.77 %	-1.60 %	16.95 %	4.89 %	-1.22	16.55 %	0.68	63 %
	Cons. Discert.	-37.39 %	-3.58 %	24.34 %	7.03 %	-1.61	-2.07 %	1.13	85 %
Passive mutual funds	IT	-36.25 %	-3.38 %	27.08 %	7.82 %	-1.41	-0.92 %	1.26	86 %
	Finance	-55.63 %	-6.11 %	31.84 %	9.19 %	-1.80	-20.30 %	1.24	59 %
	Health Care	-19.12 %	-1.62 %	17.94 %	5.18 %	-1.17	16.21 %	0.73	65 %
	Cons. Discert.	-40.49 %	-3.95 %	26.06 %	7.52 %	-1.62	-5.16 %	1.22	87 %
Active large cap mutual funds	IT	-28.19 %	-2.43 %	26.41 %	7.62 %	-1.14	7.13 %	1.13	72 %
	Finance	-52.70 %	-5.76 %	26.00 %	7.50 %	-2.10	-17.38 %	1.07	67 %
	Health Care	-19.79 %	-1.61 %	22.80 %	6.58 %	-0.95	15.54 %	0.95	68 %
	Cons. Discert.	-32.23 %	-2.95 %	24.08 %	6.95 %	-1.41	3.09 %	1.09	80 %
Actives mall cap mutual funds	IT	-35.74 %	-3.34 %	26.13 %	7.54 %	-1.44	-0.42 %	1.11	71 %
	Finance	-32.53 %	-3.10 %	17.59 %	5.08 %	-1.95	2.80 %	0.41	21 %
	Health Care	-26.28 %	-2.37 %	18.59 %	5.37 %	-1.51	9.05 %	0.70	56 %
	Cons. Discert.	-35.04 %	-3.28 %	24.40 %	7.04 %	-1.51	0.29 %	1.07	76 %

Souce: own calculation

From the calculated results in Table 3, we can state that the large cap active managed mutual funds reached the highest monthly return from all monitored funds at the growth market stage, in average and across all sectors. However, these large cap active managed mutual funds also revealed the highest risk rate, as their average monthly volatility was ca 4.35%. Taking in view the Sharpe ratio, we can say that on average and across all sectors, the ETFs and the index mutual funds clearly outperformed the active managed mutual funds. It can also be claimed that at the growth stage, the ETFs and the index mutual funds were less volatile and hence less risky than the active managed mutual funds.The previous claim can be supported by the Excess Return indicator, according to which the ETFs and the index mutual funds were in average and across all sectors (except the funds investing into the Health Care sector) more successful in reaching higher excess

returns than the active managed mutual funds. In this case the active mutual funds were able to bring higher excess returns to the investors than ETFs and the index mutual funds. When analysing individual sectors, the funds from the Health Care sector followed by the funds from the Cons Discretionary sector again reached the best results. Both in the period of decline and in the period of growth, the funds from the Health Care sector seem to be the most advantageous investment, taking in view the Sharpe ratio. On the other hand, funds from the Financials sector were once again the worst in this period, in terms of the Sharpe ratio, mainly due to a high volatility of these funds. Funds from the IT sector are relatively surprising, because at the growth stage they were unable - in the majority of cases - to beat average returns of the US stock market. From the point of the coefficient of determination, we can say that none of the analysed funds from the Health Care sector reached the eligibility limit of 70%, and it can be stated that the returns of the funds focused on this sector cannot be explained primarily by development of the US stock market, it means that there are even other active variables ensuring such good results of this sector. On the contrary, movements of all funds from the Financials sector are explained - from 70% as a minimum - by movements in the US stock market.

Table 3 Risk and Profit Profile of Funds on Bullish Market

Fund	Sector	Total return (p.a.)	Av. monthlyloss	St. dev. (p.a.)	Av. monthly st. dev.	Sharpe ratio (p.a.)	Excess return	Beta	R^2
ETF	IT	17.51 %	1.41 %	11.69 %	3.37 %	1.49	-0.44 %	0.88	76 %
	Finance	19.31 %	1.59 %	16.33 %	4.71 %	1.18	1.36 %	1.29	84 %
	Health Care	26.10 %	1.99 %	10.07 %	2.91 %	2.59	8.15 %	0.71	67 %
	Cons. Discert.	21.82 %	1.73 %	13.08 %	3.78 %	1.66	3.86 %	1.06	88 %
Passive Mutual funds	IT	18.32 %	1.48 %	13.47 %	3.89 %	1.36	0.36 %	1.03	79 %
	Finance	18.58 %	1.53 %	15.40 %	4.44 %	1.20	0.62 %	1.24	88 %
	Health Care	27.00 %	2.06 %	10.55 %	3.04 %	2.55	9.04 %	0.74	67 %
	Cons. Discert.	22.03 %	1.75 %	13.76 %	3.97 %	1.60	4.07 %	1.12	89 %
Active large cap mutual funds	IT	17.13 %	1.42 %	14.97 %	4.32 %	1.14	-0.82 %	1.06	67 %
	Finance	17.12 %	1.44 %	16.86 %	4.87 %	1.01	-0.84 %	1.32	82 %
	Health Care	35.79 %	2.66 %	13.90 %	4.01 %	2.57	17.83 %	0.83	48 %
	Cons. Discert.	22.14 %	1.77 %	14.60 %	4.22 %	1.51	4.18 %	1.03	66 %
Active small cap mutual funds	IT	14.93 %	1.25 %	14.48 %	4.18 %	1.03	-3.02 %	1.10	78 %
	Finance	18.22 %	1.52 %	16.63 %	4.80 %	1.09	0.27 %	1.27	78 %
	Health Care	27.84 %	2.11 %	10.29 %	2.97 %	2.70	9.89 %	0.71	63 %
	Cons. Discert.	18.78 %	1.52 %	13.58 %	3.92 %	1.38	0.83 %	1.03	78 %

Source: own calculation

The stagnation phase was chosen for the period when a considerable uncertainty regarding future development on the US stock market was prevailing, and the S&P 1500 return index for this period was finally only 0.40%. During this period of stagnation, 2 sharp drops were recorded, but they only had a short duration of several tens of days. In particular, the first drop in August 2015 was caused primarily by the fall of the Chinese stock and the US market responded by a drop as well. The second drop was reported at the beginning of 2016, when the negative mood lasting from summer of 2015 really hit; reports of the slowing Chinese economy and fall in oil prices did not have a positive impact on the stock markets. Then there was a sharp rise in stocks till the end of 2017.

It was again confirmed that both the ETFs and the index mutual funds are developed almost identically, and there are only slight differences in their performance. If we compare performance of the funds from the point of the Sharpe ratio, we can say that the ETFs and

the index mutual funds achieve slightly better results than the active managed mutual funds during the stagnation period across all sectors. Furthermore, it cannot be claimed explicitly that the ETFs and the index mutual funds would be less volatile than the active mutual funds, taking in view the standard deviation indicator. In this period, the funds from the Cons Discretionary sector were explicitly the best, when (with a single exception) all the small cap active managed mutual funds reached a positive Sharpe ratio value. Further on, the funds focused on this sector showed the lowest volatility and the highest excess return values. Quite surprising is performance of the funds from the Health Care sector. The Health Care sector achieved the best results in the period of decline and even in the period of growth. However, during the stagnation period, this sector, together with the Financials sector, ranked among the worst ones.

Table 4 Risk and Profit Profile of Funds on Stagnant Market

Fund	Sector	Total return (p.a.)	Av. monthlyloss	St.dev. (p.a.)	Av. monthly st. dev.	Sharpe ratio (p.a.)	Excess return	Beta	R^2
ETF	IT	0.12 %	0.11 %	16.65 %	4.81 %	0.00	-0.22 %	1.12	82 %
	Finance	-1.73 %	-0.05 %	15.68 %	4.53 %	-0.12	-2.07 %	1.07	84 %
	Health Care	-1.47 %	-0.03 %	15.50 %	4.48 %	-0.10	-1.81 %	0.96	69 %
	Cons. Discert.	5.29 %	0.51 %	14.35 %	4.14 %	0.36	4.95 %	1.02	91 %
Passive Mutual funds	IT	-2.33 %	-0.09 %	17.13 %	4.95 %	-0.14	-2.66 %	1.19	87 %
	Finance	-0.97 %	0.01 %	15.13 %	4.37 %	-0.07	-1.31 %	1.03	84 %
	Health Care	-2.88 %	-0.13 %	16.62 %	4.80 %	-0.18	-3.22 %	1.00	66 %
	Cons. Discert.	2.54 %	0.28 %	13.81 %	3.99 %	0.17	2.20 %	0.99	92 %
Active large cap mutual funds	IT	-1.24 %	0.03 %	19.00 %	5.49 %	-0.07	-1.58 %	1.10	60 %
	Finance	-5.67 %	-0.40 %	14.94 %	4.31 %	-0.39	-6.01 %	1.04	87 %
	Health Care	-7.83 %	-0.52 %	19.76 %	5.70 %	-0.40	-8.17 %	0.97	43%
	Cons. Discert.	9.76 %	0.85 %	13.41 %	3.87 %	0.72	9.42 %	0.87	75 %
Active small cap mutual funds	IT	-0.91 %	0.02 %	16.25 %	4.69 %	-0.06	-1.25 %	1.11	85 %
	Finance	-8.27 %	-0.62 %	15.85 %	4.58 %	-0.53	-8.61 %	0.95	65 %
	Health Care	-5.81 %	-0.37 %	17.62 %	5.09 %	-0.34	-6.15 %	0.93	50 %
	Cons. Discert.	-3.77 %	-0.26 %	12.73 %	3.68 %	-0.31	-4.11 %	0.81	73 %

Source: own calculation

The paper is focused on comparison of performance of individual funds at the stages of decline / growth and stagnation of the US stock market. Based on the results achieved for all monitored indicators, the active managed mutual funds prospered better than ETFs and the index mutual funds. Compared with the passive funds, the active managed mutual funds have, on average, lower monthly losses and even lower volatility values, resulting in better Sharpe ratio values. Thus, we can conclude that active managed mutual funds appears to be more suitable for a declining market than the ETFs and the index mutual funds, as managers of these funds are able to reallocate assets better and record lower losses. Moreover, the assumption and conclusion of the Sharifzadeh and Hojat (2011) study was also confirmed, as even in the declining market the ETFs and the index mutual funds are developing very similarly and the differences in performance are only negligible. From this finding, we can conclude that ETFs and the index mutual funds can be considered substitutes.

If we consider the large cap and the small cap mutual funds one complex whole, we can also conclude from the achieved results that in the analyzed period of growth, the active funds reached almost identical returns as the passive funds. But the passive funds reached this return with a lower risk rate compared with the active mutual funds, and therefore

had better Sharpe ratio values. Based on this finding, we can also claim that ETFs and the index mutual funds appear to be more suitable for the growth market. If we consider "large cap" and "small cap" mutual funds separately, then it can be stated that the "large cap" mutual funds achieved on average the highest returns, volatility and excess return (exceeding the benchmark) compared with all other analyzed funds. In any case, thanks to their high volatility, the Sharpe ratio values were low, i.e. the passive funds were a better choice in this case as well.

During the stagnation period, both the ETFs and the passive mutual funds were, on average, slightly better than the active mutual funds, as they achieved better results in terms of the Sharpe ratio.

4 Conclusions

Based on the performed analysis and the obtained results, the following investment recommendations can be defined.

The active managed mutual funds seem to be a more appropriate product for declining markets, as at the stage of decline they were able to reallocate assets more flexibly and to record lower losses than ETFs and the index funds. Passive funds lose this ability due to their specific design. On the contrary, the funds with passive portfolio management performed better on the bullish market. In the period of stagnation with a high uncertainty about future market development, ETFs or the index mutual funds are also more suitable, because during this period the portfolio managers can respond quickly to short-term steep changes in the market by rapidly changing their asset portfolio and may not always have a "good luck" when selecting the shares.

If the investor wishes to invest only and exclusively in any of the passive managed funds, I recommend to select the ETFs or the index funds rather in terms of their availability, brokerage fees and tax impacts. Based on the achieved results, the difference in performance and risk rate between these funds is negligible only, and these funds can be considered substitutes (see Sharifzadeh, Hojat (2011).

If the investor wishes to invest only and exclusively in the active managed mutual funds, it is more advantageous to select the funds, which are on the market for a long time period already, which have low TER indicator values (up to 1.0%), high ratings from various agencies such as Morningstar, and which have a very high volume of the managed assets (in the order of billions of US$). I also recommend to select the funds from the sectors having the long-term growth potential (we are not speaking about the Cons Discretionary sector.

The Health Care sector can be included among the sectors suitable for investing. Health is the most valuable commodity and we may assume that this sector will maintain long-term stable returns and low losses in the period of crises. Moreover, renewable resources, etc. can be included among such sector(s). A small investor without a profound investment experience should keep well clear of the volatile sector(s) such as the Financials sector, which seems to be the most risky according to my findings, and we may expect that - despite certain regulations in this sector – new or even exotic investment instruments, which may cause further future financial crises, will appear.

From the point of diversification, ETFs and the index mutual funds are explicitly more appropriate than the active managed mutual funds, as the passive funds offer a wide diversification with the minimum costs, precise reference index copying and a low market volatility.

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Legal Background for a Different Expert Assessments of a Business Enterprise Belonging to a Commercial Company and of a Business Share in a Commercial Company

Roman Skalický

Masaryk University
Faculty of Economics and Administration
Lipová 41a, 602 00 Brno, the Czech Republic
E-mail: 8849@mail.muni.cz

Abstract: *The role of an expert witness is to provide the court with an independent and neutral assessment (e. g. valuation) based on his expertise. The aim of this paper is to define legal background of a business enterprise (belonging to a commercial company) and a business share (in a commercial company) valuation within the legal system of the Czech Republic. For this purpose, the paper examines the legal nature of a business enterprise and a business share and the case of their purchases that might require an expert valuation, compares them and defines the differences between them influencing expert assessments so that it can subsequently result in a reliable valuation by an expert witness. The most significant differences are apparently associated with public claims and a corporate name.*

Keywords: expert witness valuation, business enterprise, business share, corporate name, brand

JEL codes: M49, K22

1 Introduction

The role of an expert is to provide the court with an independent and neutral assessment based on his expertise. (Bělohlávek, 2011) The expert witness meets in his expert practice both the requirement of expert valuation of a business enterprise or a part of it and the requirement of expert valuation of the business share in the commercial company, especially for the purposes of transactions. Such transactions may be purchases, respectively sale of a business enterprise or part thereof or transfer (up to 100%) of a business share in the commercial company.

According to Damodaran (2016), in its most common form, the intrinsic value of an asset or business is estimated in a discounted cash flow (DCF) valuation, where the value can be written as the present value of the expected cash flows on that asset, over its expected life:

$$\text{Value of asset} = \frac{\text{E(CF)}_1}{(1+\text{r})^1} + \frac{\text{E(CF)}_2}{(1+\text{r})^2} + \frac{\text{E(CF)}_3}{(1+\text{r})^3} + \cdots + \frac{\text{E(CF)}_\text{n}}{(1+\text{r})^\text{n}} \quad (1)$$

where $E(CF)_t$ is the expected cash flow in year t, r is the risk adjusted required rate of return for investing in that asset and n is the life of the asset.

If we limit the viewpoint only to a commercial companies and focus only on a business enterprise (belonging to the commercial company) as a whole and, on the other hand, to a 100% business share in the commercial company, the valuation procedure in both cases will be the same basis. The legal nature of these valuation items is, however, significantly different.

The aim of this paper is therefore to define legal background of a business enterprise (belonging to a commercial company) and a business share (in a commercial company) valuation. For this purpose, the paper examines the legal nature of a business enterprise and a business share and the case of their purchases (and sales) that might require an expert valuation, compares them and defines the differences between them influencing expert assessments so that it can subsequently result in a reliable valuation. We assume the legal system of the Czech Republic.

2 Methodology and Data

The paper deals exclusively with a business enterprise as a whole and 100% business share. It focuses only on cases of purchase, respectively sale as elementary dispositions with a business enterprise and a business share. We assume the legal system of the Czech Republic and this paper focuses on cases of commercial companies in the sense of the Business Corporations Act (2012).

To achieve the aim of this paper, the legal nature of a business enterprise and a business share in the systematic of the Civil Code were detected.

This research assesses the legal nature of a business enterprise and a business share as concepts of law and their possible purchases or sales and compares them to gain a legal background for a reliable valuation provided by an expert witness. The analysis is founded on the assumption that the role of an expert witness is to provide the court with an independent and neutral assessment. (Bělohlávek, 2011)

The research approach was developed after an extensive review of academic literature and research on brand and valuation (Aaker, 1996; Bharadwaj et al., 2011; Coopland, 2005; Damodaran, 2008; Himme, Fischer, 2014; Chen, Zhang, 2013; Larkin, 2013; Liberman, Herbden, 2012; Raggio, Leone, 2009; Rego et al., 2011; Salinas, Amber, 2009); Pinto et al., 2010; Koller et al., 2010; Mařík et al., 2011.

As the phenomenon under study is complex and explanatory in nature, qualitative data with content analysis proved to be the best way how to assess a legal background for a reliable expert valuation. As essential source of secondary data, represents Acts of Collection of Laws of the Czech Republic and their Explanatory Memoranda and commentaries on law. Expert witnesses were interviewed to gain primary data.

To achieve the aim of this paper, material regulation of a business enterprise, a business share and commercial companies in the Czech Republic current legal system was examined. Relevant laws were examined, especially the Civil Code (2012) and the Business Corporations Act (2012), Explanatory memoranda, comments on laws (secondary data). Considering the fact that the subject is an intersection of the law and the area of economics, the methods used for the study were mainly content analysis, deduction, induction, compilation and comparison. The description and method of analogy were used for more advanced considerations

3 Results and Discussion

Business Corporations and Commercial Companies

According to the Civil Code (2012), business corporations include commercial companies and cooperatives. Commercial companies include an unlimited partnership and a limited partnership ("partnerships"), a limited-liability company and a joint-stock company ("capital companies"), as well as a European Company and a European Economic Interest Grouping.

The Legal Nature of an Enterprise

According to Commission Regulation (EU) No 651/2014 (2014), *"an enterprise is considered to be any entity engaged in an economic activity, irrespective of its legal form. This includes, in particular, self-employed persons and family businesses engaged in craft or other activities, and partnerships or associations regularly engaged in an economic activity."*

The Legal Nature of a Business Enterprise

"Business enterprise" defined by the Civil Code (2012) is the concept that cannot be confused with "Enterprise" under the Commission Regulation (Skalická Dušátková, 2015). A business enterprise is *"an organized set of assets and liabilities created by an entrepreneur which, based on his will, are used to pursue his activities. An enterprise is presumed to comprise everything that is typically used for its operation,"* defined by the

Civil Code (2012) which provides the refutable presumption, that "a*n enterprise is presumed to comprise everything that is typically used for its operation."* A business enterprise is therefore definitely associated with the entrepreneur, whether legal person or nature one.

Examining the legal nature of a business enterprise, we will come to a conclusion, that a business enterprise is, within the Civil Code, a thing in a legal sense (legal abbreviation and hereinafter a "thing"), meeting its definition "everything that is different from a person and serves the needs of people". It is a collective thing, although it is not explicitly stated in the Civil Code. (Švestka et al, 2014) A collective thing is *"a set of individual things belonging to the same person, regarded as one object and bearing a single designation as such, is regarded as a whole and constitutes a collective thing (universitas rerum)."* (Civil Code, 2012)

A business enterprise comprises debts as well, because according to Civil Code (2012), *"assets and liabilities of a person consist of the totality of his property and debts,"* while *"the totality of what belongs to a person constitutes his property."*

The difference between an enterprise and a business enterprise is shown in the following table:

Table 1 The Comparison of an Enterprise and a Business Enterprise

	Legal nature	**Legal relationships**	**Is willing**
Enterprise	person	Legal entity	yes
Business Enterprise	thing	Subject-matter	no

Source: Own elaboration on the basis of the literature research (secondary data)

By purchasing a business enterprise, the buyer shall acquire everything that pertains to the business enterprise as a whole. Even where the parties exclude an individual item from the purchase whereby the whole does not lose its nature of a business enterprise, it is considered as a purchase of a business enterprise. (Civil Code, 2012)

A purchase of a business enterprise is considered to constitute a transfer of the employer's activities.

By purchasing a business enterprise, the buyer becomes a creditor in respect of claims and a debtor in respect of debts which pertain to the business enterprise; however, the buyer shall only assume those debts of the existence of which he was aware, or which he must have at least reasonably expected. If the creditor has not given his consent to the assumption of debt by the buyer, the seller is liable as a surety for the discharge of the debt.

However, this private contract cannot transfer to the buyer public claims and debts of the seller - for example, taxes, duties, public insurance, subsidies from public sources, etc. These rights and obligations are linked to this unique legal entity. Under the Tax Code, the tax transfer agreement is not effective against the tax administrator.

In the case of the sale of a business enterprise belonging to a commercial company, there is a change in the structure of assets and liabilities in the balance sheet of that company, where instead of individual assets and debts, the transaction has money and residual or other assets and liabilities. Then the buyer is the sequel to the activity. If the seller's corporate name is not transferred in addition, the buyer continues to operate under his own one. (Skalický, 2015).

Legislation does not require fundamentally expert assessment or expert participation when buying a business enterprise, but sometimes negotiates it voluntarily to assess the suitability of the purchase price and to limit possible future disputes regarding any objection to trade disadvantage or troublesome sales of the seller.

However, an expert valuation is required in the case of so-called related persons.

The Legal Nature of a Business Share

"A business share represents a member's interest (participation) in a business corporation and *the rights and duties attached thereto."* (Business Corporations Act, 2012) The business share in a business corporation has a qualitative and quantitative aspect. The quantitative portion of the share represents your own quantity and value of the share. Qualitative aspects are rights and obligations that are property or non-property.

For example, a property right, such as that a member shall be entitled to a profit share and share of liquidation balance, a property obligation is for example a deposit obligation. Non-property rights allow the member to participate in the decision-making and management of the business corporation, non-property obligations stem from the founding documents of business corporations.

According to the judgement of the Czech Supreme Court, the property aspect cannot be separated from the set of rights as a separate right. (The Supreme Court Judgement, 2010)

Each member may hold one business share only in the same business corporation. This shall not apply to an interest in a capital company and to business shares of a limited partner. A member's business share in a business corporation may not consist in a security or a book-entry security unless the business corporation is a capital company or unless provided for by another legal regulation. (Business Corporations Act, 2012)

In the systematic of the Civil Code a business share means thing in a legal sense – movable and intangible thing.

The transfer of a business share shall be effective vis-à-vis the commercial company upon the delivery of an effective business share transfer agreement with certified signatures. (Business Corporations Act, 2012)

As in the case of a business enterprise, the legislation does not require expert valuation or the participation of an expert in buying a share fundamentally. However, it may be necessary for accounting or tax reasons.

The Comparison of a Business Enterprise and a Business Share

Assuming that we take into account the whole business enterprise belonging to the considered commercial company as well as the 100% share in the commercial company under consideration, the comparison is shown in the following table:

Table 2 The Comparison of a Business Enterprise (belonging to a commercial company) and a Business Share (in a commercial company)

	Business Enterprise	**Business Share**
Definition	an organized set of assets and liabilities created by an entrepreneur which, based on his will, are used to pursue his activities	a member's interest (participation) in a business corporation and the rights and duties attached thereto
Legal background	Collective thing (universitas rerum)	movable thing intangible thing
Subject of legal relationships	entrepreneur – here the commercial company (generally nature person or legal person)	a member of the commercial company
An individual item	can be excluded from the purchase (whereby the whole does not lose its nature of a business enterprise)	cannot be excluded

Cannot be transferred	Public claims; non-alienable assets	
Buyer	shall acquire everything that pertains to the enterprise as a whole, becomes a creditor in respect of claims and a debtor in respect of debts	Becomes a member (acquires the rights and obligations of a member)
Accounting of the commercial company	significant modifications of assets and liabilities	
A corporate name of the commercial company	Fundamentally is not a part of the sold business enterprise	Fundamentally is still belonging to a commercial company

Source: Own elaboration on the basis of the literature research (secondary data)

It may seem that the difference between the two is that in each case it is another entity of legal relationships. However, from the point of view of an expert witness for market valuation purposes, this fact should not play a role.

The significant difference is mainly in the case of public liabilities etc. and, in the case of a brand in the form of a corporate name (Skalický, 2017a). According to the definition of the American Marketing Association, brand is "a name, term, design, symbol, or any other feature that identifies one seller´s good or service as distinct from those of other sellers" (American Marketing Association, 2017). A corporate name meets this definition as well. (Skalický, 2016, 2017a) The corporate name as brand can have a significant impact on the valuation (Skalický, 2017c)

4 Conclusions

In the case of a business enterprise, even in the case of a business share, the valuation will be the same basis. The expert witness can estimate the value of an asset as a function of the cash flows generated by that asset, the life of the asset, the expected growth in cash flows and the riskiness associated with the cash flows. That principle remains intact for every business at every point in time, no matter how much uncertainty there is in the process. (Damodaran, 2013)

While a business enterprise is a collective thing, a business share in the system of the Civil Code represents a movable and intangible thing. Considering the case of buying a (whole) business enterprise of the commercial company and purchasing (100%) a business share in the (same) commercial company, the buyer, i.e. who joins the legal relationship, is a different subject. While in the first case it will be the commercial company itself, in the case of the latter it will be a member or members of that commercial company.

The purchase of a business enterprise will bring significant changes in the assets and liabilities of the commercial company's accounting, the purchase of the business share in the accounting of the company itself will not affect.

In the case of buying a business enterprise, even if we consider its whole and not just a part, we can separate an individual item, whereby the whole does not lose its nature of a business enterprise. At the same time, in the case of a business enterprise, we need to allocate some cases - we cannot, for example, transfer public liabilities, which in some cases can cause significant differences in valuation.

Other significant differences in expert valuation can be caused by a brand in the form of a corporate name. If the corporate name is not transferred at the same time as the business

enterprise, the brand remains for the seller and must be taken into account for the valuation.

In conclusion, although the expert valuation will be based on a similar basis, account should be taken of the legal nature of the business enterprise or a business share.

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The Financialization and Operating Performance of Non-financial Companies Listed on the Warsaw Stock Exchange

Błażej Socha[1], Dariusz Urban[2]

[1] University of Lodz
Faculty of Management, Department of Finance and Strategic Management
Matejki Street 22/26, 90-237 Łódź, Poland
E-mail: blazej.socha@uni.lodz.pl

[2] University of Lodz
Faculty of Management, Department of Finance and Strategic Management
Matejki Street 22/26, 90-237 Łódź, Poland
E-mail: dariusz.urban@uni.lodz.pl

Abstract: *This paper deals with the issue of financialization of companies. The financialization reflects the growing asymmetry between production and exchange processes, in particular regarding the financial component of the exchange process. This asymmetry was revealed along with gradual changes in the financial behavior of non-financial enterprises, banks and households. The indication of this transformation process has been increasing the profit generated through financial transactions instead of operating activities. The main goal of this article was to answer the question about the coefficient between the level of financialization and the operating performance of companies from Poland. The research sample consists of the listed non-financial companies and the research period covers 2011-2017. The authors used calculated on their own synthetic indicators of company financialization reflecting their financial as well as investment performance and financial indicators measuring operating activity performance. In order to achieve the research goal, a standard statistical analysis of results was performed and correlation coefficients were used to measure the strength and the direction of association that exists between the level of financialization and the operating performance of companies. The empirical findings suggest the existence of differences in terms of operating activity performance (e.g. EBITDA Margin, EBITDA/Total Assets, Assets Turnover, Revenue/Working Capital) among companies with different level of financialization. It also suggests that financialization reflecting investment performance interact with operating activity performance differently to financialization reflecting financial performance.*

Keywords: financialization, ratios of financialization, operating activity performance

JEL codes: D22, F65, G30

1 Introduction

Over the last two decades, the economies all around the world have undergone profound transformations; the role of government has diminished while the one of markets has increased, economic transactions among countries have substantially risen and domestic as well as international financial transactions have grown. This changing landscape has been characterized by the rise of neoliberalism, globalization and financialization. While many studies have been devoted to neoliberalism and globalization, research on the phenomenon of financialization is relatively new. In fact, there is no even common agreement in literature about the definition of the term, and even less about its significance (Epstein, 2005).

Financialization reflects the growing asymmetry between production and exchange processes, in particular regarding the financial component of the exchange process. This asymmetry was revealed along with the gradual changes in the financial behavior of non-financial enterprises, banks and households. The indication of this transformation process has been increasing the profit generated through financial transactions instead of operating activities (Lapavitsas, 2013). By financialization scholars also mean the shift in competitive capitalism from manufacturing and distribution of physical commodities as being the

principal economic activity to the economy which is essentially structured on the basis of abstract principles and the accumulation of wealth on the basis of non-tangible assets (Styhre, 2014). Literature identifies three different approaches to the phenomenon of financialization (van der Zwan, 2014). The first approach examines financialization as a new regime of capital accumulation. Financialization is a pattern of accumulation in which profits accrue primarily through financial channels rather than through trade and commodity production. In the second approach, financialization is being analyzed in the context of the shareholder value orientation as a guiding principle of corporate behavior. The third approach to financialization points out the issue of financialization of everyday life, suggesting that the transition of finance into daily life has been made possible by the democratization of finance, whereby the financial product and services have become more available to large parts of the population.

Marek Ratajczak suggests that in the context of companies the process of financialization leads to fundamental changes in management and ownership, especially in large corporations (Ratajczak, 2014). Firstly, financialization increases the role of institutional investors from the financial sector, seeking possibilities to gain profits in the short run. Secondly, financialization shifts the perspective in management of companies from stakeholders to shareholders. Thirdly, due to financialization in the economic and financial analysis of companies excessive pressure is being exerted on indicators referring to short-term profitability rather than on the long-term perspective of stable growth of the company. According to William Lazonick (2013) companies are increasingly evaluated by measures like earnings per share rather than by the goods and services they produce. Financialization changes the relationship between the non-financial corporate sector and financial markets (Orhangazi, 2008).

The empirical findings of research from developed markets suggest a link between different aspects of financialization and investment activity of non-financial corporations (Davis, 2017; Gutiérrez and Philippon, 2016; Orhangazi 2008; Crotty, 2005). The authors point out the shift in the portfolio composition towards financial assets, suggesting that the financial investment increasingly replaces, or even crowds out the fixed investment. They also present the evidence of changes in the structure of external finance, including growth in both indebtedness and own-stock repurchases, especially among large firms. Moreover, there is an expansion in the financial profits earned by non-financial firms as well as an increase in payments of non-financial corporations to financial markets. Some large non-financial corporations increasingly resemble financial firms, being viewed as bundles of assets rather than capital accumulating enterprises. These changes in company behavior are accompanied with a slowdown in capital accumulation despite the rising profitability of the firm.

Summing up, financialization of the economy, households as well as companies over the last couple of years has attracted significant attention from both academics and practitioners. This attention was especially focused on western economies with developed markets. The publications of authors from emerging markets were filling the gap in knowledge of the theoretical aspect of this process rather than addressing the empirical research questions. Meanwhile, given the scale and scope of financialization of the listed companies from developed stock exchanges, there is a need for understanding and analyzing the issue of financialization of non-financial companies from emerging economies. It has become essential to answer the question whether financialization occurs in these companies and to what extent the path of financialization observed in developed markets is imitated by the companies from emerging markets.

The main goal of this research is to answer the question about the correlation coefficient between the level of financialization and the operating performance of companies listed on the Warsaw Stock Exchange. The paper is organized as follows: Section 2 describes the methodology of the research as well as the data, Section 3 presents and discusses the empirical findings, Section 4 concludes.

2 Methodology and Data

The research sample consisted of public companies included in the WIG index on the Warsaw Stock Exchange on 30th March 2018. We excluded from our research sample companies from financial industry and companies that reported negative equity in the research period. For companies included in the research we calculated financialization ratios based on the methodology proposed by Szczepankowski (2017) for the assessment of the level of financialization in the area of investment and financial activity (see Table 1). The research period covers 2011-2017. The required data comes from the financial statement published in the Eikon database.

Table 1 The Financialization Ratios

Area	Indicator	Formula
Investment Area (INV)	**INV1**	[Long-term Investments – Affiliate Companies + Long-term Investments – Other + Note Receivable – Long-term + Other Long-term Assets] / Fixed Assets
	INV2	[Total Current Assets – Total Inventory – Accounts Receivable – Trade Net – Prepaid Expenses] / Total Current Assets
	INV3	[Interest Income (Non-Operating) + Investment Income (Non-Operating) - Foreign Currency Gains] / Total Revenue
	INV4	[Purchase of Investments + Acquisition of Business] / [[Purchase of Investments + Acquisition of Business + Capital Expenditures]
	INV5	[Sale of Business + Sale/Maturity of Investment] / [Sale of Business + Sale/Maturity of Investment + Sale of Fixed Assets]
	INV	[INV1 + INV2 + INV3 + INV4 + INV5] / 5
Financial Area (FIN)	**FIN1**	[Long-Term Debt + Other Long-Term Liabilities + Notes Payable/Short-Term Debt + Other Current Liabilities] / [Liabilities + Equity]
	FIN2	[Long-Term Debt + Notes Payable/Short-Term Debt] / Liabilities
	FIN3	[Interest Expense (Non-Operating) + Investment Expense (Non-Operating)] / Total Expense
	FIN4	[Debt Reduction + Cash Interest] / Financing Cash Flow Out
	FIN5	Debt Issued / Financing Cash Flow In
	FIN	[FIN1 + FIN2 + FIN3 + FIN4 + FIN5] / 5

Source: own elaboration based on Szczepankowski (2017)

After calculating partial financialization ratios (INV1-INV5 and FIN1-FIN5), the level of financialization in the investement (INV) and financial area (FIN) were calculated and the value of all ratios ranges from 0 to 1. In the next step the level of financialization for companies from different NAICS sector was shown. In the last step we calculated correlation coefficient between the level of financialization and operating performance (revenue/working capital, EBITDA Margin, EBITDA/Total Assets, Total Assets Turnover, Fixed Assets Turnover) and pretax return on assets.

3 Results and Discussion

The highest level of financialization in the investment area (see Table 2) was observed in professional, scientific and technical services and the construction sector, especially due to

a relatively high level of short-term financial assets in current assets and investment inflows from financial assets in total investment inflows. What is more, the level of financialization in these two sectors grew faster than in the other sectors. Manufacturing and wholesale trade were the sectors with the lowest and stable level of financialization. In general, Polish listed companies seemed to behave in a secure way and the main pillars of its investment area were cash and short-term securities. A very low level of the financial income in total revenues confirmed the previous assumption.

Table 2 The Level of Financialization in the Investment Area (INV)

NAICS Sector	Statistic	2011	2012	2013	2014	2015	2016	2017
Information	Min	0,0282	0,0075	0,0184	0,0170	0,0167	0,0172	0,0032
	Max	0,6559	0,7838	0,6226	0,7916	0,6538	0,7808	0,5909
	Mean	0,2491	0,2290	0,2436	0,2529	0,2140	0,2260	0,1969
Manufacturing	Min	0,0042	0,0020	0,0031	0,0013	0,0000	0,0031	0,0125
	Max	0,5069	0,7761	0,6453	0,6350	0,8432	0,6161	0,4704
	Mean	0,1344	0,1427	0,1329	0,1348	0,1350	0,1263	0,1376
Professional, Scientific, and Technical Services	Min	0,0240	0,0407	0,0408	0,0089	0,0078	0,0161	0,0276
	Max	0,6309	0,7928	0,8880	0,7946	0,6677	0,7457	0,7863
	Mean	0,2357	0,2747	0,2590	0,2684	0,2275	0,2645	0,3007
Wholesale Trade	Min	0,0063	0,0058	0,0074	0,0076	0,0073	0,0063	0,0087
	Max	0,5867	0,7321	0,7550	0,5930	0,5946	0,7050	0,7005
	Mean	0,1988	0,1386	0,1286	0,1833	0,1554	0,1675	0,2138
Construction	Min	0,0000	0,0078	0,0000	0,0011	0,0038	0,0116	0,0062
	Max	0,5898	0,6744	0,7293	0,6293	0,6182	0,5949	0,8692
	Mean	0,2416	0,2065	0,2627	0,2644	0,2561	0,2056	0,2858
Others	Min	0,0041	0,0065	0,0064	0,0053	0,0047	0,0011	0,0234
	Max	0,7690	0,9798	0,7481	0,6769	0,6119	0,9267	0,5864
	Mean	0,2318	0,2204	0,2156	0,2136	0,2099	0,2094	0,2071

Source: own elaboration

The level of financialization in the financial area was, in general, higher than in the investment area. Construction and manufacturing were the sectors with the highest level of this ratio whilst companies from professional, scientific and technical services sectors had the lowest level of financialization. The median value for the FIN5 ratio suggested that more than a half of the companies in 6 out of 7 research periods had received financial inflows only from the issued debt. Moreover, a relatively low level of liabilities to equity caused that the level of financial expenses in total expenses were also low. The obtained results and their development in the examined period proved that Polish listed companies treated financial activity in a subordinate manner to their operating activities.

Table 3 The Level of Financialization in the Financial Area (FIN)

NAICS Sector	Statistic	2011	2012	2013	2014	2015	2016	2017
Information	Min	0,0001	0,0038	0,0016	0,0051	0,0054	0,0031	0,0028
	Max	0,6294	0,5648	0,6333	0,6258	0,6109	0,6119	0,6572
	Mean	0,3067	0,2777	0,2982	0,3486	0,3210	0,3197	0,2474
Manufacturing	Min	0,0054	0,0025	0,0000	0,0013	0,0021	0,0007	0,0006
	Max	0,7400	0,8210	0,8054	0,7625	0,7678	0,6818	0,6706
	Mean	0,4414	0,4244	0,4136	0,4065	0,4110	0,4049	0,3746
	Min	0,0001	0,0020	0,0001	0,0001	0,0001	0,0006	0,0082

Professional, Scientific, and Technical Services	Max	0,6150	0,6567	0,5854	0,5637	0,6302	0,6922	0,4391
	Mean	0,2443	0,3075	0,2791	0,2872	0,2921	0,3096	0,2067
Wholesale Trade	Min	0,1792	0,0027	0,0104	0,0194	0,0172	0,1925	0,1105
	Max	0,5941	0,6170	0,6171	0,6203	0,6035	0,6514	0,5295
	Mean	0,3830	0,4038	0,3691	0,3738	0,3917	0,4173	0,3056
Construction	Min	0,0487	0,0147	0,0014	0,0123	0,0049	0,0006	0,0032
	Max	0,6733	0,6294	0,6826	0,6706	0,7127	0,6533	0,7509
	Mean	0,4436	0,4334	0,4328	0,4174	0,4062	0,4081	0,3434
Others	Min	0,0051	0,0030	0,0019	0,0073	0,0027	0,0053	0,0022
	Max	0,7133	0,6999	0,7366	0,7160	0,6732	0,7046	0,6714
	Mean	0,3782	0,3944	0,4206	0,4109	0,4126	0,4245	0,3699

Source: own elaboration

In the next step of the research authors checked the correlation coefficient between the level of financialization and the operating performance of companies supplemented by pretax ROA ratio. As shown in Table 4, companies with higher level of financialization in the investment area generated less revenue from their assets. A negative and statistically significant linear correlation in 3 out of 7 periods was observed for the level of financialization in the investment area and EBITDA margin. Another important fact is the one that the direction of correlation coefficient is constant for all periods.

Table 4 Pearson Correlations Between The Level of Financialization in Investment Area (INV) and Standarized Financial Ratios

Ratio/Year	2011	2012	2013	2014	2015	2016	2017
Revenue/ Working Capital	-0,089	-0,102	-0,076	-0,083	-0,078	-0,107*	-0,122
EBITDA Margin, %	-0,160**	-0,143**	-0,188**	-0,092	-0,055	0,008	-0,045
EBITDA/Total Assets, %	-0,080	-0,104*	-0,082	-0,077	-0,055	-0,067	-0,123*
Asset Turnover	-0,147**	-0,160**	-0,094	-0,108*	-0,162**	-0,166**	-0,173**
Fixed Asset Turnover	0,016	0,043	0,005	0,232**	0,060	0,081	0,081
Pretax ROA, %	0,000	-0,099	-0,007	-0,043	-0,091	-0,027	-0,048

** Correlation is significant at the 0.01 level; * Correlation is significant at the 0.05 level.
Source: own elaboration

Results in Table 5 present that the level of financialization in the financial area was also correlated with operating performance ratios and pretax ROA. In 2015-2017 companies with the highest level of financialization generated higher revenues from their working capital, but it required more fixed assets. Moreover, the level of financialization was negatively correlated with EBITDA Margin and pretax ROA.

Table 5 Pearson Correlations Between The Level of Financialization in Financial Area (FIN) and Standarized Financial Ratios

Ratio/Year	2011	2012	2013	2014	2015	2016	2017
Revenue/ Working Capital	-0,003	0,095	0,026	0,098	0,135*	0,156**	0,184**
EBITDA Margin, %	-0,062	-0,055	-0,007	-0,060	0,026	-0,015	0,113

EBITDA/Total Assets, %	-0,120*	-0,155**	-0,038	-0,138**	-0,119*	-0,174**	-0,118
Asset Turnover	-0,152**	-0,019	-0,034	-0,069	-0,070	-0,068	-0,023
Fixed Asset Turnover	-0,198**	-0,159**	0,032	-0,075	-0,165**	-0,146**	-0,142*
Pretax ROA,%	-0,160**	-0,153**	-0,064	-0,140**	-0,108*	-0,203**	-0,129*

** Correlation is significant at the 0.01 level; * Correlation is significant at the 0.05 level.
Source: own elaboration

The obtained results may suggest that companies with different levels of financialization can generate different levels of operating performance and pretax return on assets. All statistically significant correlation coefficients, excluding the revenue to working capital ratios, showed that the higher level of financialization coexisted with the lower level of operating performance ratios. It is interesting and important to point out that financialization in the investment area and the financial area are correlated with different operating performance ratios.

4 Conclusions

The main goal of this research was to answer the question concerning the correlation coefficient between the level of financialization and the operating performance of companies listed on the Warsaw Stock Exchange. Our findings suggest that the level of financialization and the area of financialization can justify the level of operating performance and profitability. Furthermore, the level of financialization is different in the sectoral section. The provided data also showed us that the level of financialization of non-financial public Polish companies is relatively low. Empirical findings also prove that we should analyse separately the investment and financial area of financialization because of its correlation with different operating performance ratios.

Our paper contributes to the better understanding of the role of the financialization process in the financial management of companies, and according to the authors' best knowledge it is the first attempt to investigate the role of finanancialization in financial performance of Polish listed companies as an example from emerging markets. For the better understanding of the financialization effect on companies perfomance further research is required, especially in the sectoral section and with the use of the cause and effect analysis. A comparative analysis of factors affecting financialization on the emerging and developed markets would be valuable from the scientific point of view.

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The Effect of the Accounting Hocus–Pocus on the Management Earnings Forecast Precision in the IPO

Tomasz Sosnowski[1], Anna Wawryszuk–Misztal[2]

[1] University of Lodz
Faculty of Economics and Sociology, Department of International Investments and Finance
Rewolucji 1905 Street 41, 90–255 Lodz, Poland
E–mail: tomasz.sosnowski@uni.lodz.pl

[2] Maria Curie Sklodowska University
Faculty of Economics, Department of Corporate Finance
Maria Curie-Sklodowska Square 5, 20-031 Lublin, Poland
E–mail: anna.wawryszuk@umcs.pl

Abstract: *Issuers of initial public offerings can make a voluntary decision to post the earnings forecast in the prospectus. This paper explores whether managers of IPO firms take intentional action in the form of earnings management to reduce the forecast error and thereby improve the quality of such forward looking financial information revealed in the going public process. Using a sample of 87 IPOs from Warsaw Stock Exchange between 2006 and 2015 we find that, generally, managers of the new listed companies use discretionary accruals and abnormal cash flows from operations in the periods around the IPO to improve the accuracy of the earnings forecast disclosed in the IPO prospectus. Real earnings management is likely to take place in the year preceding IPO and accruals-based earnings management is used in the IPO and following year.*

Keywords: IPO, forecast error, real earnings management, discretionary accruals

JEL codes: G11, G17, G32

1 Introduction

The issue of earnings management is the topic of many empirical studies. According to Healy and Wahlen "Earnings management occurs when managers use judgment in financial reporting and in structuring transactions to alter financial reports to either mislead some stakeholders about the underlying economic performance of the company or to influence contractual outcomes that depend on reported accounting numbers" (1999, p. 368). Earnings management results from the existence of the asymmetry information phenomenon, which is clearly observed during the IPO process. The IPO prospectus issued by a company seeking to be public becomes the main source of information for IPO investors and a tool for the mitigation of the information gap. In particular, the pre-IPO financial statements included in the prospectus are the subject of investor's interest. Bearing in mind that profit is one the most important accounting numbers taken into consideration by investors, the managerial engagement into earnings management process is expected to take place around the period of IPO (Teoh et al., 1998; Gao et al., 2017). This behavior is motivated by aiming at portraying a more favorable earnings picture, and thus boosting the IPO offer price (Gao et al. 2017, p. 90). The high IPO proceeds are possible due to the fact that investors do not understand the process of earnings management, and thus they are not aware that the reported earnings are borrowed from the future or the past (Teoh et al. 1998, p. 1938). There are some empirical studies that provide evidence on earnings management practice around the time of IPO: Teoh et al. (1998), DuCharme et al. (2001), Miloud (2014). Nevertheless, Rosenboom et al. (2003), Ball and Shivakumar (2008), document the conservative reporting before IPO.

Earnings management in the IPO-year or before IPO is mainly motivated by the increase in the IPO proceeds, but another incentive to earnings manipulations occurs in the year following IPO if a company decides to include earnings forecasts in the IPO prospectus. Revealing earnings projections in the IPO prospectus is a voluntary decision which may be used as a signal that reduces the level of asymmetry information. It may affect the

investor's decision on capital involvement in the company and subsequently increase initial valuation (Hartnet, 2010).

The usefulness of voluntary issued profit projections depends on its credibility. Moreover, as Kasznik (1999) suggests, inaccurate earnings forecasts can result in litigation costs associated with actions taken by shareholders and the loss of management reputation for accuracy. Inaccuracy may also lead to the negative share price revision which is the consequence of the phenomenon known as negative earnings surprise (Matsumoto, 2002). In order to avoid the cost of inaccurate forecasts, managers tend to manage actual earnings towards the forecasted level.

Prior research on the above area usually answers the question whether the earnings management occurs in the year following the IPO in order to achieve the projected value of earning included in prospectus. For example, Gramlich and Sørensen (2004) find evidence that accrual management is used by the managers of Danish IPO companies to meet the earnings forecast target voluntary disclosed in the IPO prospectus. More specifically, they point out that earnings management reduces (increases) reported earnings if pre-managed earnings and actual sales are higher (lower) than forecasted values (Gramlich and Sørensen, p. 256). What is more, their results give evidence that forecasts errors are reduced by implementing discretionary accruals. Cormier and Martinez (2006) document that French IPOs issuing forecasts are more likely to manage earnings one year after IPO compared with companies which do not reveal such forecasts. What is more, the level of earnings management is higher for these forecasting companies whose actual earnings are lower than expected. The earnings management practice to meet the forecasted earnings, i.e. the use of discretionary accruals in the year following IPO, is also documented by Cormier et al. (2014) for Canadian IPO companies. The study by Ismail and Weetman (2007) for Malaysian IPOs, which are obliged to apply the regime of mandatory disclosure of the profit forecast in the IPO process, also shows that companies manage earnings to meet the forecasts, both in case the pre-managed earnings are lower and higher than their expected value revealed in the prospectus.

Nevertheless, some studies provide contrary results. Hutagaol et al. (2012) find that in case of 165 Indonesian IPOs there is not a significant difference in earnings management practices between forecasters and non-forecasters. Buchner et al. (2017) document that companies going public on the London Stock Exchange revealing earnings forecasts are less likely to manage earnings than those which do not include such projections. They explain that due to the costs associated with inaccurate forecasts (i.e. the negative impact on firms value) a company decides to include earnings forecasts only if this information is credible (Teoh et al., 1998; Buchner et al., 2017, p. 94).

In this study we investigate the links between managerial activities aiming at reporting certain value of earnings around IPO and the precision of forward-looking financial information revealed in the going public process. More specifically, we empirically examine the effect of earnings management in a form of discretionary accruals and real activities manipulation on the accuracy of the earnings forecast voluntarily disclosed in the IPO prospectus and ask a question whether managers of IPO firms take intentional action to reduce the forecast error and thereby improve the quality of management earnings forecast in the IPO prospectus. Thus, we contribute to the literature concerning motives behind earnings management activity of IPO companies.

As our study includes three years around the IPO, we state three hypotheses. Firstly, we assume that before the IPO managers manipulate earnings to show the most favorable picture of the company and e.g. inflate the issue price. Due to this fact, borrowing earnings from the future makes achieving better financial results in the following year more challenging and preparing optimistic as well as accurate earnings forecasts in the year of IPO becomes quite difficult, our first hypothesis states as follow:

H1: Pre-IPO upward earnings management reduces the accuracy of earnings forecast revealed in the IPO prospectus.

The second hypothesis stems from the assumption that voluntary decision to include looking forward information in the prospectus leads to earnings manipulation to meet their forecasted value. Therefore, the accurate earnings forecast increases the credibility of managers to the public, we posit:

H2: The upward earnings management in the year the firm goes public increases the accuracy of the earnings forecast disclosed in the IPO prospectus.

In the year following the IPO we expect that increasing reported earnings through earnings manipulation is very limited due to the fact that similar actions could have been taken before and in the year of IPO, which makes it more difficult to continue the earnings management process to upward earnings. If the management board decides in advance to apply an aggressive income-increasing policy of reporting in the future, it will be prone to limit the profit transfer to the current period. Such a strategy, undoubtedly, makes it difficult to meet a specific level of profit that is expressed as expected in the IPO prospectus. Thus, we formulate our third hypothesis:

H3: The increase in the reported earnings through earnings management in the post-IPO year diminishes the accuracy of earnings forecast published in the IPO prospectus.

2 Data and Methodology

In order to test our hypotheses, we construct a sample of IPOs as follows. Firstly, we identify all new companies on the main market of Warsaw Stock Exchange (WSE) between 2006-2015. This sample period reflects the current legal status in Poland regarding the disclosure of the forward-looking financial reporting in the IPO prospectus. Since the beginning of 2006 Polish stock companies have been obliged to apply uniform legal regulations concerning the going public process and the content of the prospectus. Then, in order to ensure the sample homogeneity, form the number of 337 companies we exclude: (1) IPO of foreign companies as they may apply different accounting regulations, (2) banks and insurance companies due to the dissimilarity of their financial reporting, (3) companies previously traded in the alternative public trading systems (e.g. NewConnect in Poland) because of the significant difference in the pre-IPO public data availability, (4) IPOs without the sale of primary or secondary shares for different reasons of going public, (5) companies with missing accounting data necessary for earnings management detection. Thus, the final sample consists of 159 firms (earnings management sample), of which 87 disclosed the earnings forecast for the IPO year in the prospectus (forecast accuracy sample). The data on the earnings forecast and some company's characteristics are hand-collected from prospectuses. The financial statement data are obtained either from annual reports available in the Notoria Service database or are supplemented from prospectuses and WSE official statistics.

By and large, our research refers to the influence of earnings management activities on the accuracy of the profit forecast in the IPO prospectus. We investigate if managers transfer earnings between the IPO year and periods around this corporate event to meet optimistic earnings projections made and revealed to the public before IPO, as Teoh et al. (1998) suggest. Thus, our study requires the use of appropriate measures of the forecast accuracy, earnings management, and other factors that may generally affect the quality of financial projections. Therefore, we employ the OLS regression using the forecast accuracy sample, with the general form of equation as follows:

$$Accuracy = \beta_0 + \sum \beta_j Earnings\ management_j + \sum \beta_k Control_k + \varepsilon \quad (1)$$

Our main measure of the forecast accuracy is an absolute forecast error (AFER), which shows how much of the actual value of a given financial category differs from its prediction, regardless of the fact whether the error is due to over- or underestimation. AFER is calculated as the absolute value of the difference between the reported value of profit for the IPO year and its forecast value as given in the prospectus scaled to the absolute value of the forecast. Furthermore, we use the forecast error (FER), i.e. the difference between the actual value of profit for the IPO year and its forecast form in the prospectus divided

by the absolute value of forecast, to investigate the bias of the misspredict ion. FER takes negative value if the forecast prepared and disclosed to the public was over optimistic and its positive value shows that the forward-looking information in the prospectus was conservative and too pessimistic (Yau and Chun, 1999).

Next, as the direct observation of the earnings management activities is practically impossible, we adopt a set of proxies commonly used in literature to detect earnings management. We employ both real and accrual-based earnings management. Firstly, we follow Roychowdhury (2006), Cohen and Zarowin (2010) and use the abnormal level of production costs (REM_P), the abnormal level of discretionary expenditures (REM_D) as well as abnormal cash flows from operations (REM_CFO) to investigate managers' real economic actions to maintain accounting appearances. Then, so as to detect earnings management through discretionary accruals (DACC) we employ Larcker and Richardson (2004) model, which is a modification that is widely applied in the literature model of Dechow et al. (1995) and is more appropriate for the assessment of accruals in growing companies. Abnormal values of the production costs (PROD), discretionary expenditures (DISX), cash flows from operations (CFO) and total accruals (TACC) are computed as their actual value minus the normal level of each of them are calculated using the estimate coefficients from the following equations:

$$\frac{PROD_t}{TA_{t-1}} = \alpha_0 + \alpha_1 \frac{1}{TA_{t-1}} + \alpha_2 \frac{SALES_t}{TA_{t-1}} + \alpha_3 \frac{\Delta SALES_t}{TA_{t-1}} + \alpha_4 \frac{\Delta SALES_{t-1}}{TA_{t-1}} + \varepsilon_t \quad (2)$$

$$\frac{DISX_t}{TA_{t-1}} = \alpha_0 + \alpha_1 \frac{1}{TA_{t-1}} + \alpha_2 \frac{SALES_{t-1}}{TA_{t-1}} + \varepsilon_t \quad (3)$$

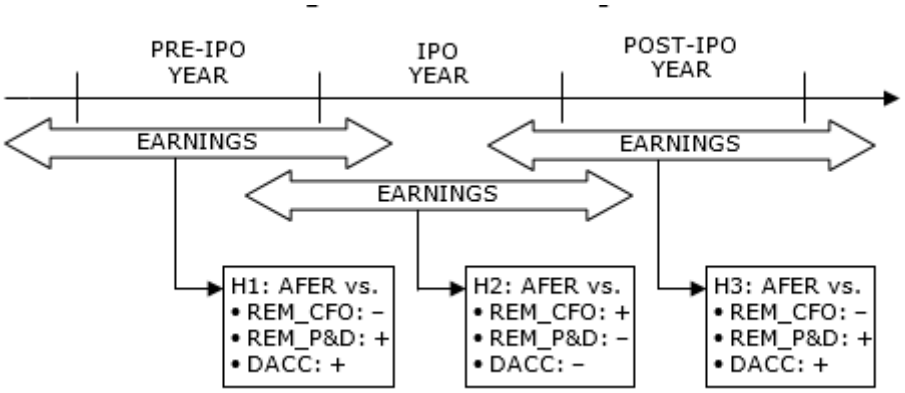
$$\frac{CFO_t}{TA_{t-1}} = \alpha_1 \frac{1}{TA_{t-1}} + \alpha_2 \frac{SALES_t}{TA_{t-1}} + \alpha_3 \frac{\Delta SALES_t}{TA_{t-1}} + \varepsilon_t \quad (4)$$

$$\frac{TACC_t}{TA_{t-1}} = \alpha_1 \frac{1}{TA_{t-1}} + \alpha_2 \frac{\Delta SALES_t - \Delta AR_t}{TA_{t-1}} + \alpha_3 \frac{PPE_t}{TA_{t-1}} + \alpha_4 \frac{BV_t}{MV_t} + \alpha_5 \frac{CFO_t}{TA_{t-1}} + \varepsilon_t \quad (5)$$

where TA refers to total assets, SALES is the net sales, ΔSALES is the change in net sales from the preceding year, ΔAR is the difference in accounts receivable in a given year, PPE is gross property, plant, and equipment, BV and MV are the book and market value of common equity, respectively.

Referring to our hypothesis we can expect both positive and negative coefficients between our depended value AFER and proxies employed as earnings management detectors in the periods around IPO. In detail, the expected sign on coefficients presents Figure 1.

Figure 1 Research Design



Source: authors' own work

Prior studies on earnings management usually estimate the above regressions for each year and every industry separately. However, as at least 15 observations in each year a

sub-sample is required (Zang, 2012; Lo et al., 2017), the use of industry classification in the IPO research with the limited number of quite divers companies is problematic and eliminates most cases. For that reason we follow Ecker et al. (2013), who recommend grouping companies in a relatively homogeneous sets according to the size of the firm, measured by lagged total assets. Therefore, in order to identify earnings manipulation activity in the earnings management sample, we divide all analyzed IPOs into 10 separate groups of a similar size (+/- 1 company), and then estimate each model separately for each decile group for pre-IPO, IPO and post-IPO year.

Because the analysis of correlations between particular forms of earnings management shows a strong and statistically significant collinearity between REM_P and REM_D, we follow Zang (2012) and aggregate these two forms of real earnings management into one proxy, REM_P&D, by taking their sum after multiplying the residuals form DISX equation by –1 so that its higher values denote a greater increase in the reported earnings.

In addition, regarding the prior research on factors affecting the accuracy of the profit forecast disclosed in IPO prospectuses we include several control variables. As interval between the earnings forecast and the realization of earnings make long-term predictions more difficult (Bédard et al., 2016), we employ HORIZON, i.e. the number of days from the release of the prospectus to the end of the IPO year. Moreover, larger and older IPOs have been shown to have a greater forecasting precision (Yau and Chun 1999; Jelic et al., 1998;). Hence, we also employ SIZE, i.e. the total value of sales in the year prior to the IPO and AGE, i.e. the number of years between the IPO date and the date of the company's incorporation. For the estimation of regression coefficients, we convert HORIZON, SIZE and AGE into a logarithm.

3 Results and Discussion

Summary statistics of the variables applied in our study are presented in Table 1. The results show that, on average, actual earnings differ from their projected value at 34%, which means that the forecasts disclosed in prospectus are inaccurate. What is more, the forecasts prepared by managers are overoptimistic (the mean FER at -16.83%).

Table 1 Summary Statistics of All Variables

Specifi-cation	Mean	Std. Dev.	Median	Min	Q1	Q3	Max
Panel A: Depend Variable							
AFER	0.3400	0.5125	0.2059	0.0011	0.0570	0.3724	3.2360
FER	–0.1683	0.5924	–0.0308	–3.2360	–0.2989	0.1304	0.7436
Panel B: Pre-IPO Year Earnings Management Activity							
REM_CFO	–0.0043	0.2294	–0.0160	–0.9468	–0.1339	0.0894	0.9528
REM_P&D	–0.0114	0.9322	0.0344	–7.5337	–0.1855	0.2467	1.6503
DACC	–0.0026	0.1148	–0.0220	–0.2843	–0.0732	0.0430	0.4428
Panel C: IPO Year Earnings Management Activity							
REM_CFO	0.0020	0.4694	–0.0094	–3.0910	–0.1240	0.1423	1.7510
REM_P&D	0.0028	0.7499	0.0817	–5.0340	–0.2438	0.2663	2.4166
DACC	0.0119	0.2849	0.0049	–1.4952	–0.0524	0.0812	0.9108
Panel D: Post-IPO Year Earnings Management Activity							
REM_CFO	–0.0037	0.1702	–0.0375	–0.4892	–0.0977	0.0617	0.9725
REM_P&D	–0.0128	0.3438	0.0311	–1.3046	–0.1305	0.2129	0.8656
DACC	–0.0074	0.1570	0.0081	–0.9400	–0.0406	0.0485	0.3411
Panel E: Control Variables							
HORIZON	172	2	201	26	140	278	487
SALES	46035	4	45622	292	19844	128234	1645672
AGE	15	2	14	3	9	20	149

Source: own calculations

Regarding the earnings management process one can see that such activities are used in the years around IPO. Although the mean values of our proxies amount to only about 1% of the total assets or less, it does not mean that Polish new stock companies have not put into practice earnings management in periods around the going public event. The level of these variables significantly varies across companies, investigated years and forms of the earnings manipulation. Moreover, the data in Table 1 reveal some differences in the use of earnings management tools between the years around IPO.

Table 2 presents the Pearson correlations coefficients between the applied variables. Significant correlations between some variables used as proxies of the earnings management process are not the random ones. The negative correlation indicates that some of the earnings managements methods are used interchangeably whereas the positive sign for REM_P&D and DACC suggests a simultaneous application of this methods. However, the observed links between variables are not constant over time.

Table 2 Correlation Matrix - Pearson Correlation Coefficients

Specification	REM_CFO	REM_P&D	DACC	HORIZON	AGE	SALES
Panel A: Pre-IPO Year						
REM_CFO	1.0000					
REM_P&D	0.0481	1.0000				
DACC	0.0054	−0.0673	1.0000			
HORIZON	−0.0432	−0.0528	−0.0128	1.0000		
AGE	0.0474	0.0501	0.2335**	0.0124	1.0000	
SALES	0.0657	0.0236	0.0168	−0.0990	0.3358***	1.0000
Panel B: IPO Year						
REM_CFO	1.0000					
REM_P&D	−0.4664***	1.0000				
DACC	−0.2393**	0.3049***	1.0000			
HORIZON	−0.1791*	0.0680	−0.2403**	1.0000		
AGE	−0.0443	0.1063	0.0937	0.0124	1.0000	
SALES	−0.0272	0.0617	0.0334	−0.0990	0.3358***	1.0000
Panel C: Post-IPO Year						
REM_CFO	1.0000					
REM_P&D	−0.3372***	1.0000				
DACC	0.0199	−0.0526	1.0000			
HORIZON	0.0767	0.0728	−0.2040*	1.0000		
AGE	0.0792	0.0522	0.0326	0.0124	1.0000	
SALES	−0.0273	0.0329	0.0287	−0.0990	0.3358***	1.0000

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Source: own calculations

Table 3 provides some insight into the results of our multiple regressions models. In the year preceding the IPO only two detectors of earnings management are associated with the earnings forecasts accuracy: REM_CFO and REM_P&D. Nevertheless, the signs of coefficients for these variables does not allow us to strictly state if applying real earnings management methods is associated with the lower earnings accuracy in the year before IPO and, thus, confirms our first hypothesis. Although the coefficient on REM_CFO is in line with our expectation form H1, the coefficient on REM_P&D points to a different dependence.

Table 3 Earnings Forecast Accuracy and Earnings Management -OLS Regression Results

Specifi-cation	Pre-IPO Year		IPO Year		Post-IPO Year	
	AFER	**FER**	**AFER**	**FER**	**AFER**	**FER**
Intercept	0.3430	−0.2637	0.8103	−0.8995	0.6344	−0.5615
	(0.6669)	(−0.4308)	(1.7162)*	(−1.6475)	(1.3023)	(−0.9576)
REM_CFO	−0.4076	0.4243	−0.0998	0.1897	0.2977	−0.0333
	(−1.9460)*	(1.7019)*	(−0.9513)	(1.5645)	(1.0547)	(−0.0981)
REM_P&D	−0.0870	0.1216	−0.0349	0.0638	−0.0287	0.1099
	(−1.6830)*	(1.9754)*	(−0.5303)	(0.8387)	(−0.2062)	(0.6552)
DACC	0.5171	−1.0352	−0.8984	1.1928	−1.3269	1.6769
	(1.1990)	(−2.0166)**	(−5.4444)***	(6.2516)***	(−4.5570)***	(4.7851)***
HORIZON	0.2194	−0.1978	0.1286	−0.0692	0.1629	−0.1334
	(3.1360)**	(−2.3765)**	(1.9542)*	(−0.9089)	(2.4310)**	(−1.6542)
AGE	−0.1188	0.1314	−0.0723	0.0552	−0.1041	0.0897
	(−1.7680)*	(1.6428)	(−1.2490)	(0.8251)	(−1.7019)*	(1.2184)
SALES	−0.0739	0.0690	−0.0842	0.0840	−0.0783	0.0774
	(−2.3112)**	(1.8145)*	(−2.9883)***	(2.5772)**	(−2.6309)**	(2.1618)**
Adj. R2	0.2499	0.2048	0.4146	0.4142	0.3466	0.2917
F−statistic	5.7741	4.6904	11.151	11.1343	8.6028	6.9025
p−value	0.0001	0.0004	0.0000	0.0000	0.0000	0.0000

The t-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Source: own calculations

The data presented in Table 3 provide evidence that in the year of IPO discretionary accruals are used by managers to meet the forecasted value of earnings. This result is consistent with our second hypothesis. However, the estimation results for real earnings manipulation activities lack the statistical significance and seem to be unimportant in explaining the level of the forecast error. Similar results are observed for the year following the IPO, but in this case these findings are not in line with our third hypothesis assuming that the earnings forecasts accuracy is decreased due to the earnings manipulation. Our findings suggest that after IPO the incentive to manage earnings is still valid and discretionary accruals are constantly applied to the reporting policy. Managers look ahead and continue to apply the income-increasing discretionary accrual management.

4 Conclusions

This paper empirically examines the use of real earnings management and discretionary accruals around IPO and the real activities manipulation in order to increase the accuracy of the earnings forecast voluntarily published in the IPO prospectus.

Our findings provide supportive evidence for the conclusion that managers use some methods of earnings management in the years close to going public so as to reduce the earnings forecasts errors. The data show that especially in the year of IPO discretionary accruals are used to increase the reported earnings in order to achieve the forecasted earnings disclosed in prospectus. Moreover, prior to the IPO we observe applying the real activities manipulation, in the year of IPO and after the discretionary accruals are associated with the level of earnings forecasts. This result may be explained by the fact that before IPO the accrual-based earnings manipulation is more constrained by auditors (Zang, 2012) and the extensive scrutiny of IPO prospectuses makes companies report less aggressively prior to IPO (Ball and Shivakumar 2008; Venkataraman et al., 2008).

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Preliminary Results of Non-bank Consumer Credit Providers in the Professional Qualifications Test by the Act No. 257/2016 Coll., on Consumer Credit

Ivan Soukal[1], Eva Hamplová[2]

[1,] University of Hradec Králové
Faculty of Informatics and Management, Department of Economics
Rokitanského 62, 500 03, Hradec Králové, Czech Republic
E-mail: ivan.soukal@uhk.cz

[2] University of Hradec Králové
Faculty of Informatics and Management, Department of Economics
Rokitanského 62, 500 03, Hradec Králové, Czech Republic
E-mail: eva.hamplova@uhk.cz

Abstract: *The new Act No. 257/2016 Coll., on consumer credit states obligatory duty for consumer credit providers and intermediaries to ensure and prove the professional qualification level of all employees involved in the provision and intermediation of a consumer credit. Qualification can be proven by the Act No. 257/2016 Coll only at accredited institutions. Such institutions provide a testing based on questions prepared by the market regulator and supervisor – the Czech national bank. No one is allowed to provide or intermediate a consumer credit without a successful test pass at an accredited institution. We analyzed the test results of 287 employees of two medium-sized non-bank financial institutions who took the final qualification test at an accredited institution. The goal is to present the test results so far and to find whether gender and age are factors of the test score. We set four main and three auxiliary hypotheses regarding an effect of gender and age variable on the test performance. We find that neither of the variables is a factor. Although some level of variance is present in a more detailed analysis, it is not statistically significant. Therefore, we claim that regarding the test by the act no. 257/2016 Coll. on Consumer Credit the results are independent of age or gender of an employee. Our result was unexpected concerning the age variable. In a discussion, we explain that results might be biased by "early-takers" employees. Therefore, we expect an increase in test results variance and change in the test result distribution skewness in a future as more regular employees will participate.*

Keywords: consumer credit, act no. 257/2016 Coll., qualification test, non-bank financial institution

JEL codes: G23, G28

1 Introduction

The latest legal development concerning the provision and intermediation of a consumer credit brought many changes when the Act No. 257/2016 Coll., on Consumer Credit became effective. All providers have to obtain the authorization to pursue the business of a non-bank consumer credit provider or the authorization to pursue the business of an independent intermediary from the Czech National Bank (thereinafter as CNB). Otherwise, they won't be allowed to provide or intermediate a consumer credit anymore. Everyone, who provided loans on the basis of a trade license, had to now apply for the license of the CNB till February 28, 2018 at the latest. Any person that provided such services and did not apply for it in time lost the license for a provision and intermediation of a consumer credit. The provision or intermediation of consumer credit is no more considered as a trade (Part II of Act No. 258/2016 Coll). Now it is defined as a special regulated activity on the financial market. CNB is the only granting authority regarding an authorization for such business. Article 18(1)(c) of Act No. 257/2016 Coll., on Consumer credit states an obligatory duty to ensure and demonstrate qualified performance of all persons that participate in the process of the provision and intermediation of a consumer credit. Qualification can be proved only by passing a qualification test organized by accredited

professional examiners, (Decree No. 381/2016 Coll.). The Act No. 257/2016 Coll. is in force since the December 1, 2016 and the latest date to prove a qualification is December 1, 2018. Until then it is possible for a person to temporarily continue in the provision and intermediation of a consumer credit but there is a duty to send the statutory declaration that a qualification was achieved by studying, training etc. CNB can verify this claim any time. Nevertheless, the only option how to continue provision and intermediation of a consumer credit (tied consumer credit, consumer credit for another purpose than housing and mortgages) is to obtain a certificate from an accredited professional examiner and to be included in the CNB's registry.

The aim of the paper is to examine whether the gender or the age are the factors of the employee's test performance. We examined this possible relation on the test results provided to us by accredited professional examiner. The examiner wished to remain anonymous and we are as well bound to respect an anonymity of non-bank consumer credit providers that used his services. This accredited professional examiner provides qualification testing to non-bank financial institutions. We analyzed results of employee's test results from the first two months of testing. The goal is to present the test results so far and to find whether gender and age are factors of the test score. We perform this analysis to find how much are the employees successful and to identify which variable should be analyzed in a greater detail in a future analysis of a significantly larger sample.

2 Methodology and Data

Out test sample consisted of 288 records of individual test performance records. All persons are employees of non-bank financial institutions. We analyzed the final test only; study or training test results are beyond the scope of the analysis. Analyzed results were gathered from the qualification test for provision and intermediation of a consumer credit for other purpose than housing, see (Article 3(1)(i) of Act No. 257/2016 Coll., on Consumer Credit). The qualification test took place during January and February 2018. Every test contained 60 test questions (professional expertise testing) and two case studies (professional competence testing). Each test was consisted of both multiple question types: one correct answer (75% of the test) and multiple correct answers (25% of the test). Any wrong or missing answer in multiple correct answers question resulted in incorrect result concerning the whole question. Professional skills were tested by two case studies with five questions each (one correct answer questions). Qualification testing test can take two hours at most (Article 9 – 11 of Decree No. 384/2016 Coll.). To successfully pass a professional examination, an examinee must obtain at least

- three-quarters of the points attainable in all the examination questions,
- three-fifths of the points attainable in the examination questions concerning professional expertise, and
- three-fifths of the points attainable in the examination questions concerning professional competence, which shall be considered an independent area for calculation purposes (Article 12 of Decree No. 384/2016 Coll.)

All statistics were performed in IBM SPSS 20, charts were constructed in IBM SPSS 20 and MS Excel 2013. Although standard statistic tests are described in many monographs and books dealing with general statistics, we chose to source our methodology from more focused sources. We needed to assess relationship between variables in professional qualification tests which is an area of educational research although an application area is qualification testing in financial intermediation area. Therefore, we selected books focused on quantitative research in education and especially test evaluation.

Chi-Square test of independence measures the difference between a statistically generated expected result and an actual result to see if there is a statistically significant difference between them, i.e. to see if the frequencies observed are significant. This test is used to in contingency table to investigate an independence between categorical variables, see e.g. (Best and Kahn, 2006; Corty, 2007; Cohen et al., 2008, Hoy, 2010, Wellington, 2015). The hypothesis states that there is no statistically significant difference between observed

samples or specifically in in case of an contingency table that tested variables are independent. We tested two hypotheses in contingency table independence test:

- H_gender_indepence: the test result is independent on gender of a participant.
- H_age_independence: The test result is independent on age of a participant.

This widely used test is suitable for gender and age effect on other variables. It was employed e.g. by Sulaiman (2012) who tested the relationship between financial risk tolerance and each of the demographic features including gender and age. Hedvičáková et al. (2017) tested financial knowledge and year of study dependence. Pahl, J. (2008) tested an independence of gender and credit usage and also employment categories. Aesaert and Van Braak (2015) used chi-square test of independence to identify gender as a factor of measured competence.

T-test for independent samples is a suitable tool for means comparison of a dependent variable between two samples or to be more specific to discover whether there are statistically significant differences between the means of two samples, using parametric data drawn from random samples with a normal distribution (Best and Kahn, 2006; Corty, 2007; Cohen et al. 2008; Hoy, 2010). The t-test has two variants: the t-test for independent samples and the t-test for related samples often called paired samples and therefore paired t-test. The former assumes that the two samples are unrelated to each other and that is the variant we employed. The hypothesis states that there is no statistically significant difference between the means of two samples. We tested one hypothesis:

- H_gender_scores: There is no difference in the test score of male and female employees.

Due to an assumption that the sets of scores have approximately equal variances, we performed a Levene's test for equality of variances, see e.g. (Cohen et al., 2008; Muijs, 2008). Although we possessed not just means, but the whole samples where variance can be calculated on, SPSS does this test automatically and a researcher then chooses a correct type of the t-test result. Also, Levene's test for equality of variances was employed before ANOVA. Homogeneity of variance is tested in a hypothesis that variance is equal in both samples. Our auxiliary hypotheses were then:

- H_gender_scores_aux: The test scores variance is the same for both male and female employees.
- H_age_scores _aux: The test scores variance is the same in all age groups.

ANOVA or One-way analysis of variance is an effective way to determine whether the means of more than two samples are too different to attribute to sampling error. In other words, if there is no statistically significant difference between samples' means. The ANOVA consists of these phases: within-groups variance calculation, between-groups variance calculation, F-ratio calculation by between-groups and within-groups variance fraction and F-ratio assessment (Best and Kahn, 2006; Corty, 2007; Cohen et al. (2008). Aesaert and Van Braak (2015) investigated gender influence on the total test scores using a t-test and a one-way between-groups ANOVA. We tested a hypothesis:

- H_age_scores: The test score means in age groups are the same.

Bonferroni all-pair-wise multiple comparison test is a part of a post-hoc analysis in ANOVA or MANOVA. Its purpose is to isolate where the differences among samples are. It replaces a series of t-tests which might be eventually misleading due to an inability to reflect a total number of samples. Therefore, e.g. Smalheiser (2017) or Cohen et al.(2008) recommends employing Bonferroni all-pair-wise multiple comparison test or other similar tool such as Turkey HSD test. Bonferroni test calculation multiplies each of the significance levels from the least square difference t-test (in SPSS as LSD) by the number of tests performed. The post-hoc analysis presents results of hypotheses for each sample stating that the means in two samples are the same.

- H_age_scores_aux: The test score means in each pair of age groups are the same.

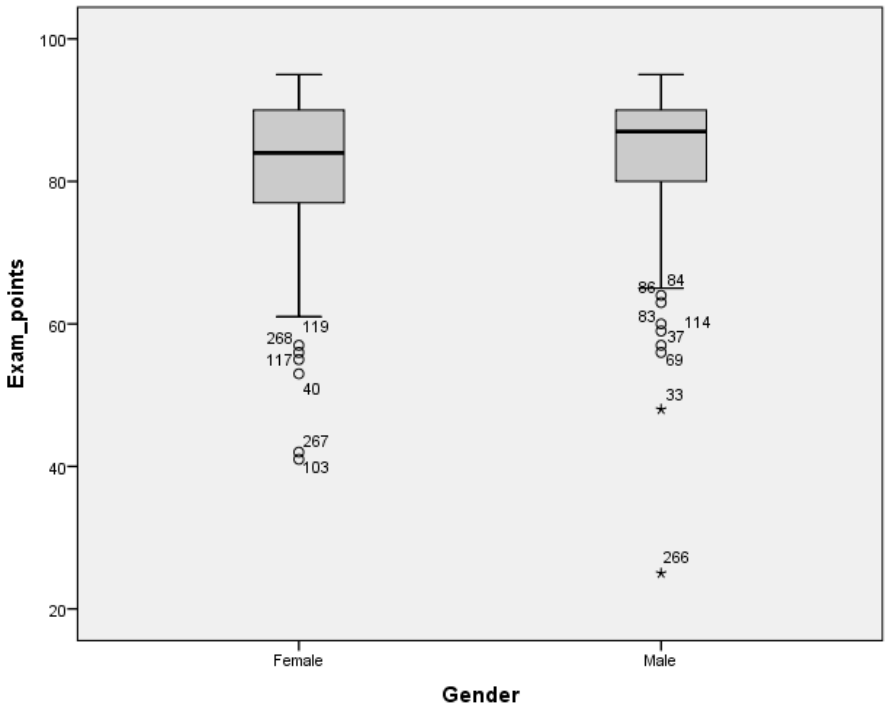
All tests were performed at the significance level of 5%.

3 Results and Discussion

The share of successful participant among male employees was 85,9% and 85,1% among female employees. Such figures are very close to each other, nevertheless as the number of participants grows, the statistical test sensitivity grows as well. Therefore, a hypothesis test was performed. We tested the hypothesis H_gender_indepence: the test result is independent on the gender of a participant. We failed to reject the hypothesis a p-value 0,87. We claim that there is no statistical evidence that test result (passed/failed) depends on gender. Both the male and female employees got the same rate of success in the qualification test. The shares of participants that passed or failed are presented below.

We constructed a box-plots of the test score in points to provide a closer look at the data, see fig. 1.

Figure 1 Box-plot of Exam Points by Gender



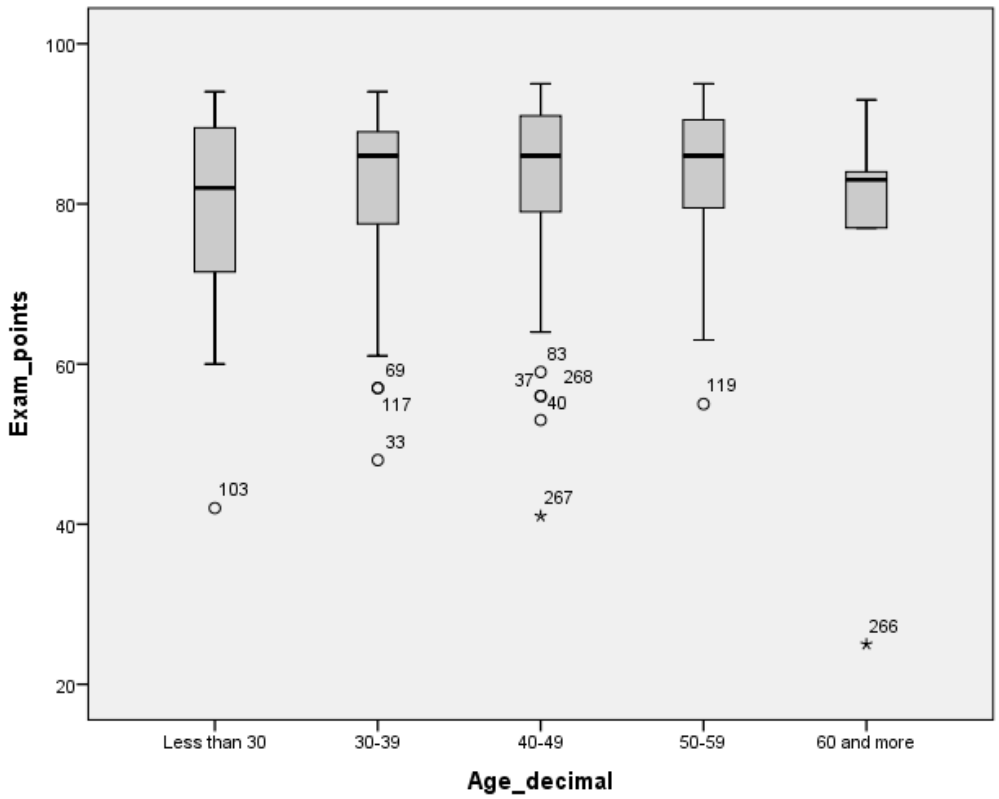
Source: own research

We can see some difference in a level of variance and also some outliers. The test score 95% confidence intervals for mean was <81;84> points for female employees and <81;86> for male employees. Such values are equal in real-world point of view. Nevertheless, T-test for independent samples was performed to assess whether there is a statistically significant difference in the test score between male and female sample. In order to perform the T-test the Levene's test for equality of variances tested auxiliary hypothesis H_gender_scores_aux: The test scores variance is the same in both male and female employees. We failed to reject a hypothesis with p-value 0,78 and therefore we accepted the results as suitable for the T-test with the same sample variance. Independent samples T-test tested hypothesis H_gender_scores: There is no difference in the test score of male and female employees. We failed to reject the hypothesis with p-value 0,48. We claim that the difference in the test score means is not statistically significant and therefore the test scores means are the same for both genders.

The sample was divided into groups by the age, to be more specific we decimalized the age and created groups of young employees below the of thirty, then employees in their

thirties, forties, fifties etc. The box-plots on figure 2 presents the test scores achieved in different age groups.

Figure 2 Box-plot of Exam Points by Age Decimals



Source: own research

A different level of variance can be observed, nevertheless, the means are of a similar value. Therefore, it was performed a chi-square contingency table test of the hypothesis H_age_independence: The test result is independent on the age of a participant. To be more specific the age groups were tested against the test results (passed/failed). We failed to reject the hypothesis with a p-value 0,21. We claim that the test result (passed/failed) is independent of the age of an employee.

After the hypothesis testing we calculated 95% confidence interval for mean for each group to provide greater detail, see table 1.

Table 1 The Test Score in Different Age Groups

				95% Confidence Interval for Mean	
Age_group	**N**	**Mean**	**Std. Deviation**	**Lower Bound**	**Upper Bound**
Less than 30	27	78,59	12,65	73,59	83,60
30-39	67	82,27	9,92	79,85	84,69
40-49	138	83,50	9,83	81,85	85,15
50 and over	56	82,75	11,98	79,54	85,96

Source: own research

There can be identified some difference in the youngest group to the 40-49 years old employees group. Therefore, we performed ANOVA on the test score to test the age groups in greater detail. However, before that the Levene's test for equality of variances was performed. We failed to reject the hypothesis with p-value 0,28. Therefore, we can assume that variance is the same in all age groups and so the ANOVA can be employed. The tested

hypothesis was H_age_scores: The test score means in age groups are the same. We failed to reject the hypothesis with p-value 0,18. We claim that the between-group difference is not statistically significant and therefore, the test score does not differ in the age groups.

This result was a bit of a surprise because we expected that experienced employees would perform statistically significantly better than the youngest workers or the oldest. The lowest mean result of the youngest group compared to employees in the age of 40-49 partially supports this expectation but so far, the hypothesis testing was inconclusive. To more closely evaluate actual intergroup difference, we performed a post-hoc analysis by Bonferroni all-pair-wise multiple comparison test, see a result in table 2 below.

Table 2 The Test Score Post-hoc Analysis

Age_group	Age_group compare	Mean Difference	Std. Error	Sig.
Less than 30	**30-39**	-3,67	2,41	,77
	40-49	-4,90	2,22	,17
	50 and more	-4,15	2,48	,56

Source: own research

Not even the post-hoc analysis found a statistically significant difference in the test scores. Generally, we can sum the results up by a claim that neither of the variable gender or the age are factors of the performance in the qualification test by the Act No. 257/2016 coll., on consumer credit.

Such results might offer a managerial implication that neither of these variables should play role in managerial decisions regarding the quality of the employee. However, we do not support such claim at least not yet. We argue that pilot study data might have been biased. If so, then a source of the bias would be connected to an "early-taker" or in more colloquial manner an "eager-beaver" issue. This issue is known phenomenon from educational sciences field but it is present also in marketing research because Albert et al. (2010) describe it also as a problem of a survey design. Quota or time-limited surveys can be biased by "eager-beaver" participants. The problem lies in a fact that these survey participants complete their task as the first group. They may have common characteristics, such as being incentive driven, having hidden agendas, or just having a certain personality type. Any of these factors may lead them to dominate and influence the results. Bleiklie (2009) uses the term and describes this term as someone who is "eager and rapid implementer". The "early-taker" group Rajbanshi et al.(2015) connect with a higher productivity in their model. In our case, we might face a similar problem.

The data comes from the beginning of the testing period. Therefore, we expect that employees in our data are likely to be these "early-takers" or "eager-beavers". Accordingly mentioned sources we expect such persons to be more motivated, more hard-working and overall more prepared for the test. Otherwise, they would take later exam term to gain more time for studying. Albert et al. (2010) recommend employing a phased launch survey in order to avoid such bias. Since this is an exploratory study of the first data, it is not possible. Nevertheless, the testing will be performed at least for half a year and maybe till winter 2018. Therefore, we may observe different results as more and more regular employees will take the test. We expect an increase in variability and also a decrease of the test result distribution negative skewness. As the number of regular employees will be growing the share of motivated, hard-working and well-prepared employees will be shrinking. Therefore, we expect a higher frequency of low scores (variance increase) and shift of the mean to lower values (negative skewness decrease).

4 Conclusions

The new Act No. 257/2016 Coll., on consumer credit states obligatory duty for consumer credit providers and intermediaries to ensure and prove the professional qualification level of all employees involved in the provision and intermediation of a consumer credit. the Act

No. 257/2016 Coll., on Consumer Credit. We performed the analysis of 288 individual records of the qualification tests organized by an accredited professional examiner in the first months of the year 2018.

The goal of the paper was to present the test results so far and to find whether gender and age are factors of the test score. The test score 95% confidence intervals for mean was <81;84> points for female employees and <81;86> for male employees. We tested the hypothesis that the test result is independent on the gender of a participant and failed to reject it. We employed the Chi-Square test of independence. Additional hypothesis concerning the group scores confirmed the results of the first hypothesis that a gender is not a factor of the test score. We employed the T-test for independent samples with the same variance assumed. The second variable to be tested was the age of participants. We tested the hypothesis that the test result is independent on age of a participant. We failed to reject this hypothesis. We employed the Chi-Square test of independence. Then we tested the hypothesis that the test score means in all age groups are the same. We failed to reject this hypothesis. We employed ANOVA and Bonferroni all-pair-wise multiple comparison test is a part of a post-hoc analysis. The post-hoc analysis showed some difference between the youngest group compared to employees in the age of 40-49. Nevertheless, it was not statistically significant. Therefore, we claim that neither of the variable gender and age are factors of the qualification tests result or score.

Finally, a managerial implication of our analysis Is that that neither of these variables should play role in managerial decisions regarding the quality of the employee. Nevertheless, we assume that our pilot study data might have been biased. If so, then a source of the bias would be connected to an "early-taker" or in more colloquial manner an "eager-beaver" issue. Therefore, we suggest repeating the testing on the full sample at the end of testing in winter to verify whether an increase of regular employees share changed the group parameters or not.

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The Role of Nonfinancial Indicators in the Process of Credit Risk Assessment

Martina Sponerová[1], Miroslav Svoboda[1], Miroslav Sponer[2]

[1] Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 603 00 Brno, Czech Republic
E-mail: sponerova.martina@seznam.cz
254801@mail.muni.cz

[2] Karel Englis College
Management Institute
Mezírka 755/1, 602 00 Brno, Czech Republic
E-mail: miroslav.sponer@vske.cz

Abstract: *Credit risk management is closely related to the bankruptcy prediction and even it was intensively investigated by the banking industry it is still at the forefront of researchers. There is a pressure on financial institutions to still improve their credit risk management system to eliminate credit risk which is one of the most significant financial risks in the banking industry. Many research studies, scientific articles and publications are still trying to find the best method to predict bankruptcy through different bankruptcy models. The reviews from the last years show that using only financial data is not sufficient to predict bankruptcy precisely and some of the researchers also include nonfinancial indicators to their models. The aim of this article is to find which of the nonfinancial indicators have the most significant prediction power to predict failure of Czech small and middle enterprises (SMEs) based on the exclusive nonfinancial data from a bank. We have investigated around 1000 companies from the SMEs segment, of which 100 failed during the period 2010 – 2016. The most important nonfinancial indicators from the credit risk point of view were found by using logistic regression.*

Keywords: credit risk, bankruptcy prediction, SME, nonfinancial indicator

JEL codes: G32, G33, C53

1 Introduction

Bankruptcy prediction has long attracted the interest of researches. Academics and practitioners have focused their research to improve the performance of existing bankruptcy models and they are still developing new models and methods to precisely predict business failure.

The business failure is closely connected with credit risk which is one of the biggest risk of financial institutions. Hence, there is a pressure to financial institutions to still improve their credit risk management systems to predict bankruptcy as accurately as possible.

Very interesting ways of research from the last years is the development of bankruptcy models specifically designed for each company feature, such as size (Altman and Sabato, 2007), industry (Chava and Jarrow, 2004) or age (Wilson and Altanlar, 2014). Tascon and Castano (2012) suggest that the more homogeneus the characteristics of the companies used for the construction of a prediction model are, the better their predictive capacity will be. In the same line, Internal Ratings Based systems, under Basel recommendations, also suggest to lenders to build models geared towards the specific characteristics of corporate sub-populations, tuned to changes in the macro environment and tailored to the available data.

The actual trend in the default prediction area is to incorporate also non-financial and macroeconomic information as predictor variables which was examined by e.g. Grunert et al. in 2005, Altman et al. in 2010, Moon and Sohn in 2010. They found that the non-financial and macroeconomics variables greatly improve the accuracy performance of the proposed bankruptcy models.

The main problems of using only financial indicators as failure predictors are that they are not able to express long-term targets of the company, they are not connected with a company´s strategy, they are based on historical data, they are lagging indicators. If the financial indicators should express the company´s targets, there could exist a danger of handling with profit. (Synek, 2016)

The aim of this article is to find which of the available nonfinancial indicators have the most significant prediction power to predict failure of Czech SMEs based on the nonfinancial data from a bank.

We focus on SMEs because they are reasonably considered as the most important segment of the economy many countries. For OECD members, the percentage of SMEs out of the total number of firms is higher than 97%. SMEs employ approximately two third of employees and create more than half of added value in EU-28 (Eurostat, 2017). Thanks to their simple structure, they can respond quickly to changing economic conditions and meet local customers´ needs, growing sometimes into large and powerful corporations or failing within a short time of the firm´s inception.

2 Literature review

The default prediction literature for corporates is well known. Many authors during the last fifty years have examined several possibilities of predicting default or business failure. The seminal works in this field were Beaver (1967) and Altman (1968). The researcher William Beaver was the first to apply a number of ratios which could discriminate between failed and non-failed companies up to five years prior to bankruptcy. Altman improved Beaver´s method and assessed a more complete financial profile of firms. Variables in Altman´s model were classified into five standard ratio categories - liquidity, profitability, financial leverage, activity, and solvency. Being the first person to successfully develop multiple discriminate analysis (MDA) prediction model with a degree of 95.0% rate of accuracy, he is considered the pioneer of insolvency predictors. Altman´s model has been applied successfully in many studies worldwide concerning the subjects of capital structure and strategic management, investment decisions, asset and credit risk estimation and financial failure of publicly traded companies (Lifschutz and Jacobi, 2010).

For many years thereafter, MDA was the prevalent method applied to the default prediction models. It was used by many authors, for example very often cited in research literature is Taffler model developed in Great Britain in 1977 (Taffler, Tishaw, 1977). Another MDA model was developed by Inka and Ivan Neumaier in 1995 and is known as IN95. This model was constructed especially for the Czech market and was updated in next years.

Considering these MDAs´ problems, Ohlson (1980), for the first time, applied the conditional logit model to the default prediction study. The practical benefits of logit methodology are that they do not require the restrictive assumptions of MDA and allow working with disproportional samples. After Ohlson, most of the academic literature used logit models to predict default. Another, very often cited model, which uses conditional probability, is the model by Mark E. Zmijewski (1984). He was the pioneer in applying probit analysis to predict default but, until now, logit analysis has given better results in this field. A probit approach is the same as the logit approach, only the distribution of random variables is different.

From a statistical point of view, logit regression seems to fit well with the characteristics of the default prediction problem, where the dependent variable is binary and where the groups are discrete, non-overlapping and identifiable. The logit model yields a score between 0 and 1, which conveniently gives the client´s probability of default. Despite the theoretical differences between MDA and logit analysis, academic studies show that empirical results are quite similar in terms of classification accuracy (Altman et al., 2010).

We witness a substantial increase in the number and complexity of default prediction studies due to the rapid advancement in technology and methodology. Above all, we can mention artificial neuron networks used e.g. by Angelini et al. (2007), decision trees

method used e.g. by Gulnur and Fikret (2011) and hazard models used e.g. by Shumway (2001).

Empirical literature also highlights the significance of qualitative information such as business type, industrial sector, location, age, etc. in understanding of firms´ credit risk behavior (Grunert et al., 2005). Altman et al. (2010) took account of this issue and studied about 5.8 million SMEs, of which 66 000 failed during the observed period 2000–2007. They reported that the prediction performance of Altman and Sabato (2007) model improved by about 13% when qualitative information was added. They found that data relating to legal action by creditors to recover unpaid debts, company filing histories, comprehensive audit report/opinion data and firm-specific characteristics make a significant contribution to increasing the default prediction power of risk models built specifically for SMEs (Altman et al., 2010).

Grunert et al. (2005) created several bankruptcy models using both financial and non-financial variables (age and type of business sector etc.). They concluded that the combination of financial and non-financial variables improves the accuracy performance of the developed models. Peel et al. (1986) and Whittred and Zimmer (1984) show, using a sample of SMEs from the UK, that the timing of the submission of annual accounts is an indicator of financial failure. Other studies also suggest that unfavorable audit reports (Peel and Peel, 1989) and the existence of payment problems (Wilson and Altanlar, 2014) are relevant variables for predicting the failure. However, whereas the importance of financial factors is widely accepted because their impact is measurable, the relevance of non-financial variables is mainly considered in a holistic manner.

3 Methodology and Data

Our dataset consist a sample of non-financial indicators for 1000 SMEs that survived in the period 2010 – 2016 out of which around 200 companies that failed in this time period. This data was exclusively gained from a bank database by random selection of SMEs that survived and all of SMEs that failed during above mentioned period.

We have at disposal non-financial indicators used in a bank as supplementary indicators when assessing creditworthiness of a client. There are eight groups of non-financial indicators containing economic environment, competitive position, relationship with suppliers and customers, country risk, management of a company, ownership of a company, relationship with a bank, relationship with other creditors. The complete list of these indicators is mentioned in the Tables 1 - 8.

Table 1 Economic Environment - List of Non-financial Indicators

Coding	Description
QS_1_2	**Main market competition – relation of aggregate demand and aggregate supply (production capacity)**
QS_1_2_1	Low (demand exceeds production capacity)
QS_1_2_2	Average (stable demand is in line with production capacity)
QS_1_2_3	Strong (demand is lower than supply)

Source: own processing

Table 2 Competitive Position - List of Non-financial Indicators

Coding	Description
QS_2_1	**Year-on-year client growth in comparison to industry growth**
QS_2_1_1	Above-average (2% more than sector performance)
QS_2_1_2	Average (sector performance +/- 2%)
QS_2_1_3	Under-average (more than 2% below industry performance or no comparison)
QS_2_2	**Position on the main market - according to the proportion of client revenues**

QS_2_2_1	Dominant - the ability to influence pricing
QS_2_2_2	Significant - price recipient
QS_2_2_3	Average - comparable to other subjects
QS_2_2_4	Marginal or market entry
QS_2_3	**The flexibility and ability of the company's innovation**
QS_2_3_1	High flexibility: the company is able to innovate products or change the scope of business within months without high costs
QS_2_3_2	Low flexibility: product innovation or eventually completely changing of business scope is possible within the years with additional costs
QS_2_3_3	No flexibility: the company is not able to innovate products, or change the business scope
QS_2_3_4	Impossible to assess: product innovation / change of business scope is not relevant
QS_2_4	**Degree of diversification of client activities**
QS_2_4_1	A diverse business scope in different sectors
QS_2_4_2	A diverse business scope in the same sectors
QS_2_4_3	One main business scope and other activities
QS_2_4_4	One main business scope

Source: own processing

Table 3 Relationship with Suppliers and Customers - List of Non-financial Indicators

Coding	Description
QS_3_1	**Customers - share of individual customers on client revenues**
QS_3_1_1	Very low dependence (below 10% incl.)
QS_3_1_2	Low dependence (between 10% -20% incl.)
QS_3_1_3	Strong dependence (between 20% - 50% inc.)
QS_3_1_4	Very strong dependence (over 50%)
QS_3_2	**Customers – share of overdue receivables**
QS_3_2_1	Excellent (overdue receivables share usually does not exceed 5% incl.)
QS_3_2_2	Good (overdue receivables share is usually 5% - 15% incl.)
QS_3_2_3	Bad (overdue receivables share is usually 15% - 30% incl.)
QS_3_2_4	Very bad (overdue receivables share usually exceeds 30% incl.)
QS_3_3	**Demand stability (demand for products/client services)**
QS_3_3_1	Stable demand
QS_3_3_2	Long-term steady demand but short-term negative fluctuation was identified (i.e. from several weeks to about 3 months)
QS_3_3_3	Unstable demand
QS_3_4	**Suppliers - client dependency on individual suppliers**
QS_3_4_1	Dependence on any of suppliers does not exceed 20%
QS_3_4_2	The share of any of the suppliers exceeds 20% and its substitution is possible anytime
QS_3_4_3	The share of any of the suppliers exceeds 20% and its substitution is not possible or it would be very difficult to

Source: own processing

Table 4 Country Risk - list of Non-financial Indicators

Coding	Description
QS_4_1	**Export, import – territory risk**
QS_4_1_1	The client has direct export/import only with industrialised countries or has no direct export/import or the risk of the country is insured
QS_4_1_2	The client has direct export/import only with industrialised countries and export/import with risk countries is less significant
QS_4_1_3	Client's export/import is mainly directed to risk countries and the risk associated with it is not always adequately treated (payment terms, insurance, etc.)
QS_4_2	**Currency risk**
QS_4_2_1	Direct export/import in currency of a similar volume (natural hedging) or exchange risk is adequately secured on financial markets
QS_4_2_2	Direct export/import in individual currencies with max. deviation up to 20% and currency risk is not adequately secured on the financial markets
QS_4_2_3	Direct export/import by individual currencies is realized in different volumes and currency risk is not adequately secured on the financial markets
QS_4_2_4	No or insignificant direct export/import

Source: own processing

Table 5 Management of a Company - List of Non-financial Indicators

Coding	Description
QS_5_1	**Credibility and stability of management – knowledge of history and moral management profile**
QS_5_1_1	Majority of management is unchanged for more than 2 years and there is no information about immoral behaviour of management members in this or other companies for at least 6 years
QS_5_1_2	Majority of management is unchanged for less than 2 years and there is no information about immoral behavior of management members in this or other companies for at least 6 years
QS_5_1_3	Majority of management is unchanged for less than 2 years and there is insufficient information about the behavior of the management members in this company or other companies
QS_5_1_4	There is information about the immoral behavior of management members in this or other companies over the last 6 years
QS_5_2	**Management capabilities**
QS_5_2_1	Management ability to control the company is above average
QS_5_2_2	Management ability to control the company is the average
QS_5_2_3	Management ability to control the company is under average

Source: own processing

Table 6 Ownership of a Company - List of Non-financial Indicators

Coding	Description
QS_6_1	**Clear and transparent ownership relation**
QS_6_1_1	The owner is known with transparent links
QS_6_1_2	The owner is known with unclear or non-transparent links
QS_6_1_3	The owner is not known

QS_6_2	**Owner´s credibility and stability**
QS_6_2_1	There is a decisive share enabling the strategic objectives to be held without change for at least 6 years and there is no information about the negative impact of the owner to the client
QS_6_2_2	There is a decisive share enabling the strategic objectives to be held without change for at least 2 years and there is no information about the negative impact of the owner to the client
QS_6_2_3	There is no decisive share enabling the strategic objectives to be held or the history of the owner is shorter than 2 years and there is no information about the negative impact of the owner to the client
QS_6_2_4	There is negative information about the activity of the owner to the client

Source: own processing

Table 7 Relationship with a Bank - List of Non-financial Indicators

Coding	Description
QS_7_1	**Liabilities repayment to a bank**
QS_7_1_1	The credit history of the client is longer than 6 years and for this period the delay has not exceeded 5 days
QS_7_1_2	The credit history of the client is from 2 to 6 years and for this period the delay has not exceeded 5 days
QS_7_1_3	The credit history of the client is shorter than 2 years and for this period the delay has not exceeded 5 days
QS_7_1_4	Instalment delays over the last 6 years exceeded 5 days
QS_7_2	**Fulfilment of terms and conditions**
QS_7_2_1	Regular fulfilment of terms and conditions
QS_7_2_2	In the past, the client was in a situation where he did not fulfil the contractual conditions (financial or non-financial), but it was a unique situation and/or acceptable level of default.
QS_7_2_3	The client has repeatedly failed to fulfil the terms and conditions
QS_7_2_4	Not to be evaluated (new client or client without credit history in a bank)
QS_7_3	**Turnover development on bank accounts**
QS_7_3_1	Client keeps most (all) payments via accounts in a bank
QS_7_3_2	The share of clients payments corresponds to the bank's share of financing
QS_7_3_3	The bank is not the main bank of a client with a very small share of the client's payment or the share of clients payments does not correspond to the bank's share of financing
QS_7_3_4	Not to be evaluated (new client or client without relationship history in a bank)
QS_7_4	**Information quality from a client**
QS_7_4_1	High quality
QS_7_4_2	Good/standard quality
QS_7_4_3	Insufficient quality
QS_7_4_4	Client without credit history in a bank

Source: own processing

Table 8 Relationship with Other Creditors - List of Non-financial Indicators

Coding	Description
QS_8_1	**Obligations repayment towards the state**
QS_8_1_1	There are no overdue payables to the tax office, social security administration, health insurance company during the last 4 years
QS_8_1_2	There are or have been overdue payables to the above mentioned institutions during the last 4 years
QS_8_1_3	As a result of the overdue payables to the state, health and social insurance, the execution was set, with a significant negative impact on the continuity of the client's cash flow and its financial situation over the last 4 years
QS_8_2	**Liabilities repayment to suppliers**
QS_8_2_1	Excellent - the share of overdue payables generally does not exceed 5% incl.
QS_8_2_2	Good – the share of overdue payables is usually 5% - 20% inc.
QS_8_2_3	Bad - the share of overdue payables is usually 20% - 30% inc.
QS_8_2_3	Very bad - the share of overdue payables is usually more than 30% inc.

Source: own processing

To find which of non-financial variable in each group has the most predictive power logistic regression through IBM SPSS software was used. We have tested each group separately to find the most significant variables in each group. The most significant variables were used to develop a bankruptcy prediction model. The reliability of the model was tested by ROC curve.

ROC (Receiver Operating Characteristic) curve is a graphical method, which is based on a square showing the relationship between true positive rate (TPR – also called sensitivity) and false positive rate (FPR – also called fall-out). TPR measures the proportion of positives that are correctly identified as such. FPR is also known as probability of false alarm, and it is calculated as the ratio between the numbers of negatives that are wrongly identified as positives. TPR is applied to the y-axis and FPR on the x-axis. ROC curve combines the values of TPR and FPR.

There are two possible extreme cases. The first case occurs when the predicted values are absolutely similar as real values. In this case the curve copies the border of the graph beginning in down left corner through upper left corner and ends in upper right corner. The second case is the exact opposite and describes the model with no predictive power. The curve in this case is a diagonal from down left corner to upper right corner of the graph. Thus, the closer the curve is to the upper left corner, the better predictive power of the model.

ROC curve is closely related to AUC (Area Under Curve) indicator that numerically represents the graph and helps with comparison of two or more models. This indicator quantifies the area under the curve and is useful for comparing two or more curves, because they are transformed into one measure and easily comparable. AUC ranges from 0.5 to 1, where a higher value indicates a better prediction model.

Model Specification

Logistic regression is the appropriate regression analysis to conduct when the dependent variable is dichotomous (binary). Like all regression analyses, the logistic regression is a predictive analysis. Logistic regression is used to describe data and to explain the relationship between one dependent binary variable and one or more nominal, ordinal, interval or ratio-level independent variables. The dependent variable should be dichotomous in nature (e.g. in our case bankrupt or non-bankrupt companies). There

should be no outliers in the data, no high correlations (multicollinearity) among the predictors. Tabachnick and Fidell (2013) suggest that as long correlation coefficients among independent variables are less than 0.90 the assumption is met. Mathematically, logistic regression estimates a multiple linear regression function defined as:

$$\pi(x) = \frac{exp^{(\alpha+ \beta_1 X_1+ \beta_2 X_2+ \beta_3 X_3+\cdots \beta_n X_n)}}{1+exp^{(\alpha+ \beta_1 X_1+ \beta_2 X_2+ \beta_3 X_3+\cdots \beta_n X_n)}} \quad (1)$$

4 Results and Discussion

We have tested each group of non-financial variables to find which variable has the most predictive power and we found the most predictive variables based on logistic regression analysis of each group. The list of selected variables is mentioned below. We do not mention all results and coding of respective variables because there is not enough space.

Table 9 List of Selected Variables

Coding	Coeficient B	p-value
QS_2_1	**Year-on-year client growth in comparison to industry growth**	
QS_2_1_1	-0.285	0.044
QS_2_1_2	-0.676	0.000
QS_2_1_3		0.000
QS_2_2	**Position on the main market - according to the proportion of client revenues**	
QS_2_2_1	-0.895	0.035
QS_2_2_2	-1.622	0.000
QS_2_2_3	-0.503	0.002
QS_2_2_4		0.000
QS_3_3	**Demand stability (demand for products/client services)**	
QS_3_3_1	-0.812	0.000
QS_3_3_2	-0.527	0.000
QS_3_3_3		0.000
QS_4_1	**Export, import – territory risk**	
QS_4_1_1	0.050	0.908
QS_4_1_2	0.640	0.156
QS_4_1_3		0.001
QS_5_2	**Management capabilities**	
QS_5_2_1	-2.265	0.000
QS_5_2_2	-1.995	0.000
QS_5_2_3		0.000
QS_6_1	**Clear and transparent ownership relation**	
QS_6_1_1	0.027	0.968
QS_6_1_2	0.559	0.417
QS_6_1_3		0.004
QS_6_2	**Owner´s credibility and stability**	
QS_6_2_1	-0.543	0.211
QS_6_2_2	-0.060	0.892
QS_6_2_3	-0.691	0.119
QS_6_2_4		0.000
QS_7_1	**Liabilities repayment to a bank**	
QS_7_1_1	-1.746	0.000
QS_7_1_2	-0.819	0.014
QS_7_1_3	-0.628	0.075
QS_7_1_4		0.000
QS_7_2	**Fulfilment of terms and conditions**	

QS_7_2_1	0.502	0.075
QS_7_2_2	0.950	0.001
QS_7_2_3	1.211	0.000
QS_7_2_4		0.000
QS_7_3	**Turnover development on bank accounts**	
QS_7_3_1	-1.079	0.000
QS_7_3_2	-0.427	0.172
QS_7_3_3	-0.714	0.028
QS_7_3_4		0.000
QS_8_1	**Obligations repayment towards the state**	
QS_8_1_1	-2.401	0.000
QS_8_1_2	-1.117	0.065
QS_8_1_3		0.000
QS_8_2	**Liabilities repayment to suppliers**	
QS_8_2_1	-1.298	0.000
QS_8_2_2	-0.527	0.000
QS_8_2_3	-0.216	0.164
QS_8_2_4		0.000

Source: own processing

Above mentioned variables entered into logistic regression again with below mentioned result.

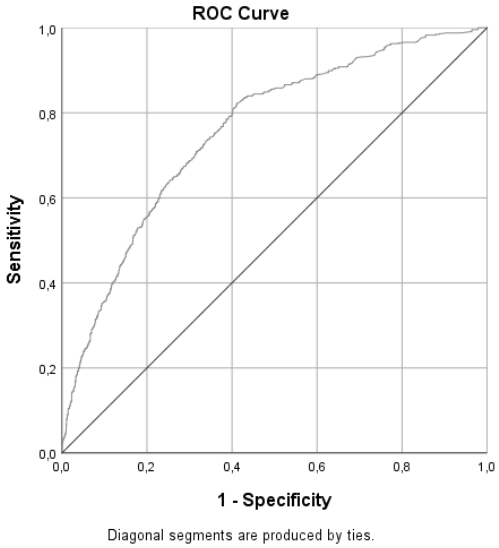
Table 10 Final List of Variables

Coding	Coeficient B	p-value
QS_2_1_3		0.000
QS_2_2_2	-1.188	0.000
QS_4_1_3		0.006
QS_7_1_4		0.000
QS_7_3_4		0.000
QS_8_1_1	-1.786	0.004
QS_8_1_3		0.000
QS_8_2_1	-1.103	0.000
QS_8_2_2	-0.416	0.002
QS_8_2_4		0.000

Source: own processing

The model was tested by ROC curve. The result is quite good when we know that there are only non-financial indicators in the model. AUC reaches 75.8% as you can see in Figure 1.

Figure 1 Results



Source: Output from IBM SPSS Statistics

The best predictive indicators are indicators year-on-year client growth in comparison to industry growth, position on the main market - according to the proportion of client revenues, demand stability (demand for products/client services), export, import – territory risk, liabilities repayment to a bank, turnover development on bank accounts, obligations repayment towards the state, liabilities repayment to suppliers. The creditors should especially pay attention if:

- the client´s year-on-year growth is more than 2% below industry performance,
- the client's export/import is mainly directed to risk countries and the risk associated with it is not always adequately treated (payment terms, insurance, etc.),
- client instalments delays over the last 6 years exceeded 5 days,
- the client is new,
- the execution was set as a result of the overdue payables to the state, health and social insurance with a significant negative impact on the continuity of the client´s cash flow and its financial situation over the last 4 years,
- the share of overdue payables to suppliers is more than 20%.

5 Conclusions

Empirical literature emphasizes the significance to add qualitative information to bankruptcy prediction models. Researches applying to qualitative information importance as failure predictors, recommends to add qualitative information such as business type, industrial sector, location, age, etc. This study analyzed the exclusive dataset of non-financial indicators used in a bank as supplementary indicators when assessing creditworthiness of a client.

Our findings confirm that non-financial indicators could be very useful when predicting failure. We found that the most important groups of non-financial indicators are year-on-year client growth in comparison to industry growth, position on the main market - according to the proportion of client revenues, demand stability (demand for products/client services), export, import – territory risk, liabilities repayment to a bank, turnover development on bank accounts, obligations repayment towards the state and liabilities repayment to suppliers.

We developed a bankruptcy prediction model based only on non-financial indicators with 75,8% predictive power. These findings confirm that non-financial indicators could be very helpful to predict bankruptcy together with traditional financial indicators.

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The Recent hHstory of E-commerce in Poland and the Perspectives for Online Sale Growth in Future.

Anna Sroczyńska-Baron

[1] University of Economics in Katowice, Department of Applied Mathematics
ul. 1 Maja 50, 40-287 Katowice, Poland
E-mail: kozak@caprisoft.com.pl

Abstract: *We have just entered an epochal period of change in the word of traditional markets - the period that is characterized by the great development of e-commerce. Thanks to the great development of IT technologies, the concept of e-commerce got a new importance. Online shops and online auctions are the significant part of e-commerce. They are more and more popular all over the world. There are a lot of advantages of this form of shopping for both clients - for example time saving or just cheaper price, and sellers - for example cost reductions or bigger number of potential clients. Of course there are also some important disadvantages but it is visible that the problems are being solved slowly. The main aim of this work is to examine the position of e-commerce in Poland, to observe the changes in its structure in a few last years and to understand the influence of some factors on the dynamics of online sale growth with the use of statistical tools. The examination shows that Poland is not even in respect of opportunities for e-commerce but the differences between leaders and the rest of the country are decreasing. Money, access to Internet and computer are not decisive for the development of online shopping.*

Keywords: e-commerce, online shopping, TOPSIS

JEL codes: L81, C38, D19

1 Introduction

Nowadays, e-commerce becomes one of the most important part of people' life all over the world. It is more and more popular way of shopping because of great development of IT technology and wider and wider range of Internet. Not only business sector but household also make use of the online shopping. Clothes and sport foods are the most popular objects people buy online. One should also take into consideration that the number of Internet users and potential buyers is still increasing. This situation is an effect of great advantages of this form of shopping (Franco and Regi, 2016). Time and price are the most important factors which influence the increase of online sale. The potential client can save much time when he uses an Internet search engine to analyze the great amount of different goods in a short time and to compare the price. He does not also waste his time by visiting a shop physically and can buy things he needs at any time, even at night when he has more free time. It is also obvious that prices in Internet are much lower than in a traditional shop. There are not typical shopping area and salesmen so the cost of running this kind of shop is less expensive. Of course one cannot forget about some obvious disadvantages, for example the client is not able to touch the product and examine it thoroughly and he must take into the consideration the potential risk that the product would not fulfil the requirements or, even worse, he will pay for non-existent product. However, it is generally observed that the online sale is still increasing thanks to updating new technologies and coming up with new solutions, for example the possibility of free return or system of feedbacks, which help us conquer some problems connecting with online-sale. Nowadays, it is estimated that nearly 85% households have got access to the Internet at home, nearly 80% regularly use it and 55% order or purchase goods or services over the Internet for private use in the EU countries (Digital Society in Poland, 2016). What is more, statistical European is used to spend 970 Euro per year on online shopping. The upward trend is generally visible in Europe but one should notice that not every country follows it. Most of the countries from the north of Europe does not agree with this feature, for example Sweden, Finland or Norwegian. On the other hand, online shopping is the most popular way of purchasing goods in England, where 83% people use Internet to do it, what is a very high result in comparison with Romanian where only 12%. So the form of online

shopping is more and more popular in EU but one must consider that there are still enormous differences among countries. The level of popularity of online shopping in EU is diverse and still depends on particular countries in spite of political and economical changes. Poland belongs to the countries where the upward trend is observed but online sale is not still heady. The result of 42% of people who use Internet to purchase goods is much lower than the mean for UE (13 percentage points) and two times lower than in England.

There are a lot of works considering special part of e-commerce like online auctions (Sroczynska-Baron, 2017) but in this work e-commerce will be analyzed wider – as all transactions conducted thanks to Internet. The only limit is the part of online sale where clients are just private people. The companies purchasing products by Internet are not the object of the examination.

The analysis of digital situation used to show huge differences between particular voivodeships in Poland, but nowadays it seems to be more equalized. It is estimated that 80,1% of households have got the access to computers. The worst situation is still in the eastern Poland but there was observed great change at the level of 13% in the last 5 years. When the access to the Internet at home is examined, even bigger changes are observed. It is estimated that 80,4% of households have got the access to Internet and the growth of it in the eastern Poland is more than 23% (Digital society in Poland, 2016). Of course, these are only two factors and the question is if they are enough to make online shopping more popular? In this work the results for two years will be compared. There will be done the analysis of main factors which influence the level of online shopping in both periods. Next the ranking of voivodeships will be presented and compare with real data. The main aim of this work is to examine if commonly known factors, for example technical factors, as access to computers and Internet, are crucial for online shopping and influence directly the level of online shopping by private people? There is also presented a short answer for the question how e-commerce in Poland is being changed?

2 Methodology and Data

The factors influencing online shopping

The most important factor that influences the level of online sale is price without any doubt. Freebaim said that clients would be main beneficiaries of the development of e-commerce thanks to lower prices (Freebairn, 2001). Therefore, one can consider that the lower income, the bigger interest in lower prices and economical necessity to find occasional prices offered by online shopping system. On the other hand, the total lack of the source of income make households impossible to use computers and Internet, so the factors as unemployment rate or poverty rate should influence negatively the level of online shopping. Next, the environment of life of a potential user of e-commerce should be analyzed. It is said, that the presence of big shopping centers do not foster online sale (Weltevreden and Rietbergen, 2007). Clients are able to spend only little time to go and see the product what is invaluable and usually have got great choice of different kinds of them. So the closeness of big cities also influences negatively the level of online shopping. There are also some social factors worth the examination. It is commonly known that people between 25 and 34 years old are the group, which do online shopping most often. What is more, families with children more often buy online (Newsweek, 2015), maybe because of bigger necessity of saving or less free time or just bigger need (for example constantly new clothes or toys). On the other hand older people prefer traditional form of shopping. Sometimes the barrier is lack of skill of using computer or Internet. So not only the age but the level of education may influence the desire of online shopping (Šimičevic, Jaković and Ježovita, 2013).

In this work a few main factors, both social and economical will be considered, to classify the voivodeships in Poland into similar groups where the conditions for the increase of online sale are the most favorable and the least favorable.

Methodology

One of the methods, which allows to construct the ranking is multi-criteria decision analysis method TOPSIS. It is a technique for order of preference by similarity to ideal solution (Hwang and Yoon, 1981). It compares a set of alternatives by identifying weights for each criterion, normalizing scores for each criterion and calculating the geometric distance between each alternative and the ideal alternative. In this method a poor result in one criterion can be negated by a good result in another criterion, what allows to obtain a realistic ranking.

The first step is the normalization process because the parameters or criteria are often of incongruous dimensions in multi-criteria problems. It could be conducted according to the formula:

$$z_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{n} x_{ij}^2}} \tag{1}$$

where x_{ij} - the observation of criterion j for alternative i. The best alternative is described as:

$$z_{0j}^{+} = \begin{cases} max_i\{z_{ij}\} & for\ the\ crteria\ having\ a\ positive\ impact \\ min_i\{z_{ij}\} & for\ the\ criteria\ having\ a\ negative\ impact \end{cases} \tag{2}$$

The worst alternative is described as:

$$z_{0j}^{-} = \begin{cases} min_i\{z_{ij}\} & for\ the\ criteria\ having\ a\ positive\ impact \\ max_i\{z_{ij}\} & for\ the\ criteria\ having\ a\ negative\ impact \end{cases} \tag{3}$$

The distance between the best alternative and the rest of them is the following:

$$d_{i0}^{+} = \sqrt{\sum_{j=1}^{m}\left(z_{ij} - z_{0j}^{+}\right)^2} \tag{4}$$

The distance between the worst alternative and the rest of them is the following:

$$d_{i0}^{-} = \sqrt{\sum_{j=1}^{m}\left(z_{ij} - z_{0j}^{-}\right)^2} \tag{5}$$

The values of aggregate variable are calculated with the use of the following formula:

$$q_i = \frac{d_{i0}^{-}}{d_{i0}^{+} + d_{i0}^{-}} \tag{6}$$

where $q_i \in [0,1]$. The highest value of aggregate variable means the best alternative and the lowest value shows the worst one.

After the linear arrangement, the alternatives are divided into groups on the grounds of the values of aggregate variable. In this work four groups will be arbitrarily considered:

I group characterized by high level of aggregate variable:

$q_i \in [max_i q_i - d, max_i q_i\ ]$

II group characterized by average level of aggregate variable:

$q_i \in [max_i q_i - 2d, max_i q_i - d\ ]$

III group characterized by low level of aggregate variable:

$q_i \in [max_i q_i - 3d, max_i q_i - 2d\ ]$

IV group characterized by minimum level of aggregate variable:

$q_i \in [min_i q_i, max_i q_i - 3d\ ]$

where $d = \frac{max_i q_i - min_i q_i}{4}$ *i=1,2,…,n* .

In this work TOPSIS will be used to classify voivodeships in Poland and divide into the groups characterized by the similar environment for online shopping.

Data

In this work the following factors were chosen to the examination of classification of the voivodeships in Poland for online shopping environment with the use of TOPSIS method:

a) social factors
   x_1 – number of graduated per 10000 residents
   x_2 – number of children
   x_3 – percentage of residents between 25 – 34 years old
   x_4 – percentage of retired residents
b) economical factors
   x_5 – the average income per resident per month
   x_6 – percentage of household with the computer
   x_7 – percentage of household with the access to Internet
   x_8 – poverty rate
c) geographical factor
   x_9 – the number of big cities – more than 40000 residents

In this work the data for 16 voivodeships in Poland in 2015 and 2016 (data for 2017 are still not present at GUS) were gathered and analyzed with the use of TOPSIS method. Variables x_1, x_2, x_3, x_6, x_7 are the criteria having a positive impact and x_4, x_5, x_8, x_9 are the criteria having a negative impact.

3 Results and Discussion

Data for 16 voivodeships in 2015 are presented in Table 1. The order of the voivodeships is the following: Dolnośląskie (1), Kujawsko-Pomorskie (2), Lubelskie (3), Lubuskie (4), Łódzkie (5), Małopolskie (6), Mazowieckie (7), Opolskie (8), Podkarpackie (9), Podlaskie (10), Pomorskie (11), Śląskie (12), Świętokrzyskie (13), Warminsko-Mazurskie (14), Wielkopolskie (15), Zachodniopomorskie (16).

Table 1 The Factors Influencing Online Shopping for 16 Voivodeships in Poland in 2015

No	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9
1	120	486 540	0,161124	0,204587	1 471,8	77,3	73,8	9,5	7
2	84	378 825	0,156845	0,190918	1 245,7	66,2	66	12,5	5
3	106	382 720	0,156577	0,200489	1 226,7	79,9	78,6	14,9	5
4	47	184 524	0,159483	0,187524	1 419,6	77,8	74,7	11,4	2
5	88	418 642	0,148345	0,218355	1 362,0	68,9	65,8	10,3	11
6	149	638 551	0,163008	0,186202	1 305,5	78,5	76	14,3	3
7	131	994 402	0,157277	0,20041	1 756,2	82,9	80,6	8,3	12
8	85	159 393	0,15745	0,201872	1 288,7	82,3	78,7	10,6	3
9	89	394 644	0,162274	0,182177	1 081,6	79,1	76,1	17,1	7
10	91	207 394	0,159335	0,194352	1 257,9	77,2	76,5	13,4	3
11	106	447 792	0,161797	0,183604	1 380,9	80,5	78,1	13,6	8
12	85	767 533	0,154713	0,206672	1 420,5	75,8	73,3	7,8	25
13	78	211 695	0,151911	0,210475	1 202,8	78,7	77,3	18,6	4
14	71	266 937	0,160268	0,177356	1 280,5	78,7	76,9	21,1	3
15	110	665 584	0,162569	0,182439	1 287,8	80,6	80,1	16,7	7
16	77	296 619	0,155322	0,195472	1 426,9	78,6	77,6	8,1	6

Source: own computation based on Central Statistical Office

Data for voivodeships in the same order for 2016 are presented in Table 2.

Table 2 The Factors Influencing Online Shopping for 16 Voivodeships in Poland in 2016

No	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9
1	115	487 606	0,157184	0,212069	1 586,0	78,8	80,7	9,2	7
2	78	376 479	0,154602	0,19754	1 308,6	78,2	77,2	13,8	5
3	97	378 515	0,154851	0,20629	1 299,1	75	75,7	17,2	5

4	42	183 640	0,155957	0,195203	1 498,5	81,3	79,5	8,8	2
5	77	417 570	0,146016	0,224844	1 458,2	78,1	76,9	9,1	11
6	144	639 225	0,161352	0,190956	1 423,5	82,5	82,1	16,1	3
7	124	1 004 436	0,153801	0,205529	1 780,9	84,1	84,9	8,5	12
8	74	158 146	0,155318	0,208516	1 389,9	79	82,1	10,3	3
9	85	390 816	0,161278	0,187583	1 134,1	82	83,2	21,3	7
10	79	206 087	0,15834	0,199124	1 419,8	74,9	74	14,7	3
11	101	450 189	0,159516	0,18963	1 560,4	85,7	83,9	11,5	8
12	74	767 290	0,151347	0,213515	1 513,2	78,8	78,8	9,0	25
13	64	209 086	0,150454	0,216974	1 305,9	76,8	77,3	18,7	4
14	64	264 364	0,158042	0,18451	1 371,8	74,6	78,3	18,6	3
15	98	667 280	0,159907	0,188339	1 400,0	82	81,9	16,6	7
16	70	295 149	0,15178	0,203862	1 482,9	78,5	80	9,7	6

Source: own computation based on Central Statistical Office

The values of aggregate variables were calculated and presented in Table 3.

Table 3 The Aggregate Variables q_i for 16 Voivodeships in Poland

	1	***2***	***3***	***4***	***5***	***6***	***7***	***8***
2015	0,6573	0,6148	0,6264	0,5771	0,5250	0,7661	0,6748	0,5901
2016	0,6554	0,6066	0,6073	0,5753	0,5220	0,7556	0,6783	0,5803
	9	***10***	***11***	***12***	***13***	***14***	***15***	***16***
2015	0,5771	0,5967	0,6018	0,3768	0,5563	0,5656	0,6750	0,5878
2016	0,5538	0,5810	0,6081	0,3625	0,5453	0,5707	0,6695	0,5734

Source: own computation

The ranking of the voivodeships is the following:

Table 4 The Ranking of the Voivodeships in Poland in Respect of Examined Factors

	2015	***2016***
1	MAŁOPOLSKIE	MAŁOPOLSKIE
2	WIELKOPOLSKIE	MAZOWIECKIE
3	MAZOWIECKIE	WIELKOPOLSKIE
4	DOLNOŚLĄSKIE	DOLNOŚLĄSKIE
5	LUBELSKIE	POMORSKIE
6	KUJAWSKO-POMORSKIE	LUBELSKIE
7	POMORSKIE	KUJAWSKO-POMORSKIE
8	PODLASKIE	PODLASKIE
9	OPOLSKIE	OPOLSKIE
10	ZACHODNIOPOMORSKIE	LUBUSKIE
11	PODKARPACKIE	ZACHODNIOPOMORSKIE
12	LUBUSKIE	WARMIŃSKO-MAZURSKIE
13	WARMIŃSKO-MAZURSKIE	PODKARPACKIE
14	ŚWIĘTOKRZYSKIE	ŚWIĘTOKRZYSKIE
15	ŁÓDZKIE	ŁÓDZKIE
16	ŚLĄSKIE	ŚLĄSKIE

Source: own computation

One can observe 4 groups of voivodeships that are different in respect of factors influencing the level of online shopping in 2015:

a) first group: małopolskie, wielkopolskie and mazowieckie
b) second group: dolnośląskie, lubelskie, kujawsko – pomorskie, pomorskie, podlaskie, opolskie, zachodnipomorskie, podkaprackie and lubuskie
c) third group: warmińsko – mazurskie, świętokrzyskie and łódzkie

d) forth group: śląskie

Similar division can be conducted for data for 2016:

a) first group: małopolskie, mazowieckie and wielkopolskie
b) second group: dolnośląskie, pomorskie, lubelskie, kujawsko – pomorskie, podlaskie, opolskie, lubuskie, zachodnipomorskie and warmińsko - mazurskie
c) third group: podkarpackie, świętokrzyskie and łódzkie
d) forth group: śląskie

Three voivodeships, which favour the most the increase of online sale in respect of examined factors are the same in both years (the group "a"). There is a better environment for e-commerce in pomorskie, lubuskie and warmińsko – mazurskie in 2016 in comparison with 2015. A little bit worse situation can be observed in podkarpackie. Theoretically, the worst situation is in śląskie in both 2015 and 2016. The changes of the values of the factors in two years in percentages for these four voivodeships, where the situation is observed to be a little bit different, are presented in Table 5.

Table 5 The Changes in [%] the Values of the Examined Factors in Pomorskie, Lubuskie, Warmińsko – Mazurskie and Podkapackie.

No	Δx_1	Δx_2	Δx_3	Δx_4	Δx_5	Δx_6	Δx_7	Δx_8	Δx_9
4	-0,106	-0,005	-0,022	0,041	0,056	0,045	0,064	-0,228	0,000
9	-0,045	-0,010	-0,006	0,030	0,049	0,037	0,093	0,246	0,000
11	-0,047	0,005	-0,014	0,033	0,130	0,065	0,074	-0,154	0,000
14	-0,099	-0,010	-0,014	0,040	0,071	-0,052	0,018	-0,118	0,000

Source: own computation

It is visible, that the factor poverty rate has got determinative participation in increase or decrease of these four voivodeships. For example in spite of nearly 10% increase of the access to Internet, much bigger poverty rate has caused the decline of podkarpackie. Generally, none of radical changes are observed and the groups are similar in respect of the chance for online shopping increase in 2015 and 2016.

There is one more problem – how close or far from real situation is that one described by examined factors? There are presented real data from 2015 and 2016 as the involvement of individuals purchasing goods or services in the last 12 months for private use in Table 6.

Table 6 The Involvement of Individuals Purchasing Goods or Services in the Last 12 Months for Private Use in Particular Voivodeships in Poland

	1	***2***	***3***	***4***	***5***	***6***	***7***	***8***
2015	40,9	30,1	34,2	40,4	31,2	35,3	44,5	36,4
2016	41	37,4	38,4	41,9	36,7	42,7	47,1	39,9
	9	***10***	***11***	***12***	***13***	***14***	***15***	***16***
2015	28,3	44,7	36,3	39,4	31,2	33,1	34,3	36
2016	36,5	41,4	44,5	47,1	35,5	40,6	34,3	43,6

Source: own computation based on Central Statistical Office

Table 7 The Ranking of the Voivodeships in Poland in Respect of Real Data

	2015	***2016***
1	PODLASKIE	MAZOWIECKIE
2	MAZOWIECKIE	ŚLĄSKIE
3	DOLNOŚLĄSKIE	POMORSKIE
4	LUBUSKIE	ZACHODNIOPOMORSKIE
5	ŚLĄSKIE	MAŁOPOLSKIE
6	OPOLSKIE	LUBUSKIE
7	POMORSKIE	PODLASKIE
8	ZACHODNIOPOMORSKIE	DOLNOŚLĄSKIE

9	MAŁOPOLSKIE	WARMIŃSKO-MAZURSKIE
10	WIELKOPOLSKIE	OPOLSKIE
11	LUBELSKIE	LUBELSKIE
12	WARMIŃSKO-MAZURSKIE	KUJAWSKO-POMORSKIE
13	ŁÓDZKIE	ŁÓDZKIE
14	ŚWIĘTOKRZYSKIE	PODKARPACKIE
15	KUJAWSKO-POMORSKIE	ŚWIĘTOKRZYSKIE
16	PODKARPACKIE	WIELKOPOLSKIE

Source: own computation

One can observe 4 groups of voivodeships that are different in respect of the involvement of individuals purchasing goods or services in the last 12 months for private use in 2015:

a) first group: podlaskie, mazowieckie, dolnośląskie, lubuskie and śląskie
b) second group: opolskie, pomorskie
c) third group: zachodnipomorskie, małopolskie, wielkopolskie, lubelskie and warmińsko – mazurkie
d) forth group: łódzkie, świętokrzyskie, kujawsko – pomorskie and podkarpackie

Similar division can be conducted for data for 2016:

a) first group: mazowieckie, śląskie, pomorskie
b) second group: zachodniopomorskie, małopolskie, lubuskie, podlaskie and dolnośląskie
c) third group: warmińsko – mazurkie, opolskie and lubelskie
d) forth group: kujawsko – pomorskie, łódzkie, podkarpackie, świętokrzyskie and wielkopolskie

The biggest increase (more than 23%) is observed for kujawsko – pomorskie, podkarpackie and warmińsko – mazurskie voivodeships in the involvement of individuals purchasing goods or services in the last 12 months but this did not improve the situation of these districts of Poland in comparison with the rest of the land. They are still one of the worst, but – what is important for future - the difference is a little bit less between them in 2016 than in 2015. The interesting thing is a huge decrease of podlaskie – it was the leader in 2015 and one year later it is located in the middle of the second group. The second voivodeship with the similar history is dolnośląskie and wielkopolskie, which is located six positions lower than one year earlier. But the uniqueness of podlaskie is caused by negative increase of online sale in this region.

When one want to compare the results obtained by the analysis of the potential factors with real history some interesting facts are visible. Model TOPSIS indicated the worst voivodeships in respect of the environment for online sale in a proper way omitting śląskie, which is the biggest surprise. All factors show that online sale should not develop in this region but it belongs to the first group of voivodeships for real data. And the second surprise comes from wielkopolskie. There is an opposite situation – all factors favor online sale but in 2016 it has got the worst involvement of individuals purchasing goods or services in the last 12 months for private use in Poland. Mazowieckie belongs to the leader group for TOPSIS model and real data.

4 Conclusions

In this work the environment for online shopping in different voivodeships in Poland where examined and compared in 2015 and 2016. There was a huge change in technical factors such access to computer and Internet at home at this time, that is why these two years were compared. The examinations show that Poland is not even in respect of opportunities for e-commerce. There are some parts of Poland that favour this kind of shopping the least.

What is more important, they are not identified with the poorest region of Poland – the voivodeships belong rather to diameter of Poland from south – east to north – west, not to the east part of Poland. Therefore, money seems not to be the main factor. The distribution of the voivodeships in Poland in both years are similar in spite of changes in access to Internet and computer. These factors are not crucial as well. One should consider all factors together to examine the possibilities of the development of online shopping in a particular district. What is more, the factors mentioned in the literature and reports most often are not enough. They allowed to find the worst regions and one of the best (the capital city) in a proper way but the rest of them were more or less different in comparison to real data. The most interesting situation is in śląskie, where online shopping is very popular and wielkopolskie, where online shopping is very poor contrarily all factors. Maybe it is not possible to separate e-shopping conducted by private people from e-shopping conducted by companies, which was ignored in this work. It seems to be natural that if a potential customer works with computer at his work and uses Internet to purchase products or services by Internet for companies, it is more natural for him to do it at home. So maybe including this kind of factor would improve the results. On the other hand, one cannot forget about mentality, which is hard to measure but influences the level of online shopping of particular countries for sure. Maybe it also influences inner division of one country.

When the real data for 2015 and 2016 are considered one can also observe that the diversification of particular voivodeships are still present in spite of better access to computer and Internet for households in 2016. The leaders are śląskie and mazowieckie, but the differences between them and the rest of the country are decreasing. The involvement of individuals purchasing goods or services in the last 12 months for private use in Poland has increased by 4% in 2016 and concurrently the coefficient of diversification has decreased by 4%. Maybe in a few next years the differences will completely disappear as Internet is considered as the future of shopping.

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The Financial and Institutional Environment for Sustainable Economic Growth of Developing Countries: the Case of Western Balkan

Jelena Z. Stanković[1], Evica Petrović[2], Ksenija Denčić-Mihajlov[3]

[1] University of Niš
Faculty of Economics
Trg kralja Aleksandra Ujedinitelja 11, 18000 Niš, Serbia
E-mail: jelenas@eknfak.ni.ac.rs

[2] University of Niš
Faculty of Economics
Trg kralja Aleksandra Ujedinitelja 11, 18000 Niš, Serbia
E-mail: evica.petrovic@eknfak.ni.ac.rs

[3] University of Niš
Faculty of Economics
Trg kralja Aleksandra Ujedinitelja 11, 18000 Niš, Serbia
E-mail: ksenija.dencic-mihajlov@eknfak.ni.ac.rs

Abstract: *The economic growth and its sustainability have attracted significant interest of academics and policy makers in recent decades. Faster economic growth observed in developing countries has been associated with capital mobility. Therefore, the first aim of this study is to examine the finance-growth link and effectiveness of financial systems in promoting sustainable economic growth in developing countries. On the other hand, developing countries have experienced vast changes in their economic and institutional environment in order to integrate with the world economy. Thus, the second aim of this study is to examine the quality of the institutional environment and its role in providing conditions for sustainable growth in developing countries. The proposed analyses are conducted on the sample of Western Balkan countries using indicators provided by the World Bank database. According to the results of panel data analysis the level of financial development, especially the level of banking sector development, significantly influences the level of economic growth. It can be concluded that international capital flows are not the main determinant of the growth rate of GDP in observed developing countries as well as that financial development leads to economic growth.*

Keywords: financial development, institutional development, sustainability, economic growth, developing countries

JEL codes: F43, G28, O16

1 Introduction

The relationship between economic growth and its sustainability, on one side, and financial and institutional development, on the other, have attracted significant interest of academics and practitioners in recent years. The economic theory supports the argument that a developed financial and institutional environment increases the efficiency of intermediation by reducing asymmetric information, transaction and monitoring costs and supports investment by providing a set of instruments with different risk-return trade-offs. Through the offer of a mixture of instruments and information to companies to deal with adverse shocks, it can reduce volatility of the economy. Furthermore, for a given level of saving, more developed financial sector increases the productivity of investment. All these functions should produce a more efficient allocation of limited human, financial and material resources and accelerated technological progress which leads to the economic growth. Efficient financial system together with developed institutional infrastructure is the prerequisite for a sustainable economic growth, which, according to *United Nations Sustainable Development Goals,* "will require societies to create the conditions that allow people to have quality jobs that stimulate the economy while not harming the environment" (United Nations, 2015).

The concept of sustainability and sustainable growth at the company, national and global level has attracted a lot of attention during the last decades. Numerous challenges, such as global warming, climate change and energy regulation, data protection, resource scarcity, social conflicts and migrations, force companies to respect the requirements for sustainability management (Denčić-Mihajlov and Zeranski, 2017). On the other hand, the problems concerning economic stagnation, poverty, illness, endangering the living environment and influencing fast globalization show the need for national and global sustainable growth (Islam et al., 2003).

The revival of interest in growth theory and empirical economics is initiated by the global economic crisis and its consequences. The drastic declines in economic activity during the crisis caused by the adverse implications of financial disturbance, underlined the need to choose the optimal size of financial systems for sustainable economic growth. Prior research is mainly concentrated on "endogenous growth" theories that consider the long–term growth rate as the outcome of government policies, including institutional frameworks and financial system development (Barro, 1991).

In the neoclassical growth theory, a steady economic growth rate can be achieved with the proper amounts of the three driving forces: labour, capital and technology. Subsequent theories and models argue that other factors, such as, for example, technological progress, innovations, governmental policies and interventions, culture and religion, trade policy, economic openness, currency undervaluation, education or institutions, have also a role in promoting economic growth. The empirical studies, which show that financial sector development has an economically important impact on growth, mostly relay on the broad samples of countries at different development levels (Levine, 2003). However, economic growth in developing and transition economies is strongly influenced by "transition" factors such as initial conditions, scope of structural reforms together with market-oriented infrastructure and sound economic policies made to influence the development of macroeconomic stability (Mervar, 2004). The progress in structural reforms allows a more efficient use of available resources and realization of technological progress, promoted by increased trade openness and foreign investment. Theoretically, technological changes can be improved by foreign direct investment (FDI) through the effects of spillover of knowledge and new capital goods, but what determines the size of FDI's contribution is overall business environment in recipient countries (Chamarbagwala et al., 2000). On the other hand, the level of development of the domestic financial sector has an internal impact on the relationship between FDI and economic growth (Lee and Chang, 2009). Considering the fact that FDI and domestic financial markets are important sources of capital investment funds, the focus of this paper is the analysis of their relation to economic growth in transition countries of the Western Balkan. The aim of this study is twofold: to examine the finance-growth link and effectiveness of financial systems in promoting sustainable economic growth and to analyse the quality of the institutional environment and its role in providing conditions for sustainable growth in developing countries. The proposed analyses are conducted on the sample of the Western Balkan countries using relevant indicators provided by the World Bank database.

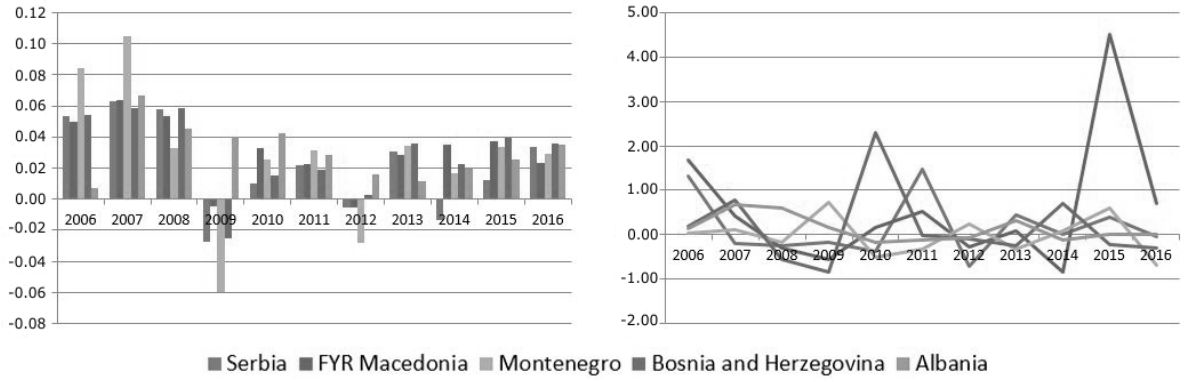
This paper is organized as follows: section 2 sets the context by providing evidence how political instability and financial development contributed to the economic growth of selected countries. Section 3 describes the data and details econometric methodology. Finally, section 4 discusses the main results, while the summary of conclusions is presented in section 5.

2 The role of finance and political instability in the economic growth of the Western Balkan countries

Globalization typically impacts transition economies by connecting their emerging capital markets, labour markets and tradable goods markets to the international economy. The path of transition in the Western Balkan countries was rather different. Although SFR Yugoslavia had specific international relations, especially with the European Community, and experience with market-oriented economic reforms, its successor states were

progressing diversely. Except Slovenia that had smoother transition, the extreme political instability in the region during the 1990s negatively influenced economic performance and postponed many of the economic reforms of the other Western Balkan countries. Moreover, the attainments to achieve transition-related economic objectives were significantly influenced by delay in support and integration with European Union (EU) as well as inappropriate economic policies (Uvalic, 2012). After the initial negative economic effects of the transition measures, such as a significant decline in production, high inflation, an increase in unemployment, social inequality and poverty (Uvalic, 2003), convergence with average EU macroeconomic standards in certain aspects has already occurred (Sanfey and Milatovic, 2018). Considering economic development it can be concluded that the Western Balkan countries have succeeded in decreasing the gap with EU in the previous two decades. In the period from 2001 to 2016 the average annual GDP growth rate of this region was 3.2%, while GDP of EU had been increased by the average rate of 1.4%. Under the impact of global economic crisis in 2008 the average growth rate of this region was decreased to 1.2% (0.7% in EU) due to two recessions as a late response on the global economic crisis in 2009 and 2012 (graph 1 left). Also, all Western Balkan countries have reached high degree of price stability and convergence on inflation rates with advanced EU countries.

Figure 1 The Grow Rate of GDP per Capita (left) and FDI (right) of the Western Balkan Countries in the Period 2006-2016



Source: authors' calculation

However, a major constraint on economic development in the Western Balkan countries was insufficient level of savings and low investment rates. As a result of several interconnected factors, among which there were low levels of income, underdeveloped capital and financial markets and delays in banking reforms, was the deficiency of financial resources. Therefore, financial liberalization was the main step in economic transition that should open borders for foreign capital inflows and attract new investments. Financial systems of all Western Balkan countries have certain country specifics, but in general all financial systems are bank-oriented with financial markets of insufficient depth and minor influence of other institutional investors (insurance, pension and mutual funds) on the financial flows (Kozarevic et al., 2017). Under such terms of financial development these countries became highly dependent on foreign capital inflows. However, FDI to the Western Balkan countries during the first decade of transition was very low. Due to unstable political environment in the period 1989-1996 the cumulative FDI inflows in the Western Balkan countries (except Bosnia and Herzegovina) amounted only 2% of the total FDI invested into 27 transition economies in Europe and remained at the low level until 2000s (Uvalic, 2003). Driven by geographical and institutional factors, FDI inflows have increased after 2000s (graph 1 right), but their limited volume and inadequate structure, mainly concentrated in services (banking sector, telecommunications, retail trade and real estate), produce insufficient restructuring of basic industries (Estrin and Uvalic, 2014). Moreover, the Western Balkan countries still lag behind EU standards in the terms of governance quality, especially in the level of corruption followed by the government effectiveness and political stability (Sanfey and Milatovic, 2018). Considering the fact that quality of institutional environment and business environment free of corruption are main

determinants of FDI inflows (Zeneli, 2014), further development will be significantly influenced by the undertaken governance reforms and the level of convergence of government development with EU norms.

3 Methodology and Data

In this study a panel-data approach is used covering 5 middle income countries, as classified by the World Bank in 2018, the successor states of the SFR Yugoslavia - Serbia, FYR Macedonia, Bosnia and Herzegovina and Montenegro, and Albania. These countries are selected for its combination of underlying structural and systemic transformation problems. However, these countries have strong economic potential and encounter with the same challenges related to convergence in macroeconomic fundamentals due to the prospect of their accession to the European Union.

The relationship between financial and institutional development on one side and economic growth on the other is examined using regression analysis and causality test for panel data. Dependent variable in analysis is economic growth measured by the growth rate of GDP per capita, while explanatory variables are selected among the World Bank indicators of financial and institutional development. In order to cover various aspect of financial development we use following indicators from the Global Financial Development database: liquid liabilities (LL) over GDP as a traditional proxy of financial development indicating size of the financial system; domestic credit to private sector (DCPS) over GDP as a proxy for the degree of the financial intermediary activities provided to the private sector; broad money (BM) over GDP as a measure of a given country's money supply; and deposit money banks' assets (DMBA) to GDP (%) as an indicator of the size of banking sector of a given country. Indicators of capital market development as well as indicators of size and activities of other institutional investors are not considered in this research since data for some countries are not available.

Indicators that are used to observe institutional development in the Western Balkan countries are selected among Worldwide Governance Indicators of the World Bank. For the purposes of this study we use following indicators: government effectiveness (GE) as a measure of the quality of public services, their independence from political pressure and the quality of policy formulation; regulatory quality (RQ) as an indicator of government ability to provide sound policies and regulations that promote private sector development; and control of corruption (CC) that indicates the extent to which public power is exercised for private gain. For the purpose of proposed analysis we use the countries' rank among all countries covered by the aggregate indicator.

Foreign capital flows in the countries of the Western Balkans are approximated by FDI net inflows over GDP obtained from the World Development Indicators database. In order to balance panel-data set we use annual data from the period 2006-2016. Descriptive statistics for variables used in analysis is shown in table 1.

Table 1 Descriptive Statistics for Used Variables (sample)

Variable	Number of observations	Mean	Standard deviation	Minimum	Maximum
Δ GDP	55	0.02791	0.02859	-0.05997	0.10505
Δ FDI	55	0.19548	0.84782	-0.85598	4.50720
Δ LL	55	0.05823	0.13712	-0.08176	0.74769
Δ DCPS	55	0.07776	0.23318	-0.16815	1.21087
Δ BM	55	0.05941	0.14928	-0.22360	0.85095
Δ DMBA	55	0.07925	0.16292	-0.14800	0.93556
Δ RQ	55	0.03902	0.07347	-0.15238	0.29288
Δ GE	55	0.03351	0.15207	-0.36672	0.64286
Δ CC	55	0.01583	0.09784	-0.26665	0.28138

Source: authors' calculation

Since economic time series are generally non-stationary, series of selected variables are transformed using differentiation, which in practical analyses provides the stationarity of the time series. Testing for stationarity is conducted using test of panel unit root of Im, Pesaran and Shin (2003) and Maddala and Wu (1999) and obtained results are presented in table 2.

Table 2 Results of the Panel Unit Root Tests (sample)

Test	Statistic	p-value
Im, Pesaran and Shin (2003)	-17.76	0.00000
Maddala and Wu (1999)	334.49	0.00000

Source: authors' calculation

Based on the results of tests it can be concluded that the series of variables are stationary. The relationship between the stationary time series can be determined using a linear regression model. Therefore, we test the impact of institutional quality and financial development on economic growth through a general standard model in the following form:

$$\Delta GDP_{it} = \beta_{0i} + \beta_{1i}\Delta FDI_{it} + \beta_{2i}\Delta LL_{it} + \beta_{3i}\Delta DCPS_{it} + \beta_{4i}\Delta BM_{it} + \beta_{5i}\Delta DMBA_{it} + \\ + \beta_{6i}\Delta RQ_{it} + \beta_{7i}\Delta GE_{it} + \beta_{8i}\Delta CC_{it} + \varepsilon_{it} \quad (1)$$

in which we incorporate all selected variables for country *i* at time *t*, β_0 is a constant term indicating the start level of country growth, coefficients $\beta_{1,2,\dots,8}$ are the rates at which GDP grow rate changes with respect to the rate of change of concrete variable, ε_{it} is the error term.

Considering observed countries' specifics we use fixed effect model to estimate the proposed panel regression model, which allows intercept to vary for each cross-section and thus account for the individual effects. The slope coefficient β is estimated using ordinary least square (OLS) method. After statistically significant variables are determined, we use the Dumitrescu-Hurlin test (2012) in order to test the causal relationship between variables. This test follows the linear heterogeneous regression model shown in equation (2):

$$y_{i,t} = \alpha_i + \sum_{k=1}^{K} \gamma_i^{(k)} y_{i,t-k} + \sum_{k=1}^{K} \beta_i^{(k)} x_{i,t-k} + \varepsilon_{i,t} \quad (2)$$

where $K \in N^+$ and $K \in N^*$ and $\beta_i = (\beta_i^{(1)}, \dots, \beta_i^{(K)})$ and α_i, $\gamma_i^{(k)}$ and $\beta_i^{(k)}$ indicate constant term, lag parameter and slope coefficient, respectively. The null hypothesis that supports the absence of homogenous Granger causality for all cross-section units in the panel is defined as:

$$H_0 : \beta_{i1} = \dots = \beta_{iK} = 0 \qquad \forall i = 1, \dots, N \quad (3)$$

Assuming that Granger causal relationship may exist between some units in the panel, but not necessarily for all, the alternative hypothesis thus writes:

$$H_1 : \begin{cases} \beta_i = 0 & \forall i = 1, \dots, N_1 \\ \beta_i \neq 0 & \forall i = N_1 + 1, \dots, N \end{cases} \quad (4)$$

where $N_1 \in [0, N-1]$ is unknown and $N_1 < N$. If $N_1 = 0$, there is causality for all units in the panel and if $N_1 = N$, there is no causality for all units in the panel and H_1 reduces to H_0.

4 Results and Discussion

The application of proposed regression models resulted in statistically significant results given in the table 3. Variations of selected independent variables determine 31.17% (adjusted R^2) of the variation of the GDP per capita growth rate.

Table 3 Regression Results

Explanatory variables	Estimation	Standard error
Δ FDI	0.00123	0.00397
Δ LL	0.21976*	0.08177
Δ DCPS	0.11887*	0.04776
Δ BM	-0.14986*	0.06494
Δ DMBA	-0.14297*	0.05874
Δ RQ	0.06037	0.04718
Δ GE	0.00688	0.02275
Δ CC	-0.00580	0.03824
R^2	0.45190	
Adjusted R^2	0.31169	
F-statistics	5.06468*	

***indicates significance at the 0.01 level.**

Source: authors' calculation

However, statistically significant relationship is observed only between GDP per capita growth rate and indicators of financial development. If we consider relationship between growth rate of liquid liabilities and growth rate of GDP per capita, it can be concluded that this relationship is positive and statistically significant verifying that financial system growth positively influence the economic growth of the Western Balkan countries. A positive and statistically significant relationship also exists between the growth rate of domestic credit to private sector and the growth rate of GDP per capita. Considering the dominant role of banking sector in the financial systems of the analysed countries due to insufficiently developed capital market, it can be stated that credit financing have significant influence on economic growth. On the other side, negative and statistically significant relationship is observed between the growth rate of GDP per capita and growth rate of broad money and domestic money banks' asset. These results indicates that in the Western Balkan countries there is still excess supply of money that negatively influence economic growth, as well as issue of necessarily oversized banking sector. Namely, since alternative sources of long-term financing in observed countries are scarce, economies are enforced to use the expensive bank credits, which negatively influence the economic growth.

According to the obtained results there is no statistically significant relationship between economic growth and the change of institutional environment in the analysed sample of countries. Contrary to the expectation and results of other similar studies, we could not verify the relationship between economic growth and growth rate of FDI inflows either.

Table 4 Results of the Dumitrescu-Hurlin Test (2012)

→	**Δ GDP**	←	**Δ GDP**
Δ LL	0.37227	**Δ LL**	-0.00099
Δ DCPS	2.2146*	**Δ DCPS**	-0.59653
Δ BM	14.174*	**Δ BM**	-1.08120
Δ DMBA	-0.99084	**Δ DMBA**	5.4235*

***indicates significance at the 0.05 level.**

Source: authors' calculation

The results of causality test presented in table 4 indicate that there is causal relationship between the growth of domestic credit to private sector and broad money, on one side, and growth rate of GDP per capita on the other. However, the causality between these variables is not bidirectional, but we can conclude that growth of GDP per capita has promoted the growth of banking sector in the Western Balkan countries.

5 Conclusions

The main objectives of this study were to examine the link between financial development and economic growth, on one side, and institutional development and economic growth, on the other, in the Western Balkan countries. In order to cover the most important aspects of financial and institutional development analyses included four indicators of the development of financial intermediation and three indicators of governance and institutional quality, as well as indicator of foreign capital inflows. The annual growth rate of GDP per capita was used as a proxy for economic growth. All indicators were obtained from the relevant World Bank databases. The relationship between selected indicators was examined using panel data analysis – regression analysis and causality test.

The conducted empiric research showed that process of financial deepening contributed to process of economic growth. Namely, a unidirectional causal relation between the growth rate of money supply and economic growth as well as the growth rate of credits approved to private sector and economic growth was confirmed. On the other hand, empirical findings suggested that the economic growth promoted development of financial intermediation. Due to the specific "transition" factors the dominant role in the financial intermediation was taken over by banking sector. However, in the previous years this aspect of financial market became oversized at the expense of other aspects, such as capital market, insurance sector, pension and mutual funds. In order to provide sustainable economic growth the countries of the Western Balkan should adopt the adequate reforms in order to promote development of all aspects of financial system that would enhance the foreign capital flows and achievement of transition goals.

In the existing state of the Western Balkan countries institutional environment did not prove to have significant influence on the economic growth. Considering the specifics of each country in the sample, further country focused analysis could provide important insight into governance and institutional quality issues and its relation to economic growth.

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A Call to Theorize Digital Information Technology Due Diligence: Analysis of Research Gaps for the Subject of Information Technology Due Diligence in Mergers and Acquisitions

Dirk Stein[1], Alexander Zureck[2], Tina Jäger[3]

[1] FOM University of Applied Sciences
Lecturer for Entrepreneurship / Turn Around Management at Chair of Finance,
Lecturer for Information Technology Management
Leimkugelstraße 6, 45141 Essen, Germany
E-mail: dirk.stein@fom-net.de

[2] FOM University of Applied Sciences/Masaryk University
isf Institute for Strategic Finance/Faculty of Economics and Administration
Leimkugelstraße 6, 45141 Essen, Germany
E-mail: alexander.zureck@fom.de

[3] FOM University of Applied Sciences/Fontys University of Applied Sciences
Lecturer for Scientific Research Methods/Lecturer for Accounting and Marketing Controlling
Leimkugelstraße 6, 45141 Essen, Germany
E-mail: tina.jaeger@fom.de

Abstract: *The role of information technology in mergers and acquisitions has gained increased importance in recent times due to digitalization. Beside its importance for value creating processes within an organization, information technology can be more and more regarded as a core asset, for which sound valuation is necessary in order to determine any risks and support of assessing a adequate acquisition price for information or digital technology in merger and acquisition transactions. This paper identifies five dimensions of a due diligence for information technology. These dimensions for assessment for the research gap are the technological scope setting and the respective planning and execution process for a information technology due diligence, the dimension of the interrelation to other due diligence audit fields as well as the assessment of previous research approaches in the information technology due diligence audit field and the potential impact of digitalization on planning and execution of information technology due diligence. The before mentioned five dimensions represents the research analysis grid of this article and elaborates issues in this regards the current state of research on the topic as the main result of this article.*

Keywords: information technology, due diligence, Merger & Acquisition, corporate valuation, risk management, digital due diligence

JEL codes: D23, G32, G34, M15

1 Introduction

The concept of due diligence has been established in mergers and acquisitions processes. From a buyer's perspective, in a mergers and acquisitions process, the importance of the due diligence to reduce risk potential and acquisition price is obvious (Berens et al., 2010b). This buyer expectation is empirically confirmed (Berens et al., 2010c). Therefore this paper takes the buyers perspective for the following investigations.

It is empirically confirmed, that often unplanned integration activities due to a merger and acquisition transaction are necessary with the effect that the initial expectation regarding acquired value and communicated objectives have a significant negative deviation (McKiernan/Merali, 1995; Pack, 2005; Strasser, 2000). Especially synergy potentials are not realized in many cases, which can explain ex post most failures of mergers and acquisition (Pack, 2005; Weber, 1991) Desired synergies, as a strategic objective for an acquisition need a detailed plausibility check before the acquisition decision is taken (Cullinan et. al., 2004). Due to this situation due diligence is widely seen as an appropriate instrument in mergers and acquisition.

The significant strategic importance of IT for strategic business success is stated in literature (Cullinan et. al., 2004). IT is as well a critical success factor to create business flexibility and effective performance improvements in company's organization in order to achieve strategic objectives of the acquisitions.

The analysis of impacts for the subject of information technology due diligence in merger and acquisitions should take the buyers perspective. It is supposed, furthermore, that the buyer has the intention to achieve a competitive advantage through acquiring and internalizing the acquisition target, which means explicitly no divestiture, no not using, shut down or closing the acquisition object after deal closing.

2 Theoretical framework

Asymmetric information distribution regarding the acquisition object between buyer and seller can be assumed for merger and acquisition projects. Normally the seller will not provide too much information to the buyer on a voluntary basis because the risk in terms of a negative impact on his sale price is probable.

This phenomenon exists between contracting parties with regards to distribution of relevant due diligence information in mergers and acquisitions (Spremann, 1990).

The asymmetric information distribution between buyer and seller in terms of incomplete information in the process of contractual design is one of the core assumptions of the Principal Agent Theory (Laux, 1990; Eisenhardt, 1989; Fama/Jensen, 1983). This theory addresses the handling of the typical problem of asymmetric information distribution between the principal and the agent. The principal in this context is the buyer and the agent is the seller. The instrument to solve the information problem of the buyer before the final acquisition decision is made, is the concept of due diligence (Berens et al., 2011b). Therefor the Principal Agent Theory is suitable and chosen as a theoretical foundation for the research.

The problem of insufficient information during acquisition processes before the acquisition decision is made is confirmed in literature (Rigall/Hornke, 2007). It is empirically confirmed that the problem of asymmetric information distribution has in numerous cases a negative impact on the buyer's transaction cost.

Transaction cost are defined as all cost with relation or caused by the contractual process of a mergers and acquisition project. Main transaction cost drivers in theory are costs for gathering information regarding the acquisition object to support the mergers and acquisition decision process of the buyer. In this study these costs are defined as cost for an digital IT due diligence test from an ex-ante perspective, i.e. before signing a contract between buyer and seller.

The ex-ante cost of an IT due diligence could avoid unplanned ex-post cost, in terms of post-merger integration cost, due to better information about the object for the buyer. This is the main rational and value added in context of this doctoral thesis for an IT due diligence test in mergers and acquisitions. Therefor the transaction cost theory (Coase, 1937; Williamson, 1979) is suitable as well and set as theoretical foundation in addition to the Principal Agent Theory to theorize digital information technology due diligence.

This research underlies the assumption that the buyer has the intention to acquire information technology to improve his own business in terms of technology, processes or efficiencies.

The Principal Agent Theory and the Transaction Cost Theory are chosen as the theoretical foundation for this research. These theories allows the definition of the research questions and the methodology to theorize digital technology due diligence between seller and buyer.

3 Current State of Research

There are several studies regarding IT due diligence. Sayana published in 2002 an audit process on information technology (Sayana, 2002) Instead of IT the synonym IS

(information systems) is used. The publication has no explicit research question and focuses on an audit process as a facilitator of good corporate governance. Sayana describes an IT audit process. There is no obvious consideration of mergers and acquisitions purposes. The audit process includes the physical and environmental review, systems administration review, application software review, network security review, business continuity review and data integrity review. No scientific approach underlies the development of the IT audit process, or the data source and the sample of investigation. Sayanas publication is rather a report of individual professional experience in IT audit processes.

A framework for conducting IT due diligence in mergers and acquisitions is the publication by Sundberg et al. (Sundberg et al., 2006). It examines the IT due diligence in terms of what needs to be done in the pre-merger and post-merger phases. The examined factors for IT due diligence are strategy alignment, business continuity, human capital, IT operations and IT assets in the used IT due diligence framework. This framework focuses mainly on the fulfillment of regulatory requirements regarding IT due diligence in mergers and acquisitions. The publication has no interrelation to an overall mergers and acquisitions strategy. The framework is based on the methodologies of COBIT, COSO and ITIL from a theoretical perspective. It is enhanced with practical knowledge of IT professionals and companies from past acquisition projects under confidentiality. A sample description of the used practical knowledge for this framework is not provided and the necessary transparent development process of the results is not given either.

Larsen et.al. published the investigation of 17 IT-Governance tools on the basis of a case study. (Larsen et al., 2006). The research question is: How is IT-Governance adapted in the selected case study firm? The selection criteria for using IT-Governance tools are the investigated factors of the publication. The study makes a positive distinction between IT audit and IT due diligence. In this context Sisco postulated that IT due diligence objectives need to be defined first. The following scope of an IT due diligence is recommended: Current IT operations, risk and risk avoidance plans, financial plan, capital investment requirements, leverage opportunities and recommend plans, transition plan, IT due diligence report (Sisco, 2002).

A dedicated blueprint for an IT merger due diligence was has been published by Bathia (Bathia, 2007). A precise research question is not mentioned in this so called blueprint concept for IT due diligence. The investigated factors have a clear relation to a given IT merger strategy. Bathia recommends linking the factors customer products and services and IT support as determinants to the IT merger strategy. These factors will consequently determine the scope of an IT due diligence. IT due diligence according to the Bathia blueprint includes technological considerations of IT organization, network, application and information architecture, data center, facilities and contracts with staff, vendors, partners, customers and business process providers. The study does not detail a transparent scientific development process of the recommended IT due diligence blueprint. A description of the sample for primary research results for this blueprint is missing as well as the applied methodologies and models.

IT audit as a critical business process was analyzed by Carlin et al. (Carlin/Gallegos, 2007). This article formulates no specific research question. It describes an IT audit process. The theoretical foundation is the COBIT IT-Governance reference model. The fulfillment of legal requirements and regulations is the main objective of the IT audit process. The described IT audit process includes the following activities: define audit scope, define audit objectives, perform a preliminary evaluation, conduct compliance testing, conduct substantive testing in warranty area, complete evaluation in internal controls and communication of weaknesses. No relation of the IT audit to a consideration of merger and acquisitions needs is observable. The included primary research data is mostly not transparent. A sample description is missing as well. The focus is on the fulfillment of regulatory requirements and of overall strategic business requirements in mergers and acquisitions.

Andriole publishes a recommendation of selection criteria for decision support of acquiring and deployment of technologies (Andriole, 2007). Fifteen selection criteria are discussed. The defined selection criteria are obviously not scientifically derived, but traceable. The importance of an IT due diligence process is underlined but not further specified. The benefits of an IT due diligence process are to reduce risk and to increase the return of technology.

For an initial IT due diligence Delak describes an approach with emphasis on risk identification before capital investment in finance industry (Delak, 2008). The research goal is to identify the most appropriate concept for IT due diligence. The study relies on case studies in independent financial institutions outside bank industry. A model for IT due diligence of the National Bank of Slovenia underlies the publication.

Scope of the publication are frameworks, models, best practices and standards for conducting IT due diligence in different types of companies. The scope is similar and nearly a subset to Larsen et.al. (Larsen et al., 2006) and Sundberg et. al. (Sundberg et al., 2006). A combination of the comparison of existing IT governance models with research methodologies is the methodology of this publication. Primary research is not mentioned nor obvious. A sample description is not given. The authors state that an IT due diligence tool is under development. So far no progress is published. From a scientific point of view the used proprietary model of the National Bank of Slowenia is not transparent and not available for scientific evaluation purposes.

A framework for delivering an information system due diligence with scientific focus on rapid information system due diligence is published in 2013 (Delak/Bajec, 2013a). The approach is a mix of methodologies of literature review with objective of potential IT governance model comparison regarding strength and weaknesses, expert opinion involvement and a case study. The expert opinion involvement is not transparent in terms of documentation of results. The sample of compared models comprises nineteen analyzed IT governance frameworks. There are three case studies, focusing on the European transition economies Bulgaria, Kosovo and the Russian Federation. The result is a synthesis of information systems due diligence with a simple decision process model and a questionnaire with validation according the three selected three case studies.

Information system due diligence data as an input for knowledge management was published 2013 by Delak and Bajec as well (Delak/Bajec, 2013b). It is based on the 2013 publication by Delak and Bajec (Delak/Bajec, 2013a). The scientific research question is: How to use an information system due diligence framework to facilitate information systems knowledge management? The result of this analysis is the recommendation of a re-use of the developed process (Delak/Bajec, 2013a) from the first publication of the authors. The recommendations are based on two case studies and the personal expertise of the authors.

Wright and Altimas published a process of a due diligence in information technology (Wright/Altimas, 2015). The key question in this publication is defined as "Are you buying an IT asset or liability?" An IT due diligence process model is the result of this publication. The process contains the following steps: Understand the deal, scope and risk assessment, perform reviews, report findings and post deal activities. The investigated technological scope of consideration for IT due diligence are risk analysis, identification key systems, reliability of key systems, upgrade and patching strategy of systems, systems resilience strategy, IT security and regulatory requirements (Wright/Altimas, 2015). The paper relies on four case studies which are not available for assessment purposes and professional consultancy experience of the authors.

Bloch and Zerfass examined, why IT due diligence can make or break a deal (Bloch/Zerfass, 2010). The deep knowledge regarding all aspects about IT environment of the acquisition target is stated as critical to analyze strategic goals of the intended transaction. The recommended factors to be considered are date center, network strategy, hard and software architecture, hard and software currently in use, hard and software maintenance, hard and software development strategy, software licensing models, desktop systems and

their maintenance, human resources with skills to run current IT environment, headcount for IT operations, capacity utilizations for hard and software and their limits, current IT projects, IT procurement, usage of outsourcing and freelancers.

In addition to these lists of investigation factors for IT environment, Bloch and Zerfass recommend their IT due diligence approach, which can be seen as an IT due diligence process. The process steps are preparation, information screening, analysis / Q&A`s, evaluation, result, integration of results in offer. They see the preparation step of the IT Due Diligence approach as part of the overall mergers and acquisition process, in which the intended deal strategically should be understood in terms of relations to IT of the deal.

Howson considers IT due diligence in two forms (Howson, 2003). Information Technology (IT) is understood as a set of information systems, process and hardware to run the business. Production technology (PT) is defined as processes, equipment and know-how to make products or deliver service. Due to an overlapping of the content of both technology types the due diligence of both should be considered together. Howson categorizes the IT/PT due diligence into three levels.

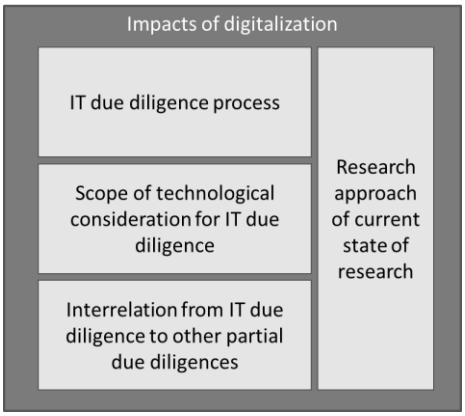
The audit level answers the key question of what equipment and software is being used with regards to its quality. Howson recommends on the audit level considerations of vulnerability, trust and complexity. Vulnerability is defined in the context of accessibility and number of users, trust is defined in considerations of employee vetting and management concerns and complexity is defined in considerations of technology risk, organizational risk and system design.

The management level should answer the key question of how well the IT/PT supports the business. The strategic level should answer the key question about the sufficiency of the used technology and organization for the future.

4 Research Gaps in Digital IT Due Diligence

Based on the current state of research, research gaps for IT due diligence are identified. It includes a synthesis approach of five assessment perspectives:

Figure 1 Impacts of Digitalization



Source: own processing

First of all, the observed IT due diligence processes and it`s process steps are collected and analyzed. The process perspective is chosen because it is a common approach to conduct a Due Diligence. Berens et al. mentions finish-to-start dependencies during a Due Diligence which requires a process perspective (Berens et al., 2011a) to approach the nature of an IT Due Diligence.

The objective of the research to theorize information technology due diligence is the development of an IT due diligence framework based on scientifically good practices and

norms. The investigation and assessment of existing IT due diligence process models is a baseline or the starting point in this research.

As second perspective, the recommended technological scope of consideration in the current state-of-research is evaluated. The technical and managerial criteria are generally based on IT-Governance Management Models like COBIT or ITIL. The approaches to IT Due Diligence in the current literature are inconsistent, heterogeneous and often not well scientifically founded. The development of an improved IT due diligence process requires the consideration of proper scientific standards, the usage of a generally accepted process improvement methodology and the involvement of particular knowledge from experts.

Due to the cross functional nature of digital information technology the IT due diligence is consequently cross functional as well. IT due diligence with focus on pure technological considerations may not sufficient for the decision process in the context of mergers and acquisitions. Partial due diligence tests like legal and financial due diligence test may be necessary in order to have a holistic view on the target acquisition object for the decision process. These partial tests are identified in the literature review.

The fourth evaluation perspective is the evaluation of the literature review sources from a scientific perspective in order to identify approaches and limitations of the reviewed publications regarding applied scientific standards.

A. IT Due Diligence from a Process Perspective

Most authors focus on risk assessment and fulfillment of regulatory requirements of information technology with regard to a merger and acquisition. They neglect aspects which may be important for internalization in buyers organization. This is in general not sufficient for a sound decision about information technology as acquisition object as part of a merger and acquisitions decision. Especially a joint consideration of an IT due diligence, with the intended business strategy from a buyers perspective, is missing in reviewed publications as well. The IT due diligence results are mostly not sufficiently integrated into the overall mergers and acquisition transaction process before deal closing. A comprehensive and integrated IT due diligence process model is missing or rudimentary outlined in literature.

A few authors provide simple IT due diligence processes and approaches (cf. Table I in Appendix). Their process approaches are different in terms of defined process steps and it`s granularity. The necessity and importance of a standardized IT due diligence process model for mergers and acquisitions is discussed in the reviewed literature for a better support of mergers and acquisitions decisions. This standardized IT due diligence process model must be integrated into an overall mergers and acquisition process.

The evaluation of the existing concepts of IT due diligence is summarized as follows. Most of the publications focus on regulatory issues and advocate a heterogeneous process perspective. Authors are using IT audit processes in order to evaluate the regulatory alignment of information technology management processes. The majority of the observed IT due diligence processes are not designed from the strategic mergers and acquisition perspective of an internalization of the acquisition object into buyer's organization.

B. Scope of Technological Consideration of Digital IT Due Diligence

The technical object of investigation for an IT due diligence in the analyzed literature is heterogeneous pronounced. The publications give on a high level assistance which technological areas should be considered and analyzed. In the analyzed literature of IT, concept is undifferentiated defined and used as a general term for an IT due diligence from a technical perspective.

This undifferentiated approach leads, due to the cross-functional nature of IT, to the problem that, the subject of examination is diffuse and the result, in terms of the benefits of IT due diligence for merger and acquisition transaction success, is problematic or questionable. A merger and acquisitions transaction intends to buy at a target acquisition target which includes more and more IT today and in future.

Orlikowksi and Iacono (Orlikowski/Iacono, 2002) have identified the problem of insufficient definition of the IT concept in their research commentary and called to theorize the IT artifacts more precisely and to include them into research and studies. The undifferentiated use of the IT concept in analyzed literature can be seen in that way that IT is used as a general term and definition on a high level.

Table 2 in the appendix shows, that the analyzed literature has overall no homogeneous view of what needs to be considered and analyzed from a technological perspective.

The selection assessment attributes IT-Architecture, Data Center / Network, Human Resources, Risk and IT Security, Operations of IT and Sourcing were identified in the literature review and are as well the most important evaluation attributes for an information technology artefact from an IT Governance perspective and are widely accepted by IT Governance Models (Weill/Ross, 2004; Harmer, 2013; Bernard, 2012).

The IT Governance Models use the term domain or management domain as synonym for the term evaluation attributes (Harmer, 2013).

C. Interrelations of Digital IT Due Diligence with other partial Due Diligences

The analysis of the IT due diligence publications gives numerous indications that IT due diligence is linked to other partial due diligence tests. Touchpoints can be observed to financial due diligence, legal due diligence HR due diligence, cultural due diligence, operational due diligence, tax due diligence and intellectual property due diligence (Koch/Menke, 2011).

The literature review identified additional publications, that also mention touchpoints between an IT DD and other partial due diligence tests as depicted in table 3 of the appendix.

The result of this analysis in terms of touchpoints from IT due diligence to other due diligence tests is, as well, heterogeneous pronounced. Especially the scope of the identified touchpoint in terms of scope and considerations varies between the reviewed publications. From a research perspective there is a need to harmonize the touchpoints of IT due diligence to the other due diligence tests for merger and acquisitions purposes to assure a consistent scope and quality in context of an IT due diligence project.

D. Research Approach of Current State of Research

From a research perspective it must be criticized, that the methodology of most analyzed publications does not meet proper scientific standards and practice. The results are often based on practical experiences of the authors which are neither comprehensible nor replicable from a research perspective. The cited case studies are often not transparent and not accessible to analysis by other scientists. In cases of expert interviews, as primary research data, interview minutes are neither cited nor available for research verification purposes.

The applied case studies in the analyzed publications have further deficits. They are reflecting in many cases only specific industries. Their transferability in terms to generate general implications to a standard methodology for IT due diligence is doubtful. Some authors confirm this issue implicitly. Some case studies and expert opinions are marked as confidential, which is another disadvantage for scientific analysis.

The reviewed publications provide in summary only rudimentary information for conducting an IT due diligence. The search for scientific publications about the implementation of an IT due diligence in the context of mergers and acquisitions rendered only a few studies. In contrast, near-scientific publications based upon the authors own experiences or case studies have been far more prevalent. They are taken into consideration in this literature review, since their authors can be considered as experts in the field. Their findings might have some value for the analysis of this thesis at a later stage. They will however be treated most critically.

Ideas for the process dimensions and considerations for the development of an IT due diligence process model lead to an explorative research approach. The application of expert interviews for the development of a standardized IT due diligence process model could not be observed in the available literature.

The knowledge of experts in this field however is expected to provide valuable insights for the development of a standardized IT due diligence process model that is capable of being applied in practice for IT Due Diligence internalization scenario. Moreover, expert interviews are a data collection method that provides more multifaceted insights for the scientific research than personal experiences and the study of a single ITDD case.

The need for research about a proper scientifically developed model for an IT due diligence process is evident. Table 4 in the appendix provides an overview of the evaluation.

E. Consideration of Digitalization

In addition to the reviewed aspects of IT due diligence one aspect is not considered by most researchers in this field. Many companies find themselves exposed to an aggressive market environment, which is often driven by technological advance and digitalization. The role of IT is also regarded as being enabler of the digitalization itself (Châlons/Dufft, 2016).

Scheer mentions, that digitalization often affects the business models of companies and thus effects the requirements of IT systems that need to be accessible from multiple devices and channels and concludes, that due to digitalization, the world becomes more flat and more complex (Scheer, 2016). Urban/Ahlemann point out that the effects of digitalization may be a treat to business processes and business continuity itself (Urban/Ahlemann, 2016). This development has tremendous effects on the valuation of IT systems, that need to be considered in the course of an digital IT due diligence.

The literature review indicates that this important aspect has not been sufficiently analyzed by researchers (See Table IV in Appendix). In this regard the literature was reviewed by searching for digitalization-related keywords such as Big Data, RFID, Internet of Things or Industry 4.0. Only Andriole has considered digitalization as being an influencing factor for IT due diligence (Andirole, 2007).

Thus, the impact of digitalization on IT due diligence can be regarded as an overarching research gap that has implications for the process-related research dimensions as outlined before. For this reason the effects of digitalization on the process of IT due diligence will be part of the research.

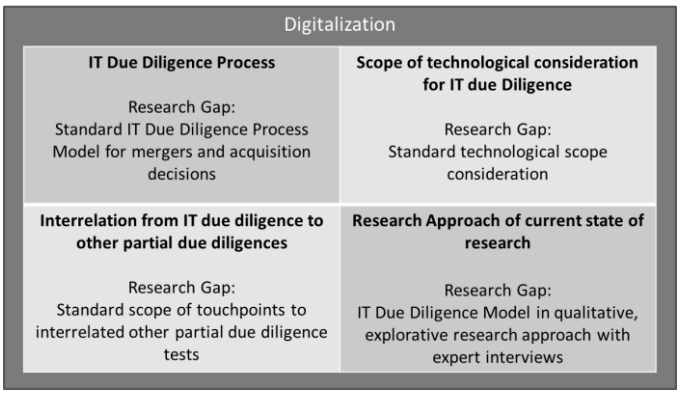
5 Conclusions

Based upon the foregoing analysis of the subject of IT due diligence in the current state of research, it can be concluded that there are multifaceted research gaps. Three research gaps are related to the process of IT due diligence itself. These are referring to the overall process of IT you diligences, the technological scope of its consideration and interrelations with other partial due diligence tests.

One methodological research gap has been identified in the way that academic literature has approached the topic. Research in this field is mostly based upon personal experiences and case studies, which offers only limited perspective on the multifaceted aspects of an IT due diligence. Moreover, the research process itself might profit from a more generally-oriented approach, rather than relying on personal experiences and specific cases.

In addition, the topic of IT due diligence is gaining additional importance due to the technological advancements that are labelled under the term of "digitalization". Impacts of digitalization on the due diligence of IT in the context of mergers and acquisitions have not sufficiently been researched by the academics in this field, so that there impacts can be regarded as an additional and overarching research gap. The below figure illustrates the five research gaps that have been derived from literature.

Figure 2 Digitalization



Source: own processing

The managerial implications of this analysis are, that managers need to consider multiple aspects when assessing the IT value when preparing a merger or acquisition in order to match the requirements of their IT due diligence.

Specific research dedicated to gain insights into these five research gaps might increase the degree of standardization in IT due diligence, which can contribute to a more timely and efficient conduction of IT due diligences. Thus, researchers might put and focus on assessing the topic with research methods that provide more in-depth data sets. These data sets might be acquired by conducting quantitative research and by assessing the expert opinion of multiple experts on the topic.

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Influence of Capital Market on the US Unemployment and GDP

Erik Suchý[1], Michal Šoltés[2]

[1] Technical University of Košice
Faculty of Economics, Department of Banking and Investment
Němcovej 32, 040 01 Košice, Slovakia
E-mail: erik.suchy@tuke.sk

[2] Technical University of Košice
Faculty of Economics, Department of Banking and Investment
Němcovej 32, 040 01 Košice, Slovakia
E-mail: michal.soltes@tuke.sk

Abstract: *In this paper we analyze the size of the US capital market and its attributes. Following the 2008 economic crisis, many countries' economies or even whole European Union and US were in recession. Unemployment rate increased, GDP declined and some businesses bankrupted, mainly banks. In order to support economic growth, countries have taken various steps such as quantitative easing, interest rate cuts, investment incentives etc. The US market has recovered from the crisis sooner than rest of the world, even though the trigger for the crisis was in the US. The US economy is considered to be the most developed, as it has a huge banking and capital market. The banking sector or mortgages market to be concrete was the trigger for the crisis, but the capital sector can be considered as a support system in the rebuilding of the US economy. In our paper we deal with the US capital market, which is the largest in the world and supports the US economy and therefore employment, GDP, economic growth, capital inflows and more. The size and usability of the US capital market is unparalleled and therefore its aspects need to be further explored. The European Union has one of the main objectives of building a capital markets union on the US image where capital markets operate at a much better level. For this reason, our research addresses various indicators of the US capital market and their impact on unemployment and GDP in the US.*

Keywords: capital market, stock market, stocks, unemployment, GDP

JEL codes: F21, G15, O16, E22, E44

1 Introduction

For the proper functioning of the economy, healthy economic growth and development, the effective functioning of the overall financial system and the financial market is crucial. Capital market, as part of the financial market, significantly affects the size of the real economy of the country. In this paper, we will focus on analyzing the United States (US) capital market as the most developed market in the world. We will analyze the capital market with respect to the macroeconomic indicators, namely the impact on economic growth and unemployment. The aim is to find out what impact the US capital market has on the underlying macroeconomic indicators.

The bulk of the literature provides extensive evidence of the importance of the capital market in the country's economy. Authors and scientists focus on the correlation between capital market indicators and two or more macroeconomic indicators (e.g. Zhou (2011), Coskun et al. (2017)). As a result, there are various analyses of the causal relationship between the financial market, economic growth and economic performance. Schumpeter (1911) first came up with the idea of exploring the financial market and the pace of economic growth, focusing on investment, credit mechanism and the creation of new capital from savings. Investments which make a surplus on the capital market, stimulates the overall financial market and consequently support economic growth.

Due to the size of the financial system, Coskun et al. (2017) deal with the issue in more detail and analyze the financial market in relation to the specific economic sector and subsector. According to the conclusions of a large number of research papers, a strong correlation between the financial market and economic performance has been confirmed.

On the other hand, some studies (e.g. Kaserer, Ch., Steffen-Rapp, M. (2014)) point to the fact that economic growth can improve and stimulate financial market, but the impact of economic growth on the capital market is questionable in view of the government's economic policy that affects the effective allocation of funds. In terms of economic policy, the capital and financial markets also have an impact on the financing of public debt and government deficits (e.g. Fincke, Greiner (2015), Nordin, Nordin (2016), Coskun, Y., Seven, U., Ertugrul, HM, Ulussever, T. (2017). The public debt financing is based on the relationship between the development of government bonds on the capital market and real economic growth, with the above-mentioned studies agreeing that there is a positive correlation between government bonds´ performance and economic growth.

Further scientific papers point to the relation between the capital market and economic growth in terms of market liquidity and rates of return. Beck, Levine (2004) & Boubari, Jin (2010) concludes that the purchase and sale of stock market shares as a long-term appreciation of financial assets will foster economic growth in the country but, on the other hand, by distributing their savings into long-term investments, they push away current consumption, which eliminates real money in the economy and has a negative impact on current economic growth. The market liquidity and the relationship between savings and investments are also addressed in a study Coskun, Y., Seven, U., Ertugrul, HM, Ulussever, T. (2017) in which states that more liquid markets eliminate market risk in the longer term and investment costs, which favorably affect economic growth.

Another way to determine the correlation between economic growth and the capital market is through exploring the diversification of risk and the development of the international integration of financial markets. Ologunwa, O.P., Sadibo, O.V. (2016) describes the risk shift to higher yielding projects that can significantly boost economic growth as compared to low risk investments that can, on the contrary, cause a slowdown in economic growth or even a reduction in economic welfare. On the other hand, we can meet with the literature examining the integration of financial markets and the impact of globalization on the level of real output in emerging countries, for example study by Yepes-Rios, B., Gonzalez-Tapia, K., Gonzalez-Perez, M.A. (2015) which applies capital market research in the countries of Latin America.

Pan L., Mishra, V. (2018) characterizes the capital market in terms of economic theories and economic models. As stated, the relationship between the capital market and economic growth can be analyzed according to the five basic economic models:

- Keynes model: analyzes the relationship between investment and savings, examines and defines the liquidity trap;
- Neoclassical model: According to this model, all capital market operations are cost-free because they consider money and capital as substitutes;
- McKinnon model: assesses the relationship of deposit interest rates and investments;
- IS-LM: provides a detailed analysis of interest rates and savings in relation to real macroeconomic output and the money market;
- Endogenous Economic Growth Model: Explains the relationship to the financial market on the basis of technological progress and innovation.

Following the global financial crisis, studies focusing on the development of the financial and capital market in terms of an optimal capital structure in relation to public finances and the accumulation of capital by banking institutions or analyze the impact of foreign capital flows on macroeconomic performance (Carp, L. (2012)).

Choi, S., Lounani, P. (2015) studies the development of the unemployment rate in the US through the structural autoregressive model and the impact of economic shocks on the financial market during the economic crisis. Based on data for the US stock index S&P500, the results show two main conclusions: overall market uncertainty has a short-term impact on the unemployment rate, while sectoral uncertainty related to the crisis period had a steady impact on unemployment.

Pan L., Mishra, V. (2018) argues that there are also critics among the economists who question the relationship between economic growth, economic performance, and the capital market. The main causes of skepticism are the asymmetry of information (market conditions as well as insufficient information about companies) and the reluctance of investors to invest in new shares. Another issue that these economists argue is that authors analyzes the relationship between economic growth and the financial sector and recognizes that there may be strong correlation between the variables. However, this correlation is not explored deeply, so it remains questionable whether there is a significant link between the real economy and the financial and capital markets.

In terms of empirical exploration of capital markets, we can find among the literature several approaches such as regression models, causal relationships, impulse-response functions, or autoregressive VAR models. Within the models, they analyze relationships using primarily monthly or quarterly data of developed countries (especially US market data), or examine the development of financial markets in emerging markets (such as the Chinese, Indian, Turkish and Latin American markets).

This paper consists of four parts: the introductory part describes the theoretical and empirical overview of the expert studies covering interdependence of the capital market and the real economy; secondly we describe methodology used in the model and the acquisition of input data; in the next part the research results are discussed and the final part summarizes the main results and sets out recommendations for potential research. The main purpose of this work is to investigate the impact of the United States capital market on the level of macroeconomic indicators such as unemployment rates and the rate of economic growth.

2 Methodology and Data

In analyzing the capital market and economic indicators, the choice of methodology is important. This work will be based on dependence on economic growth (GDP and unemployment) and on the characteristics factors of the capital market. We assume that certain characteristics affect the US capital market and ultimately affect the country's unemployment and GDP growth. We have data available from 1975 to 2015 that we obtained from the World Bank database.

We used annual data for all variables and apply two-stage least squares regression analysis. The general linear model is defined as:

$$GDP_{it} = \alpha_i + X_{it}\beta + u_{it} \qquad (1)$$

$$UNEM_{it} = \alpha_i + X_{it}\beta + u_{it} \qquad (2)$$

For t=1,…T and i=1,…N, where GDP_{it} (Gross domestic product) is a dependent variable, used as a representative figure for the economic growth of the country. $UNEM_{it}$ (Unemployment) is a dependent variable in our second model. X_{it} is the time variant matrix of explanatory variables – characteristics of capital market in our case, α_I is the unobserved time-invariant individual effect and u_{it} is the error term, Bai (2009).

For both models, we used as explanatory variables: Market capitalization (% of GDP), Stocks traded turnover ratio (%), Stocks traded total value (% Y2Y), Stock market total value traded to GDP (%) and Stock market turnover ratio (%). Our goal is to determine the statistical significance of the model as a whole and whether individual indicators affect GDP growth and unemployment in the US economy.

3 Results and Discussion

Both models for GDP growth and unemployment are statistically significant. However, not all coefficients affect dependent variables, so they were removed from our model. In the following model, we derived formula from variables that were not correlated with each

other - eliminating highly correlated variables. For the GDP model, the resulting formula is as follows:

$$GDP = 0{,}0420571 * MC - 0{,}047284 * STTV + 0{,}0483991 * SMR + u_t \quad (3)$$

Table 1 Estimated Coefficients from US GDP Growth Model

Coefficients	Estimate	p-value
Market capitalization (MC)	0,0420571	0,0002 ***
Stocks traded total value (STTV)	-0,047284	0,0140 **
Stock market return (SMR)	0,0483991	0,0759 *

Note: ***, **, * denote significance levels on 1, 5 and 10 per cent respectively. R-Squared is 0,687079. According to Pesaran-Taylor test, there is not heteroscedasticity presented in the model, z = 1,16769. Residuals are normally distributed, Chi-square=3,9378.

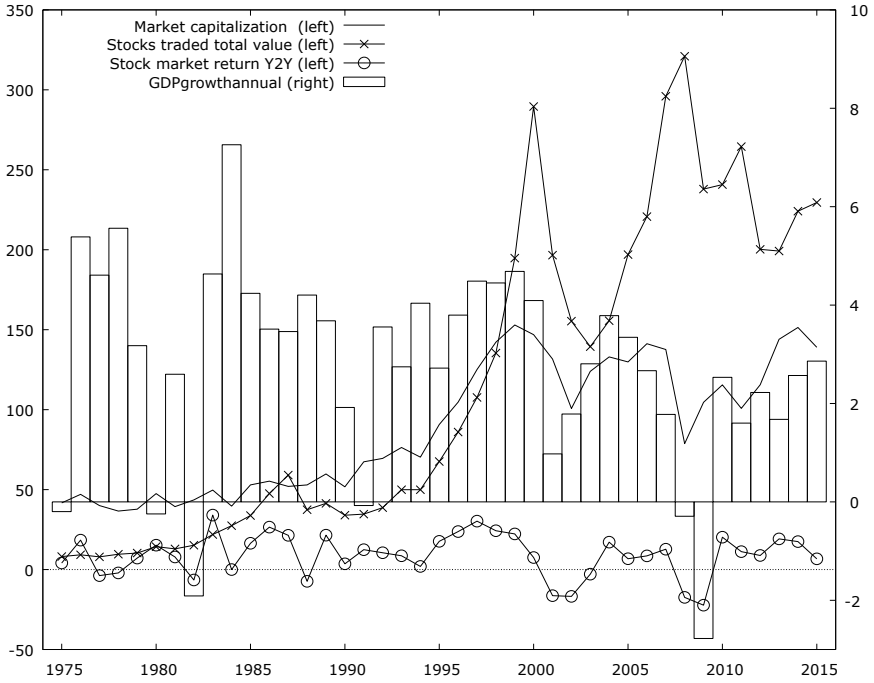
Source: own elaboration using data from World bank database

Table 1 shows that GDP is positively influenced by two factors: Market capitalization and Stock market return negatively influenced by Stock traded total value. Growth of market capitalization has a positive impact on GDP, as market capitalization reflects the size of the capital market; we can say that larger and stronger capital markets have impact on GDP growth. Market capitalization is, in essence, determined by the size of companies, and it is obvious that companies in the economy are larger; they increase production volume and thus contributing to GDP growth in the country. Stock market return is the second factor that positively influences GDP growth. This variable is a return on the capital market, which means that if the capital market is in positive numbers, companies listed on the stock market are doing well and ultimately supporting GDP growth. Our results of GDP analysis are similar to some studies mentioned above, such as Coskun, Y., Seven, U., Ertugrul, H.M., Ulussever, T. (2017), or Kaserer, Ch., Steffen-Rapp, M. (2014), and proved a relationship between capital market and real economy. Moreover, as Pan, L., Mishra, V. (2018) claimed in conclusion, our analysis also proved a positive relationship between capital market and the size of companies in the economy. There is an evidence that the stronger capital market, the higher GDP in the economy is and therefore also the lower unemployment rate.

On the other hand, we can see that stocks traded total value has no positive effect on GDP growth, which can be justified by the small importance of the volume of trades on the capital market. We argue that the factors that have a positive influence on GDP are more based on quality and Stocks traded total value more on quantity, because it expresses the volume or the value of trades, which does not have to influence GDP, according to our results.

Figure 1 shows our results graphically. It can be seen the relationship between GDP and capital market in this figure. As it has been already stated above, we can also see that the influence of GDP on market capitalization and stock market return is positive, meanwhile stock traded total value has a small negative effect on GDP growth.

Figure 1 GDP Growth Compared with MC, STTV and SMR



Source: own ellaboration

Secondly, we analyzed an influence of the US capital market and unemployment rate in our unemployment model. For this model, we used standardized data. The resulting formula can be described as follows:

$$UNEM = 10{,}3869 - 0{,}0265562 * STTR + 0{,}0540119 * SMR - 0{,}0685065 * MC + 0{,}0415102 * SMTVT + u_t \quad (4)$$

Table 2 Estimated Coefficients from US Unemployment Model

Coefficients	Estimate	p-value
Const	10,3869	6,99 e^{-16} ***
Stocks traded turnover ratio (STTR)	-0,0265562	0,0,0032 ***
Stock market return Y2Y (SMR)	0,0540119	0,0063 ***
Market capitalization (MC)	-0,0685065	3,42 e^{-6} ***
Stock market total value traded (SMTVT)	0,0415102	0,0003 ***

Note: ***, **, * denote significance levels on 1, 5 and 10 per cent respectively. R-Squared is 0,56185. According to Pesaran-Taylor test, there is not heteroscedasticity presented in the model, z = 1,40411. Residuals are normally distributed, Chi-square=0,68997.

Source: own elaboration using data from World bank database

Based on the results that is presented in the Tab. 2, we see that Stock traded turnover and Market capitalization has a positive impact on unemployment (lower unemployment). These factors influence unemployment, as the growth of market capitalization and the capital market turnover support the capital market, ultimately the companies and institutions that create jobs.

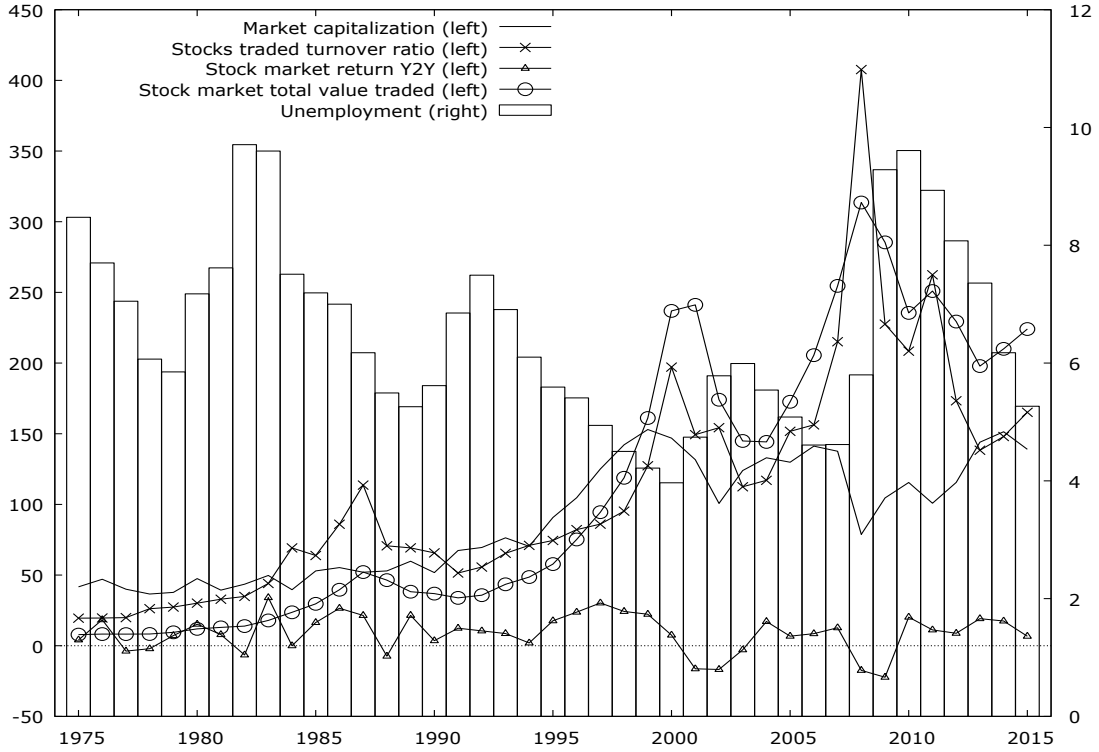
On the other hand, the Stock Market Return Y2Y (year-to-year) and Stock market total value traded does not affect the reduction of unemployment. We are based on the assumption that capital market gains and the volume of trades on the capital market do

not have a direct (positive) impact on unemployment as these factors apply to the business and profit of non-job-creating investors.

The similar results is stated in study Choi, S., Lounani, P. (2015) where authors analyzed unemployment rate and economic shocks. Also, our findings about an impact of unemployment on economic activity is comparable to one of conclusion of Choi, S., Lounani, P. (2015) who claims that unemployment is affected by indicators of capital market only in the short-term period of time.

The results of our unemployment model are presented in Fig. 2.

Figure 2 Unemployment Compared with Statistically Significant Coefficient



Source: own ellaboration

4 Conclusions

The aim of this work was to analyze relationship between the capital market and the underlying macroeconomic variables that we applied to the US data. The literature provides evidence of a correlation between the capital market and the country's economy, either at the microeconomic level (market liquidity analysis, efficient allocation of financial resources) and at the macroeconomic level (analysis of various macroeconomic indicators in relation to the financial market as a whole).

In our paper, we have come to the conclusion that the capital market or capital market factors significantly affect GDP growth and unemployment. The Stock market total value traded negatively affects GDP growth and even unemployment, so we can consider this factor to be significant in a negative sense. On the other hand, market capitalization has proven to be a significant impetus for both macroeconomic variables and our recommendation is to continue to support the growth of market capitalization in the US.

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Identification of Financial Strategy in E-commerce

Veronika Svatošová[1], Sylva Chalupová[2], Petra Dvořáková[3]

[1,2,3] Mendel University in Brno
Faculty of Regional Development and International Studies,
Department of Regional and Business Economics
Street and Building Number, 613 00 Brno, Czech Republic
[1]E-mail: veronika.svatosova@mendelu.cz
[2]E-mail: xchalup8@node.mendelu.cz
[3]Email: xdvora89@node.mendelu.cz

Abstract: *The researches and practice declare the strategic key factor of long-term business success is considered to be strategic approach to financial management along with proposing and implementing financial strategy. However, this area explored is often among businesses deeply underestimated. The current researches focus on the modern aspects of e-commerce, nevertheless, no impact is given to financial strategy in e-commerce. Therefore, this paper deals with determining the financial strategy in e-commerce. The main objective of paper is to identify the financial strategy of selected enterprises primarily focused on e-commerce. The research sample of enterprises involved to the survey is selected based on the following restrictive criteria: headquarter of enterprise in the Czech Republic, legal form of business joint stock company, existence of enterprise in e-commerce minimum 5 years, main business area B2C market, enterprises trading mostly electronically selling goods. The main research methods are following: analysis of financial statements of selected enterprises, selected methods of situational analysis and financial analysis and selected methods of descriptive statistics and financial strategy model simulating in Vensim program. Input data is used for the year 2016 compared to the year 2011, i.e. observing the development in 5 years. Findings identified the* selected enterprises apply in most cases a conservative financial strategy (i.e. strategy of maximum liquidity). *The conclusion of paper is based also on proposing the series of recommendations for effective creating and implementing financial strategy in e-commerce with a help of dynamic financial strategy model that could support the long-term competitive development of business in e-commerce. This model simulates changes of conservative financial strategy into aggressive financial strategy focusing on maximizing profitability during next 5 years, especially during the period of rapid economic growth and massive e-commerce development.*

Keywords: e-commerce, financial strategy, situational and financial analysis, Vensim program, financial strategy model

JEL codes: M20, M21, M29, G30, G39

1 Introduction

Strategic approach to managing business activities is considered to be a baseline for a long-term business success and its development or strategic market position. However, creating and implementing appropriate corporate and functional strategies among businesses in practice is obviously deeply underestimated. When managing finance in business is used, it is obviously limited on functioning accounting and strategic approach to financial aspects of business is missing. The same prerequisite is given to the area of e-commerce even though this business field is gaining more and more popularity and importance in global economy. Therefore, the paper focuses on determining the financial strategy in e-commerce. The research deals with the identification of financial strategy of of enterprises primarily focused on e-commerce with a help of modelling of financial strategy for e-commerce in Vensim program. Finally, the dynamic financial strategy model for e-commerce is proposed that suggests the optimal e-commerce financial strategy development and that could support the long-term competitive development of business in e-commerce.

2 Theoretical Background – Financial strategy and E-commerce

E-commerce represents just a part of e-business. E-business includes expect of e-commerce also e-administration, e-logistics, e-government, e-learning etc. E-commerce is defined as a purchase of goods or services carried out by computer networks. The term includes service and support after the purchase too. Definitions state that providing business information and maintaining business relationships are also important part of e-commerce. Business-to-consumer (B2C) e-commerce is highly broadened owing to offering a quick response to request or wide offer of products (Kunešová et Mičík, 2015). EE-commerce is internationalized and people are generally used to buy things online across national borders. It means a lot of new business opportunities for small domestic firms or international firms (Hallikainen et Laukkanen, 2018). The objective of the e-commerce model is to give consumers together, on one side, and the sellers on the other and to determine the way in which they communicate. The seller created business strategies, which aim to increase sales and build consumer trust (Marković at al., 2016). Electronic commerce can be also used as a tool to reduce the economic space between countries (Villa et al., 2018) Because the collaboration with foreign associates is very important in today's digital world for better organizational performance and co-creating value (Nadeem et al., 2018).

The financial strategy is defined as a relatively coherent and interconnected set of strategic financial objectives, criteria and rules that underlie such planning (Landa and Polák, 2008). Three steps to set up a successful financial strategy are following (Mallete, 2006): Step 1 – *Establish appropriate financial capital structure, following which a determination would be made of the magnitude of its cash surplus;* Step 2 – *Understand whether a company is undervalued or overvalued in the market, by examining investors' expectations;* Step 3 – *Develop a financial strategy, to be proposed to the Board for approval, ensuring the company's operations are sufficiently funded, that financial balance is achieved*. According net working capital, three basic financing strategies are then distinguished to (Režňáková, 2012, p. 107-108): "***aggressive financial strategy*** *– net working capital was is negative. The part of long-term assets is financed by short-term resources. These situations occur in a period of rapid business growth, extensive investment or withhold payments to suppliers;* ***conservative financial strategy*** *–the long-term sources of financing are used to finance seasonal fluctuations in current assets. Here, it is typical lax approach to inventory management and collection of its receivables or prompt payment of liabilities to suppliers;* ***balanced financial strategy*** *– consistency between the maturity of financial sources with a lifetime of assets in the company is ensured*."

Considering the expansion of information technology and new business models, e-commerce is more ordinary in many sectors (learning, shopping, tourism etc.) in these days. The difference between e-commerce enterprises and traditional enterprises is obvious. That is the reason why also financial management differs. Financial management in e-commerce companies has wider possibilities. The study on financial management is very important, especially for the sustainable development of e-commerce companies. E-commerce often follows a new business model, which works on browser or server applications, offering several commercial trade activities for people from all over the world (Li, 2017). Financial management along with financial strategy in e-commerce companies is centralized. The optimal mode of centralized financial management is a network financial system. It helps to allocate funds collectively in all branches in one big company. Another important mode is to coordinate finance and business, which is easier with today´s speed of internet (Tu, 2016). We can see two kinds of financial strategies and goals which e-commerce brings. The first one is, the enterprise want to realize a maximum profit. Enterprises should reduce their costs and improve their income to increase their profit, which they can invest to their development. The second financial strategy is to realize maximum values of enterprises (Tu, 2016). Global firms have important advantage in influencing online pricing for consumer products thanks to the achievement of economies of scale. Global firms in developed countries, for example the Amazon, can utilize their resources and network scale to easily emasculate the local markets of developing countries (Broome, 2016). Critical success factors for electronic commerce include: adding value,

focusing on a niche, expanding, maintaining flexibility and segmenting geographically, adopting the right technology to handle a critical perception, providing exceptional service, creating an effective connectivity, and understanding the culture of the local markets (Villa et al., 2018). According to the abilities of firms these changes may create new opportunities or offer new challenges such as a shift from being a producer depending on wholesalers which provide access to markets, to dealing directly with the end-customers (Broome, 2016). "*With the deepening of the research of electronic commerce, expanding the research angle of ecommerce enterprises, the traditional financial management theories of the enterprises need to be updated, the traditional pattern of enterprise financial management has been difficult to adapt to the needs of the times, therefore explore the E-commerce Context for enterprise management, the survival and development, is especially suitable for the financial management mode of enterprise electronic commerce not only has the theoretical necessity, and the realistic necessity*" (Lili, 2016).

"The concept of network finance and the implementation of the corresponding strategy is a major innovation of enterprise financial management theory. The efficiency of capital management directly determines whether the financial management of e-commerce enterprises is effective or not, and to a large extent affect the success or failure of e-commerce business. Decentralization is a major feature of the e-commerce enterprise, as the premise for the construction of e-commerce enterprise financial organization mode it is necessary to set up Financial Shared Service Center as a financial organization core connection points" (Jia, 2016). We know the traditional models of financial management: Centralized Type, Decentralizing and Type Fusion of Centralization and Decentralization. E-commerce cannot accept these traditional models anymore. New financial processes in these days created a new financial management model with huge theoretical foundation and accounting practices: Network of Financial Services (Cui, 2016).

3 Methodology and Data

The paper is based on the research that aims to identify the financial strategy of selected enterprises primarily focused on e-commerce. The identification of financial strategy is realized with a help of financial strategy model proposed in Vensim program as a result of previous research Svatošová, Svobodová, 2016; Svatošová, 2017). For fulfilling the main aim of the research, the selected methods of financial analysis and situational analysis are used (details see in Model specification) complemented with analysis of financial statements of selected enterprises. The modelling has been provided for median and arithmetic mean of selected financial analysis indicators for the year 2016 compared to the year 2011 to observe the development of financial situation of e-commerce in 5 years. Data for the year 2017 is not available yet.

Research Sample

Research Sample is consisted of enterprises primarily focused on e-commerce selected on following restrictive criteria: headquarter of enterprise in the Czech Republic, minimum existence of the enterprise for 5 years, focused on B2C market solely selling goods, legal form joint stock company (their financial statements are regularly published in Trade Register) and member of Association for Electronic Commerce (as a reliability of seriousness and trustworthiness of their business activities). Studying the environment of Czech e-commerce has shown that there is no comprehensive database of businesses that trade mainly electronically. Therefore, for the purpose of the research, the database was created on the basis of the restrictive criteria defined above. Each individual company was searched based on the following sources: *https://www.apek.cz/seznam-členu,http://wwwinfo.mfcr.cz/ares/ares_es.html.cz, https://portal.justice.cz/Justice2/Uvod/uvod.aspx*.

Based on the restrictive criteria, in summary 26 enterprises primarily focused on e-commerce (having e-shops or e-malls) were involved to the research sample. 11 enterprises have up to 50 employees, 6 enterprises have up to 250 enterprises, 1 enterprise has up to 500 employees and remaining 8 enterprises have over 500 employees. 3 enterprises belong to the 10 biggest Czech enterprises trading mostly electronically (i.e.

Alza.cz, Mall.cz, Datart). The oldest enterprise in research sample was set up in 1991 (i.e. originally enterprise selling only "offline"), the youngest enterprise was set up in 2011. Nowadays, it is almost impossible to make difference among enterprises that were originally selling solely traditionally and later were connected into e-commerce and enterprises that were selling earlier only online and later started selling also traditionally. Both groups of enterprises are involved into this research sample. Individual e-retailers are not subject of the research because it is focused on the biggest enterprises primarily oriented on e-commerce on the Czech market; furthermore individual e-retailers in most cases have not complemented data for financial analysis in financial statements (there are not published in Trade Register)and are not willing to be participated this research. The research sample is consisted of relatively homogeneous group of selected enterprises.

Model Specification

This dynamic financial strategy model derives from the basic principles of financial analysis that explores the profitability, liquidity and the cost and capital efficiency. For creating the model, the selected variables of financial analysis were used (see Table 1) – i.e. ROE (Return on Equity) and ROA (Return on Assets) as a basic variables of profitability, Total (Current) Liquidity as a complex liquidity variable, Long-term Coverage (Level of Capitalization) and WACC (Weighted Average Cost of Capital) as a complex variable for cost and capital efficiency evaluation (details see Table 1 and Svatošová, Svobodová, 2016; Svatošová, 2017). Cost of Equity is calculated based on INFA methodology (MPO ČR, 2016; MPO ČR, 2011).

Table 1 Variables in Financial Strategy Model

Return on Equity (ROE)	$ROE = \frac{EAT}{Equity}$
Return on Assets (ROA)	$ROA = \frac{EAT}{Equity}$
Total Liquidity	$Total\ Liquidity = \frac{Current\ Assets}{Short-term\ Liabilities\ and\ Credits}$
Long-term Coverage	$Level\ of\ Capitalization = \frac{Equity+Long-term\ Liabilities\ and\ Credits+Reserves}{Total\ Assets}$
WACC (Weighted Average Cost of Capital)	$WACC = R_E * \frac{E}{C} + R_D * (1-t) * \frac{D}{C}$ $R_E = R_F + R_B + R_{FS} + R_{LA}$ $R_D = \frac{cost\ of\ interest}{the\ average\ value\ of\ bank\ credits} * (1-t)$
Financial Strategy Model	$FiFFinancial\ Strategy = \frac{ROE + ROA + Total\ Liqudity + Level\ of\ Capitalization + WACC}{5}$

Legend: EAT – Earnings after Taxation, R_E – Cost of Equity, R_D – Cost of Debts, t – Tax rate, E – Equity, D – Debts, C - Total Capital, R_F – risk-free rate, R_B – business risk, R_{FS} – risk premium of financial stability, R_{LA} – risk premium of company size

Source: own work based on (Svatošová, 2017)

Afterwards, the scoring evaluation for individual variables in model was determined (see Table 2). The set points on interval 1 – 5 are determined, where 5 means the excellent result and 1 means very bad result. The selected values and set points of individual variables are inspired by Kralicek Quick test.

Table 2 Evaluation of Variables in Financial Strategy According to Points (1 – 5)

	Excellent (5)	**Very good (4)**	**Good (3)**	**Bad (2)**	**Very bad (1)**
ROE	> 0.50	> 0.30	> 0.10	> 0.00	< 0.00
ROA	> 0.15	> 0.12	> 0.08	> 0.00	< 0.00
Total liquidity	> 1.80	> 1.50	> 1.00	> 0.80	< 0.80
Long-term coverage	> 1.1	> 1	> 0.98	> 0.95	< 0.95
WACC	< 0.05	> 0.05	> 0.15	> 0.25	> 0.30

Source: own work based on (Svatošová, 2017)

Final results of the dynamic strategy model are pointed as an arithmetic average of received points of set variables (see Table 1) that determine current financial strategy. A detail description of individual strategies is given in Table 3. The concrete financial strategies are inspired by these sources (Režňáková, 2012, p. 107-108; Živělová, 2014).

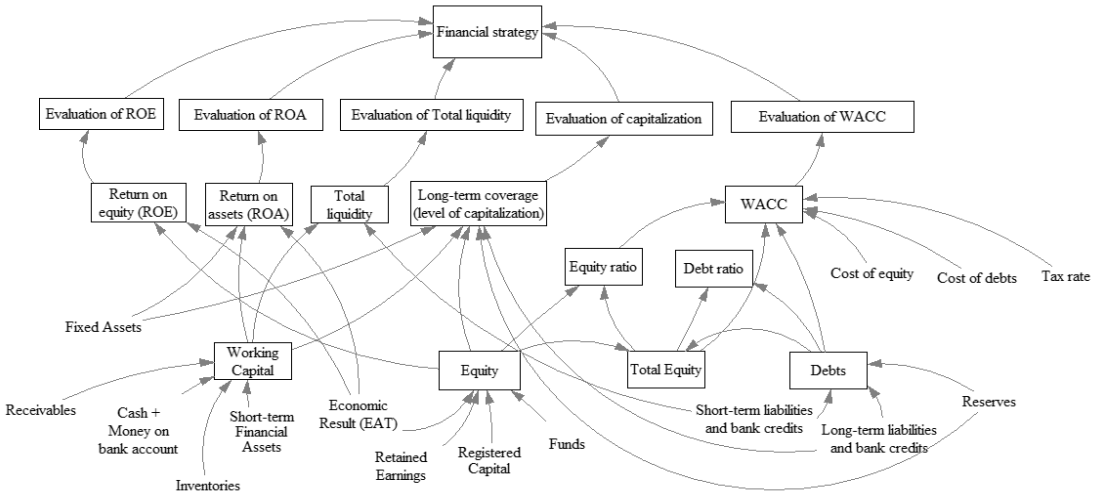
Table 3 Received Points and Final of Results to Concrete Financial Strategy

Evaluation According to Received Points	Type of Financial Strategy	Description of Financial Strategy
4 – 5	**Strategy of maximum profitability**	**Aggressive strategy:** maximizing the profitability, low or negative value of working capital, possibilities of high volume to long-term investments, potential of the company to be expanded and be progressive, the opportunity for absolute innovations
3 – 3.9	**Strategy of proportional profitability and liquidity**	**Balanced strategy:** reaching the reasonable value of working capital and acceptable profitability, the short-term investments or long-term investments with lower volumes could be realised, the expansion of company is possible, but only moderate, not progressive
2 – 2.9	**Strategy of maximum liquidity**	**Conservative strategy:** high volume of working capital, low profitability, conservative approach to the managing the long-term investments (no long-term expanding the company, focusing on operational issues of the business)
1 – 1.9	**Crisis and remediation strategy**	**Rescue strategy:** the effort to be rescued from bankruptcy, bad values of financial analysis (liquidity, profitability, indebtedness, etc., i.e. no comprehensive financial strategy is in the company realised, change of corporate and business strategy, the change of company conception, production and business, looking for new sources and opportunities for rescue and redevelopment of the company

Source: own work based on (Svatošová, 2017)

Based on the information above, the financial strategy model without dynamics in Vensim program was created (see Figure 1), in which the direct links of dependent and independent selected variables are observed that have direct impact on final results.

Figure 1 Financial Strategy Model without Dynamics



Source: own in Vensim program based on (Svatošová, 2017)

4 Results and Discussion

The financial strategy model has been then simulated for identifying the current financial strategy among 26 selected enterprises. For final evaluation, the arithmetic mean and median values among 26 enterprises have been used (see Table 4; for the year 2016 compared to the year 2011). The results are influenced by imperfections due to using arithmetic mean and mean for each variable and also by the fact that accruals and deferrals have been not calculated in this financial analysis. The median and mean values have been selected to transform the data on one value as the form of preliminary research (the other research will focus on financial strategy of individual selected enterprises in e-commerce and their comparison).

Table 4 Input Data for Creating the Financial Strategy Model in E-commerce (n = 26 enterprises primarily focused on e-commerce)

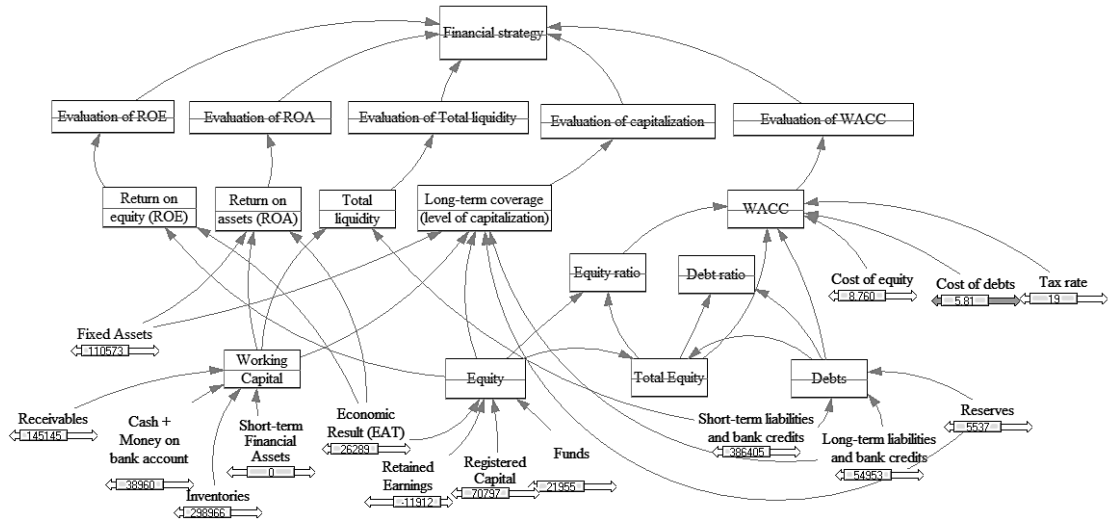
	MEDIAN VALUES		ARITHMETIC MEAN VALUES	
Issue/Year	**2011**	**2016**	**2011**	**2016**
Assets	60489	107037	339317.8	600487.4
Fixed Assets	8288	9375	78088.5	110572.8
Current Assets	50451	100299.5	248708.7	478460.1
Inventories	26004.5	51687	130544	298966.4

Receivables	13131.5	35917	79142.92	145145.4
Short-term financial assets	3560.5	9182.5	38635.85	38960.5
Equity	10584	12598.5	148111.1	102605.6
Registered capital	2000	2000	73347.69	70796.62
Funds	200	200	6484.038	21955
Retained earnings	3410	-32	52961.96	-11912.3
Economic result (EAT)	765.5	1493	15197.5	26289.23
Debts	28878	136245	183477.6	474015.3
Reserves	0	0	1070.692	5537.5
Long-term liabilities	70	259.5	18318.42	40098.35
Long-term bank credits	0	0	1070.692	14854.69
Short-term liabilities	16099	56435	138318.42	335451.4
Short-term bank credits	0	0	30988.62	50953.92
Cost of interests	33	635	1281.154	6534.115
t – tax rate	19%	19%	19%	19%
r_f – risk-free rate*	3.79%	0.58%	3.79%	0.58%
r_B – business risk*	2.68%	2.63%	2.68%	2.63%
r_{fs} – risk premium of financial stability*	3.65%	6.10%	0.03%	0.20%
r_{LA} – risk premium of company size*	5%	5.35%	5.35%	5.35%
r_E – cost of equity	15.12%	14.66%	11.85%	8.76%
r_D – cost of debts	0%	0%	2.10%	5.81%
ROE	**0.120069 (3)**	**0.407812 (4)**	**0.10692 (3)**	**0.245399 (3)**
ROA	**0.0150144 (2)**	**0.0140635 (2)**	**0.0465594 (2)**	**0.0442845 (2)**
Total liquidity	**2.25187 (5)**	**1.45644 (3)**	**1.51425 (4)**	**1.25017 (3)**
Long-term coverage	**0.127911 (1)**	**0.0405938 (1)**	**0.513102 (1)**	**0.282356 (1)**
WACC	**0.0378297 (5)**	**0.00758445 (5)**	**0.0623218 (4)**	**0.0548998 (4)**
Financial strategy	**3.2**	**3**	**2.8**	**2.6**
Type of the financial strategy in current year	**Strategy of proportional profitability and liquidity**	**Strategy of proportional profitability and liquidity**	**Strategy of maximum liquidity**	**Strategy of maximum liquidity**

**calculated according to INFA methodology (details see MPO ČR, 2016; MPO ČR, 2011), changes in cost of equity and cost of debts have been adopted according to INFA methodology in 2011 and 2016*

Source: own work with help of Vensim program (Note: the amounts are given in thousands CZK)

Figure 2 Financial Strategy Modelling for E-commerce (example, year 2016, arithmetic mean values)



Source: own processing in Vensim program

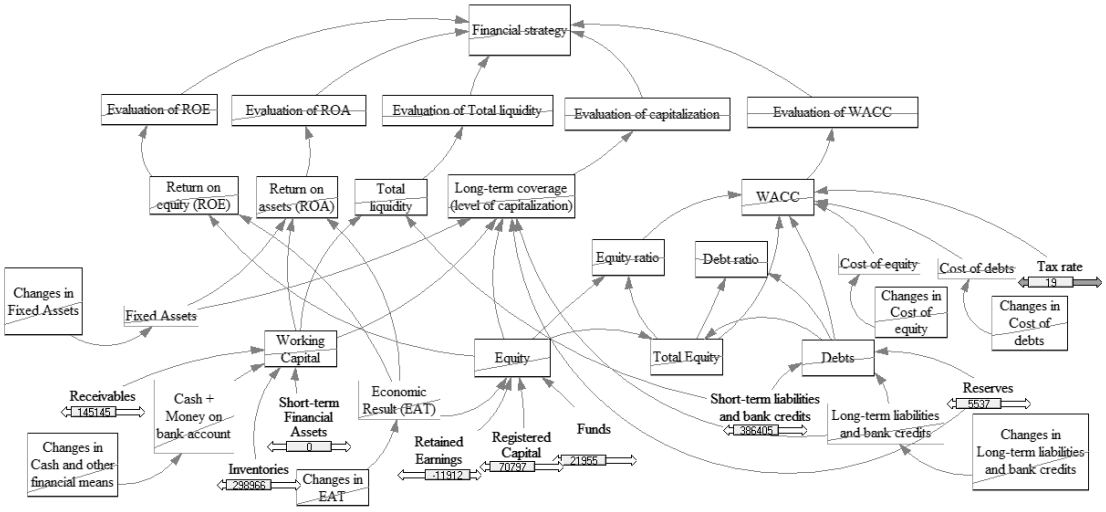
We have to highlight there are differences and gaps in financial indicators among observed enterprises, especially in the volume of assets, portion of equity and debts or final economic results. These differences may be also caused by the size and origin of enterprise (also due to making difference among enterprises trading traditionally and electronically and vice versa). Despite these facts we can define financial strategy for the observed group of enterprises. Based on the financial strategy model simulating in Vensim program, the selected enterprises focused primarily on e-commerce apply in most cases a **conservative financial strategy** (i.e. strategy of maximum liquidity; final value of the model is 2.6 for arithmetic mean values in the year 2016, details as an example simulating see in Figure 2). The same financial strategy is used in the year 2011 when applying arithmetic mean

variables. When the median variables is set into this model, the financial strategy for both observed years is balanced financial strategy (i.e. strategy if proportional profitability and liquidity). We can conclude enterprises focused primarily on e-commerce focus on higher liquidity when having lower profitability (in both cases when involving arithmetic mean and median variables). The main reason of using the conservative financial strategy in e-commerce is **missing strategic thinking on investment and long-term development of the business** (this statement has been proven in previous research, i.e. Svatošová, 2018, the similar results are observed in e-commerce). The other economic indicators confirmed these results. Based on **financial analysis in 2016 compared to 2011**, the economic results (EAT) reached lower values also due to the fact many enterprises in research sample reached economic loses. The higher liquidity is caused by higher values of short-term receivables and inventories. On average the current ratio of observed enterprises is 2.29 (the recommended value 1.5 – 2.5), quick ratio 1.45 (the recommended value 1 – 1.5) and cash ratio is 0.77 (the recommended value is 0.3 – 0.5). The similar values of liquidity were reached in 2011 too. On average, receivable turnover period is 334 days in 2016 and 62 days in 2011, inventory turnover period is 55 days in 2016 and 51 days in 2011 and suspension of payments period is 110 days in 2016 and 95 days in 2011. Money turnover cycle is 277 days. On average in 2016, ROA is 8.62 % and ROE is 25.6 %, in 2011 ROA is 4.45 % and ROE 10.26 %. Equity ratio is 32 % and debt ratio 68 % in both observed years. Short-term indebtedness is 56 % in 2016 and 49 % in 2011. Long-term indebtedness is 9.61 % in 2016 and 16 % in 2011. On average in 2016, the level of capitalization is 0.27 (the recommended value is around 1), in 2011 this value was on average 0.48.

Recommendation

Especially, during the area of massive e-commerce development due to rapid economic upturn, it is recommended to be focused on higher profitability that could be used in other investment activities in e-commerce, i.e. expansion or innovation along with technological progress. Therefore, figure 3 proposes the Dynamic Financial Strategy Model for e-commerce for the next 5 years (the starting point year 2016 on example of arithmetic mean values). This model demonstrates changes in fixed assets (growth by 50 million CZK each year), growth in financial means (by 50 million CZK each year), growth in economic result (by 50 million CZK each year) and growth in long-term indebtedness (by 50 million CZK each year), growth in cost of equity (by 1 % each year) and growth in cost of debts (by 1% each year). The simulation of these changes has caused a change of conservative financial strategy into **aggressive financial strategy focusing on improving profitability** (in model with final value 4 in 5 years).

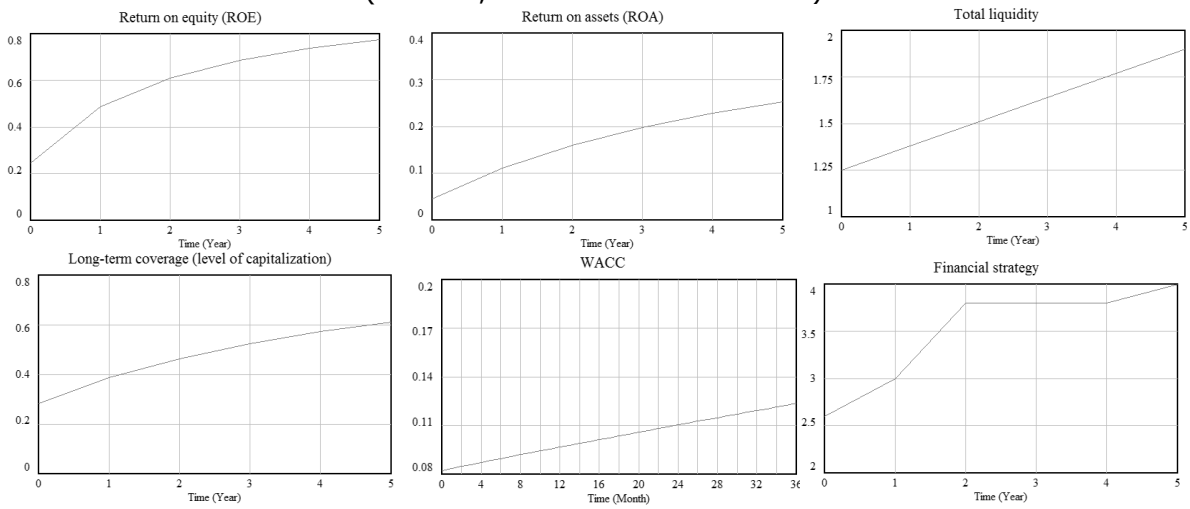
Figure 3 Dynamic Financial Strategy Model for E-commerce
(year 2016, arithmetic mean values)



Source: own processing in Vensim program, prerequisite for next 5 years

Figure 4 illustrates changes in the proposed Dynamic Financial Strategy Model for e-commerce during the next 5 years, i.e. variables of ROE, ROA, current ratio (total liquidity), level of capitalization and WACC. The final average evaluations of model have been changed from 2.6 into 4 that reflect an aggressive financial strategy. These changes suppose the economic growth and e-commerce expansion for the next 5 years with prerequisite of investment into online business (generating growth in assets and long-term indebtedness while respecting acceptable value cost on total capital in the form of WACC). The suggestions should lead into economic development in e-commerce and improving long-term competitiveness of observed enterprises.

Figure 4 Changes and Its Impact on Variables in Dynamic Financial Strategy Model (in 2016, arithmetic mean values)



Source: own processing in Vensim program, prerequisite for next 5 years

5 Conclusions

The theoretical framework and results of the research has confirmed only few researches are dedicated to the issue of financial strategy and financial management in e-commerce. With the development of e-commerce, new approaches in business have to be applied including the financial management. This paper focused on identification of financial strategy of enterprises primarily focused on e-commerce. The observed research sample of enterprises primarily focused on e-commerce apply conservative financial strategy (i.e. strategy of maximum liquidity) caused be lower level of profitability. The identified financial strategy in e-commerce is based on higher receivable turnover period and inventories turnover period. Especially, during the period of rapid economic growth and massive e-commerce development, it was recommended to change the financial strategy into aggressive strategy focusing on improving profitability that could support the long-term competitive development of business in e-commerce. Dynamic Financial Strategy Model in Vensim program simulated the changes of observed variables within 5 years. The paper was focused on small group of enterprises primarily focused on e-commerce; nevertheless, it could provide a baseline for the strategic approach in managing finance in Czech e-commerce. The further research activities will focus on greater research sample of enterprises primarily oriented on e-commerce based on comparison of individual groups of e-retailers and other enterprises trading mostly electronically.

Acknowledgments

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Qualitative Indicators (Soft-facts) in Internal Rating Systems

Martin Svítil

Soukromá vysoká škola ekonomická Znojmo
Loucká 656/21, 66902 Znojmo
E-mail: svitil.martin@svse.cz

Abstract: *The article builds on last year's work, which compared internal rating systems of three banks from the German-speaking region. This year's paper deals in detail with the analysis of qualitative indicators (soft - facts), which is one of the two main components of rating systems of banking clients. The qualitative indicators (soft - facts) have different wage in the considered rating systems, although in all of them the wage is lower than 50% and / or the ability of soft-facts to change the overall rating score is limited. On the other hand, in all cases the importance of qualitative factors is significant enough to pay attention to them. The research is focused on the rating of business entities, more precisely the corporate, (especially limited liability companies or joint-stock companies). It does not deal with the rating of natural persons or non-profit organizations, municipalities etc. The procedure of collecting empirical data as well as data from relevant literature, their assessment according to the criteria of verifiability and relevance and the application of the induction method was used and a generalization of conclusions was subsequently made. The result of the research shows that two categories of qualitative indicators (soft - facts) are present in all considered rating systems: (i) quality of company's management and / or strategy and (ii) market, where the evaluated company is present. Another regularly present qualitative indicator is (iii) accounting or related indicators like information system or audit quality. On the other hand, the use of the factor (iv) relationship with the bank (or similar) is quite different across the surveyed rating systems. The roles of members of staff in making of the rating are also mentioned.*

Keywords: Rating, Risk Management, Soft-Facts, Qualitative factors

JEL code: G24

1 Introduction

My last year's works (Svítil, 2017a, Svítil, 2017b) have dealt with the comparison of three internal rating systems, compatible with IRB Approach for Basel II.The result of the research showed, that the structures of compared bank's internal rating systems are very similar, based mainly on integration of "hard-facts" rating based on quantitative indicators and "soft-facts" rating based on qualitative indicators.

To continue my research, I decided to focus on the qualitative factors (soft - facts), which seems to be much less detailed in the recent literature (see below). In just a few of works, I have managed to find comparable data like those I have worked with, and in all cases to a single rating system only. If it was worthwhile, I added these data to my comparison (Belás,Cipovová (2011), Kavan (2017) and Radojevic, Suknovic (2008), for details see below). My own sources are three internal rating systems used currently and / or in the recent past by three banks or banking groups originating from the German-speaking economic environment and regions. All the mentioned banks use their rating tools for estimate the credit risk of their clients, expressed in the PD (probability of Default).

My goal was to find out how much the structure of used qualitative factors (soft- facts) is similar or even the same across the particular rating systems and what weights of individual factors are used for calculations.

Belás and Cipovová (2011) analyze the requirements for rating models of banks in relation to financial performance and compare them to selected credit scoring and bankruptcy models. In their work, there is just one real model (used by existing bank) mentioned. The conclusion of the research showed, that "Bankruptcy and credit scoring models produce results that aren't quality sufficient for credit decisions. The final decision about proposal to qualified loans should be based on expert estimates of credit analyst, which should

assess whether the company is able to withstand the temperature rise or it's threatened by insolvency on the basis of detailed financial analysis." (Belás, Cipovová (2011), p.119). This conclusion confirms that it is meaningful and important to examine the qualitative elements of the rating systems, which is the essence of this article.

Grunert, Nordenand and Weber (2005) in their work came from a similar environment as the data in my text: they surveyed data from four major German banks. Their conclusion is unambiguous: the combined use of financial and non-financial factors leads to a significantly more accurate default prediction than the single use of financial or non-financial factors. But they have been limited by the availability of data.

The importance of qualitative factors for rating is also mentioned by other authors, like Guserl (2014), or Morrow (1998), or Crouhy, Galai, Mark (2001): "The rating process includes quantitative, qualitative and legal analyses. (...) The qualitative analysis is concerned with the quality of management, and includes a thorough review of the firm's competitiveness within its industry as well as the expected growth of the industry and its vulnerability to technological changes, regulatory changes and labor relations." (Crouhy, Galai, Mark (2001), p. 51).

The research conducted by Fracassi, Petry and Tate (2016) examined the influence of the analyst's subjective judgment on the outcome of the rating, and although the article deals more with credit rating agencies (CRA) than banks, its outcome is worth mentioning: "We find that significant variation in credit ratings can be explained by differences in the dispositional optimism of the analysts covering the firm. (...) Our results suggest that some firms can face more frictions in raising capital simply because they are covered by less able credit analysts. Perhaps of more significance, our results suggest that long-term relationships between firms and the analysts who rate their debt issues can lead to inflated ratings and costs of capital that are too low." (Fracassi, Petry, Tate (2016), p. 535). My article briefly focuses on attempts to minimize possible negative impacts of subjective assessment by one person in Part 3.3.

2 Data and methodology

For comparison, documentation for three rating systems used by three different banks (banking groups) from the German-speaking environment was available. Since some of these documents are confidential and have not been granted full disclosure, the results of the investigations are limited in some respects. It is also not possible to publish the names of the mentioned banks (banking groups). The data are anonymized accordingly, however, in order not to affect their value for the research. These three banking institutions and their rating systems are **listed under A, B and C**.

Data from available literature were also used for comparison: Belás, Cipovová (2011), Kavan (2017) and Radojevic, Suknovic (2008). The first mentioned source concerns a real (anonymous) bank acting in Central Europe, the second one is a leasing company owned by an Austrian bank. The last mentioned source is just a proposal (not yet used in practice), but in my view it is interesting enough to be included in the comparison. These three rating systems are **listed under D, E and F**, where F is the unused proposal.

The research is focused on the rating of business entities, more precisely corporate, (especially limited liability companies or joint-stock companies). It does not deal with rating of natural persons or non-profit organizations, municipalities etc. Excluded are also the banks, insurance companies, leasing companies etc. For all these entities the examined banks (A, B, C) have special different modules in their rating systems.

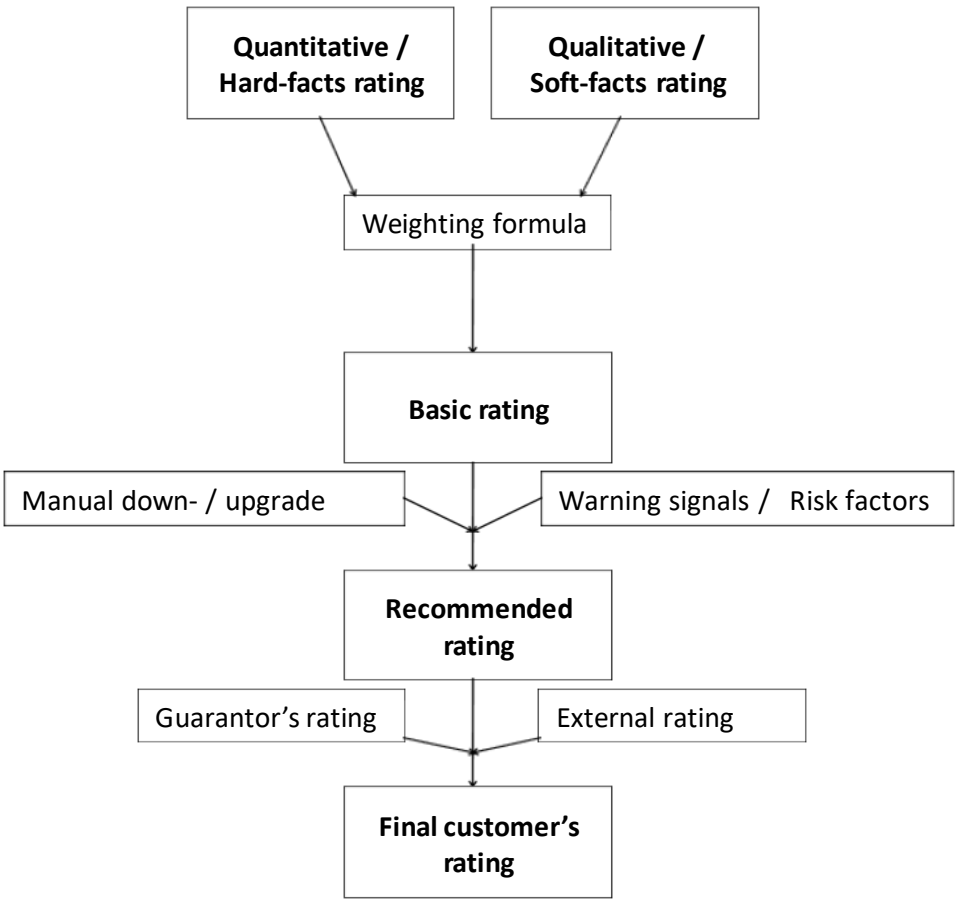
The procedure of collecting empirical data, their assessment according to the criteria of verifiability and relevance and the application of the induction method was used and a generalization of conclusions was subsequently made.

3 Results and Discussion

The weight of the qualitative factors (soft- facts) in the rating systems

For better understanding of the rating system as a whole, it is needed to shortly describe its basic structure. This structure (as shown in the Figure 1) is quite similar for all of the mentioned rating systems (except rating system E in some respects), just the names used for particular steps are different. At the same time we pay attention to the weight of the qualitative criteria (soft - fact) on the rating result.

Figure 1 The Basic Structure of the Rating Systems



Source: Author by using banks "A", "B" and "C" rating manuals

All three compared rating tools first produce the part of the rating, based on clients' financial statements (financial data). After possible other inputs like sector data, budgets etc., the financial statement rating becomes **quantitative or hard-facts (HF) rating**, as one of the two main sources for the final result. The second source is the **qualitative** or **soft-facts (SF) rating**, based on qualitative criteria (see below).

In the next stage, the hard-facts rating and the soft-facts rating are integrated together, according to a given **weighting formula**. This formula gives the weight (meaning) of quantitative and qualitative factors on the rating result. In all the compared rating tools, the quantitative factors (hard-facts) are more important (they enter the calculation with higher weight). Please do not confuse this high-level formula (HF to SF) with the importance of individual qualitative factors for the soft - facts rating, as discussed below.

At **bank A**, the hard - facts and soft - facts ratings are weighted at fixed ratio of 2:1. In addition, soft - facts cannot improve the financial statement rating by more than two grades (there are 8 grades total), whereas downgrading is unlimited.

At **bank B** the weight is fixed too, at ratio 60% (HF) to 40% (SF). In the contrary of the bank A system, the up- or downgrading by soft-facts is not limited in any way.

The **bank's C** rating system uses more advanced approach, where the weight is dependent on operating performance (revenues), as the Table 1 shows:

Table 1 Bank C Weight of Quantitative (hard - facts) and Qualitative (soft - facts) Indicators

Revenues as in Income statement	Weight	
	Hard Facts	**Soft Facts**
< EUR 1,1 Mio.	50 %	50 %
EUR 1,1 – 7,3 Mio.	60 %	40 %
EUR 7,3 – 21,8 Mio.	62 %	38 %
EUR 21,8 – 75 Mio.	65 %	35 %
>EUR 75 Mio.	67 %	33 %

Source: Bank "C" rating manual

As the operating performance increases, the weighting of the qualitative factors (soft-facts) for the final rating result decreases. On the one hand, because the quality of the balance sheets usually increases with the size of the company and, on the other hand, because the creditworthiness of small businesses is often very much related to the person of the entrepreneur. Smaller companies are more endangered by one person's mistakes or loss (like death of the owner / CEO in one person), their processes (like accounting) are usually less intensively checked by internal and external audits etc.

It is also worth mentioning that for small companies with revenues of up to EUR 1,1 million, the Bank C system is the only one from all compared systems, that gives the same weight to both quantitative and qualitative factors.

The **bank D** (as mentioned in Belás, Cipovová, 2011) used the weight 43,5% for soft facts, later changed to 30%. As (Belás, Cipovová, 2011, p. 111) say: "(...) our cooperating bank has changed the ratio of qualitative and quantitative criteria in rating model used by RFB from the original ratio of 43,5: 56,5% to 30:70%, as the impact of the current crisis. There are frequent cases, where the client with good performance is granted with higher risk level just because of changes in aggregate indicators of the industry, in which the company operates. This phenomenon is quite common issue in World's banking practice. The clear disadvantage of this approach is sweeping behavior towards the clients and pro-cyclical approach of credit risk management (low rate of individualization of loan products)."

The **rating system E** mentioned by Kavan (2017) uses a different approach: the qualitative factors themselves do not create a soft - facts rating, they only can change (up- or downgrade) the hard - facts component of the rating. The system uses six groups of qualitative factors (see below for details), every group can change the final rating at most by 0,5 degrees up or down, the total possible upgrade by soft - facts is limited to 1 degree, total downgrade is not limited (the final rating has the range 1 to 5 degrees). Note: Originally, the ownership structure and management criteria are formally grouped into one category, but for better comparability with other systems, I've divided them into two categories. Off course, I have retained the weights and therefore the influence to the final rating.

Radojevic and Suknovic (2008) use in their paper a rating model (my designation **rating system F**) with fixed weights 60% (HF) to 40% (SF), with no limits for up- or downgrade.

Using the weights (as mentioned above), the hard-facts rating and the soft-facts rating result together in a **basic or automated rating**. Such credit rating is then manually reviewed for possible manual down- or (in some cases) upgrading.

Next to the possible manual downgrade, all the banks use a fixed list of warning signals or risk factors. If one or more of them appear at the client, the rating must be downgraded in an appropriate manner.

After the down- or upgrade or after non-use of this possibility (which is the most common case), the basic rating becomes the **client's rating** or **recommended rating**, which can

be (or even must be under some circumstances) modified by other guarantor's rating or external rating, if existing. The banks use exact and similar-to-each-other rules, at what circumstances the rating of the guarantor or the external rating (usually made from one of the big rating agencies like Moody's or S&P) must be used.

When the last step (guarantor's rating or external rating) is made or skipped, the rating becomes **overruled rating** or **final customer's rating**.

Qualitative indicators (soft - facts)

Each of the monitored banks or financial institutions uses their own range of indicators. Whilst there are some generally accepted methods that can be used as a starting point for assessing quantitative indicators (hard - facts, like e.g. bankruptcy models), for soft-facts there are not. That's why I find it interesting to compare what indicators the individual banks have chosen and how their methods of calculating soft-facts differs.

Technically, in all cases, the process contains a filling in a prepared form (questionnaire) in the rating software, either in the form of a direct selection on a given scale for individual factors, or by answering questions from which the system itself calculates the result.

In all the banks, the qualitative indicators are grouped into several **aggregated categories** (topics). In some cases, these aggregated high - level categories are further broken down into more detailed questions, otherwise they are not (for details see below).

The following Tables 2 and 3 show the categories (topics), as used by particular banks. Banks A, B and C were the primary objectives of my research, data on D, E and F rating systems from other sources (see above) serves to compare.

Figure 2 Qualitative Indicators (soft - facts) Part 1. Please note that the numbers of weights can be rounded.

Rating A		Rating B		Rating C	
Management	15%	Strategy	17%	Management	30%
Internal organisation (Accounting, Technology)	15%	-		Accounting	20%
				Qualifications of employees / Technology	10%
Market / Industry	15%	Influence / Market position	27%	Market incl. supplier and customer structure	30%
Relationship with the bank	40%	-		Relationship with bank	10%
Miscellaneous (Age of the company, Location...)	15%	Economic situation (general, influence on the company)	27%		
		Divergence from planning in last 3 yrs.	15%		
		Business expectations incl. bank's view	15%		

Source: Author by using banks "A", "B" and "C" rating manuals

In rating system of the **bank A**, the criteria are structured along the following categories:

- Management: Successor, Qualification of Management, Personal sphere of management
- Internal Organisation of Company: Accounting, Organisational structure, Technological standard, External information policy
- Market / Industry: Dependency on suppliers, Dependency on customers, Sensitivity to economic cycles, Rank in industry, Position within the regional context, Product development / Range of products, Other dependencies
- Relationship with the bank
- Miscellaneous: Age of company, Credit standing of entrepreneur / shareholders, External credit rating / credit reports, Location / region

For every category, the list of detailed questions is prepared for the analyst.

The **bank B** do not use further structuring of the categories, but similarly to bank A, there are the questions (one or two for every category), which should help the analyst to assess the company properly. For example, the question in the category Market influence is: Is the company able to co-determine / decisively influence the market development due to its position in its main markets?

The **bank C** also uses predefined sets of questions, with between five and ten questions on each topic. In this case, the analyst answers the questions directly to the software. The system than evaluates the answers himself and at the end it shows the result of the individual categories as well as the whole soft-rating rating.

Figure 3 Qualitative Indicators (soft - facts) Part 2. Please note that the numbers of weights can be rounded.

Rating D		Rating E		Rating F	
Management + Business Strategy / Planning	23,0%	Management	12,5%	Management	24,0%
Audit quality	18,5%	Accounting	25,0%	Accounting, Planning and Information systems	38,0%
		Qualifications of employees / Technology	12,5%	Equipment + Systems	17,0%
Market Position / Share + Industry Risk	31,0%	Market and Competition	25,0%	Market and market position	21,0%
-		-		-	
Ownership structure	27,5%	Ownership structure	12,5%		
		Economic situation + Divergence from planning	12,5%		

Source: Author by using dates from "D": Belás, Cipovová (2011), "E": Kavan (2017) and "F": Radojevic, Suknovic (2008)

If we compare all the mentioned rating systems and their main soft-facts indicators (topics), we can identify some similarities: all systems take (i) **Management** (or the

closely related topic **Strategy** in case of bank B) and (ii) **Market position** of the company as important criterions, although with different weights (from 12,5% to 30% for Management and from 15% to 31% for Market).

As the next most common criterion, three systems use (iii) **Accounting**, although in bank F together with Planning and Information system (with the high weight of 38%). The bank A uses a more general category Internal organisation, where the Accounting is included. The rating system D includes the category Audit quality. Unfortunately, the data source (Belás, Cipovová (2011)) does not specify the extent to which this category deals with accounting, however, due to the structure of the other categories, this can be assumed with a high probability.

Among other soft - facts indicators, there are already substantially more variations, similar to the weights that each category has on the overall rating result. An interesting difference to mention is surely the category **Relationship with the bank**, which includes the period as well as the quality of the collaboration between the bank and the customer (thus the rated company). The rating system A take this indicator as the most important one with the weight of 40% (rounded), the system C makes do with 10% weight and all the others do not use this indicator at all (they use only problems in the relationship / previous collaboration with the customer as a warning signal, if existing). Even the later approach can make a good sense, considering the result of the rating process as a universal transferable number. The possibility to transfer the rating result can, but does not need to be relevant for the bank.

Another noteworthy difference between the rating systems is the use of the unique indicators in the rating system B, concerning the divergence from company's planning in last three years and the company's business expectations including the bank's own view and opinion to these expectations.

The roles of members of staff in making of the rating

In the context of soft - rating creation, it is worthwhile to briefly mention the collection and processing of the data in terms of competencies. These details are usually not mentioned directly in the manuals of the particular rating systems, their settings are rather governed by internal regulations of particular banks, or even just by habit.

Typically, two or three people participate in the process of making of the soft - facts rating (four- or six-eyes principle). The first one is a (i) **representative of the bank** (sometimes called account manager, relationship manager or similarly) who is in direct contact with the client. He / she acquires from the client both the data for the creation of hard - facts rating, as well as he / she also gets an image about the functioning of the client's business during the negotiations. The information from the representative is therefore very valuable, on the other hand the representative is materially involved in the deal and thus wishes the client's rating to be as good as possible. There is a possible risk of conflicts of interest existing.

Therefore, in most cases, the credit rating itself is the task of a second person, (ii) the **analyst of the Risk management department**. The analyst gets the information from the representative, makes his own research (on web, in publicly accessible databases, in news...) and then fills in the appropriate form (questionnaire) in the rating system. In some cases this role is entrusted to the (i) representative of the bank and the four-eyes principle is respected by the (iii) manager.

Finally, there is always (iii) a **person with the authorization power (manager)** who approves the final rating result. Mostly, this person is the chief of Risk management. Banks thus try to minimize potential conflicts of interest and also they prefer to make an "average" from the subjective views of more persons (members of staff) in making of the rating. The very fact of using soft - facts itself logically involves a subjective view, which the creators of the rating systems count on. But the inclusion of more people's views and multiple sources of information is definitely desirable.

4 Conclusions

The result of the research shows that in all the compared rating tools, the qualitative factors (soft-facts) are have lower weight (are less important) than the quantitative (hard - facts), but with the weight from 33% to 50% they surely are not negligible.

Two categories of qualitative indicators (soft - facts) are present in all considered rating systems: (i) quality of company's management and / or strategy and (ii) market, where the evaluated company operates. Another regularly present qualitative indicator is (iii) accounting or related indicators like information system or audit quality. On the other hand, the use of the factor (iv) relationship with the bank (or similar) is quite different across the surveyed rating systems.

The possible risk of conflicts of interest in data collection and making of the rating are solved by four - eyes principle (two persons involved in make of the rating) or mostly even three persons involved.

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Interest Rate Risk in the Banking Book (IRRBB) – Comparing Variance/Covariance with Historical Simulation and Several Copula Functions with Focus on the Actual EBA Guidelines

Martin Svoboda[1], Svend Reuse[2], Annika Rüder[3], Noel Boka[4]

[1] Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 60200 Brno, Czech Republic
E-mail: Martin.Svoboda@econ.muni.cz

[2] FOM Hochschule für Oekonomie und Management
isf Institute for Strategic Finance
Luxemburger Allee 121, 45481 Mülheim an der Ruhr, Germany
E-mail: svend.reuse@fom.de

[3] FOM Hochschule für Oekonomie und Management
Finance Department
Friedenstraße 39, 22089 Hamburg, Germany
E-mail: Annika.Rueder@web.de

[4] FOM Hochschule für Oekonomie und Management
Finance Department
Gutenbergstraße 47, 45473 Mülheim an der Ruhr, Germany
E-mail: noel.boka@gmx.de

Abstract: *Interest rate risk and its measurement are important for banks worldwide. Strategic maturity transformation positions in combination with the historical low level of yields leads to the question, whether the standard risk measurement models as variance/covariance or historical simulation lead do adequate results. This article answers this question and offers an empirical analysis in which several alternative Copula functions are used to quantify interest rate risk. The results are compared to the EBA guidelines on IRRBB. The aim is to show if the six interest rate risk scenarios that are defined by the EBA are an adequate measurement method.*

Keywords: Value at Risk, Copula, EBA, IRRBB

JEL codes: G21, G24, G32

1 Introduction

Interest rate risk is one of the main risks in the banking sector (see Reuse 2012a for definitions). This is strengthened by the actual low levels of yields in Europe, especially in Germany. In addition, German banks are nearly the only ones that offer long maturities to their customers and follow a long-term oriented maturity transformation strategy (discussed in detail in Reuse and Svoboda, 2014a, pp. 37; Reuse and Svoboda 2014b, pp. 377).

While the efficiency of several interest rate risk benchmarks were analyzed in several articles (see Frère, Svoboda and Reuse 2008; Reuse 2012b; Reuse and Svoboda 2014b), the methods of risk quantification in IRRBB have not been analyzed or changed since the last 15 years. This article focusses on the German market. Two academic research aspects should be analyzed/answered:

a) *Which VaR approach fits best to quantify IRRBB?*
   This paper compares the existing quantification methods as historical simulation and variance/covariance approach with several Copula functions in order to show, which approach fits best to quantify IRRBB.
b) *Are the six EBA interest risk scenarios an adequate measurement approach?*
   In addition, the newest consultation paper of the EBA with its six interest risk scenarios is analyzed and compared to the Copula results.

Therefore, this article is structured as follows. Section 2 describes the relevant measurement methods of interest rate risk measurement and derives the six scenarios of the EBA Paper. Section 3 offers data and methodology of the empirical analysis. In section 4, the results are presented. The article ends with a final conclusion and an outlook.

2 Measurement Methods of IRRBB

Existing methods in Theory

Measuring interest rate risk in the banking book can split up in economic value (EV) and earnings measures. Therefore, earnings measures expect the future profitability based on different yield curve scenarios (Steinwachs 2012, pp. 93 f.). Economic value measures display changes in the net present value. Hence, the changes of the net present value are defined as a continuous or a discrete distribution (Rolfes 2008, pp. 92) with typical two outcomes (Value at Risk and Expected Shortfall) (Daníelsson 2012).

While historical simulation, variance/covariance and sometimes the Monte-Carlo Simulation are very common for IRRBB, Copula models get common in the recent past. Relating to these quantitative risk measures a regular cycle of the yield curve lead to adequate results (Sievi et al. 2011, pp. 333 f.). Although the length of the data base provides a slow adaption of the risk forecast. Even if there is a shorter and smaller data base a low volatility causes a systematic underestimation of risk (Duckheim 2014, pp. 63). Table 1 sums up the main aspects of these four methods of risk quantification.

Table 1 Comparison of Different Interest Rate Risk Measures

	Historical simulation	Variance/ covariance	Monte-Carlo	Copula
distribution assumption	empirical	normal	no restrictions	no restrictions
non-linear Cashflows	fully considered	approximately	fully considered	fully considered
data requirements	regarding an adequate historical data set no special requirements	Variance/covariance - matrix	parameters of the distribution	parameters of the marginal distribution and the dependence structure
effort	low/medium	for linear CFs low	high	high
goodness of fit	depending on stationarity property and the length of the empirical data	depending on the normal distribution of the empirical data	depending on several adjustments good goodness of fit	depending on several adjustments good goodness of fit
extrem events	depending on the empirical data	low fitting on extreme events	depending on the selected distribution good fit on extreme events	depending on the selected distribution good fit on extreme events
advantages	- easy to implement - well comprehensible - no assumption about correlations or distributions	- quick risk measure - easy to implement	- besides empirical also other possible interest rate changes - freedom of distribution assumption - consideration of fat tails e.g. - best fit for non-linear cashflows	- besides empirical also other possible interest rate changes - no distribution required distribution assumption - consideration of fat tails, asymmetric distributions e.g. - additional mapping of the dependence structure - especially for non-linear dependence structures - best fit for non-linear cashflows - consideration of remaining term effects, volatility clusters

	Historical simulation	Variance/ covariance	Monte-Carlo	Copula
disadvantages	- possible negative effects of autocorrelation - ex post and ex ante stationarity of the data set - no consideration of implied volatility - possibility of non-adequacy consideration of leptokurtic flanks or fat tails - especially for simple/linear portfolios	- assumption of normal distribution - linear assumption for risk factors and the portfolio (approximatively for non-linear portfolios with a Taylor series) - systematic underestimation of fat tails or high kurtosis ex post and ex ante stationarity of the data set	- mathematical sophisticated - model risk	- mathematical sophisticated - model risk

Source: Reuse 2006, pp. 366; Steinwachs 2012, pp. 118; Rolfes 2008, pp. 104; Steiner et al. 2002, pp. 69; Jorion 2007, pp. 270; Drosdzol 2004, pp. 107; Eddari 2007, pp. 28; Hlawatsch and Reiching 2010, pp. 5

Starting with the historical simulation, ex post observed changes of interest rates were extrapolated to the current yield curve. These yield curve changes could computed as absolute, relative and logarithmic changes (Wiedemann 2013, pp. 92). It has to be mentioned that the ex post changes repeat itself whereby stationarity is a necessary assumption of yield curve changes (Schierenbeck et al. 2008, pp. 96 f.). Self-Repeating yield curve changes predict varying economic values over time. The computed empirical distribution of EV achieves a VaR quantile (Choudhry 2014, pp. 487). At least the freedom of model assumptions is a great advantage of the historical simulation (Drosdzol 2004, pp. 107).

The normal distribution is a key element of the variance/covariance approach (Steinwachs 2012, pp. 118). If the risk factors follow the normal distribution, the linear changes of the portfolio follow the normal distribution as well. The standard deviation as a measure of risk leads to the change of the net present value of the economic value of the non-trading-book portfolio (Eddari 2007, pp. 10).

The Monte Carlo method expands the historical simulation by randomized numbers to achieve hypothetical variations of interest rate risk changes in the risk forecast. Especially ex post not observable interest rate changes that could take place in the future could improve the risk forecast (Eddari 2007, pp. 28). Hence, an increasing yield curve is not observable in the past, these uncertainty of economic value changes get enhanced. Creating new yield curve scenarios by the Monte Carlo method assumes a model for the evolution. The evolution of interest rate is typical driven by Wiener processes. The correlation of the random sampling is generated by Cholesky-decomposition (Wiedemann 2013, pp. 67). Driven by historical and hypothetical yield curve scenarios the economic values of the non-trading-book portfolio are simulated. The computed distribution procedure of economic value changes is identical to the above mentioned historical simulation.

The Copula approach removes the restriction that dependence structure and marginal distributions must originate from the same distribution family. The dependence structure can be modeled independently of the marginal distributions (Hlawatsch and Reiching 2010, pp. 5). Furthermore, it is possible to model the marginal distribution in different ways. (Hahn 2012 pp. 181).

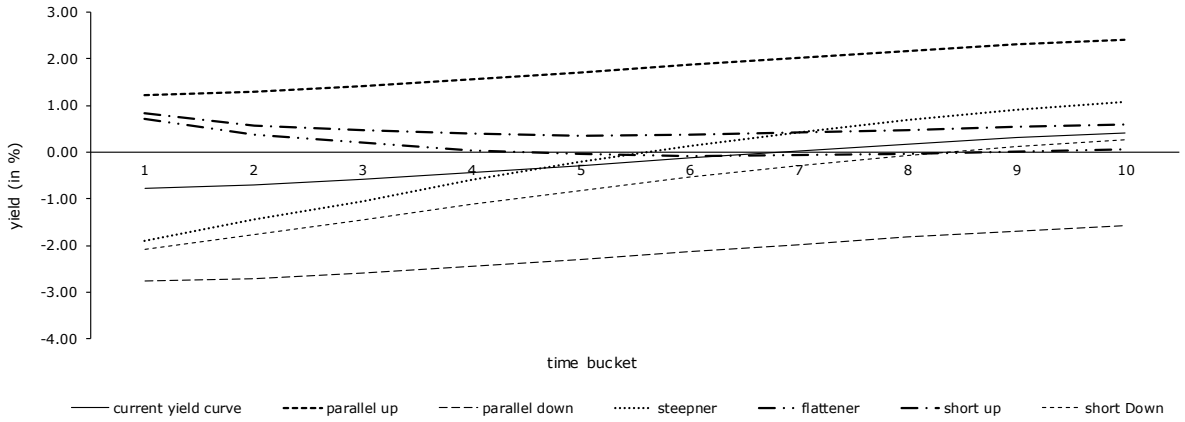
Interest Rate Risk Scenarios

Even though the six EBA scenarios cannot be defined as professional risk measurement methods, they may lead to additional capital buffers in the EU (see Reuse 2018, pp. 148-153). As a consequence, they have to be analyzed and compared to the above-mentioned methods.

In Annex III (EBA 2017, pp. 51), the EBA provides data to generate these six interest rate risk scenarios. Referring to the Basel II interest rate shocks (plus and minus 200 basis points on current the yield curve) the EBA Guideline extends these two yield curve scenarios up to six scenarios. The IRRBB scenarios for measuring the Economic Value of Equity measures (EVE) are a parallel shock up and down, a steepener shock, which means that the short rates decrease while the long rate increases, a flattener shock (short rate increases and long rate decreases) and a short rate shock up and down. The parameters of the scenarios are specified by the EBA for the main currencies. Data basis for estimating these parameters are time series of the "riskfree" interest rate of sixteen years (2000 – 2015). In detail the EBA defines the following shock parameters: short rate 250 basis points, long rates 150 basis points and parallel shift 200 basis points whereby these shock parameters get relevant for 19 defined maturity bands.

The EBA does not specifies the valuation curve, so using a bank-specific risk-free calculation curve is possible. Furthermore, the guideline does not provide a floor for low interest rate environments. Hence, negative interest rates are possible. Figure 3 visualizes these 6 scenarios.

Figure 1 Yield Curves of the EBA Interest Rate Risk Scenarios



	1 yr.	2 yr.	3 yr.	4 yr.	5 yr.	6 yr.	7 yr.	8 yr.	9 yr.	10 yr.
current yield curve	-77.0 bps.	-71.0 bps.	-59.1 bps.	-44.1 bps.	-29.2 bps.	-13.1 bps.	2.0 bps.	17.3 bps.	30.6 bps.	41.9 bps.
parallel up	200.0 bps.	200.0 bps.	200.0 bps.	200.0 bps.	200.0 bps.	200.0 bps.	200.0 bps.	200.0 bps.	200.0 bps.	200.0 bps.
parallel down	-200.0 bps.	-200.0 bps.	-200.0 bps.	-200.0 bps.	-200.0 bps.	-200.0 bps.	-200.0 bps.	-200.0 bps.	-200.0 bps.	-200.0 bps.
steepner	-112.9 bps.	-73.0 bps.	-45.2 bps.	-15.3 bps.	8.0 bps.	26.2 bps.	40.3 bps.	51.3 bps.	59.8 bps.	66.5 bps.
flattener	148.9 bps.	107.9 bps.	79.2 bps.	48.4 bps.	24.4 bps.	5.7 bps.	-8.8 bps.	-20.1 bps.	-28.9 bps.	-35.8 bps.
short up	160.7 bps.	129.1 bps.	107.1 bps.	83.4 bps.	64.9 bps.	50.6 bps.	39.4 bps.	30.7 bps.	23.9 bps.	18.6 bps.
short Down	-130.6 bps.	-104.9 bps.	-87.0 bps.	-67.7 bps.	-52.8 bps.	-41.1 bps.	-32.0 bps.	-24.9 bps.	-19.4 bps.	-15.1 bps.

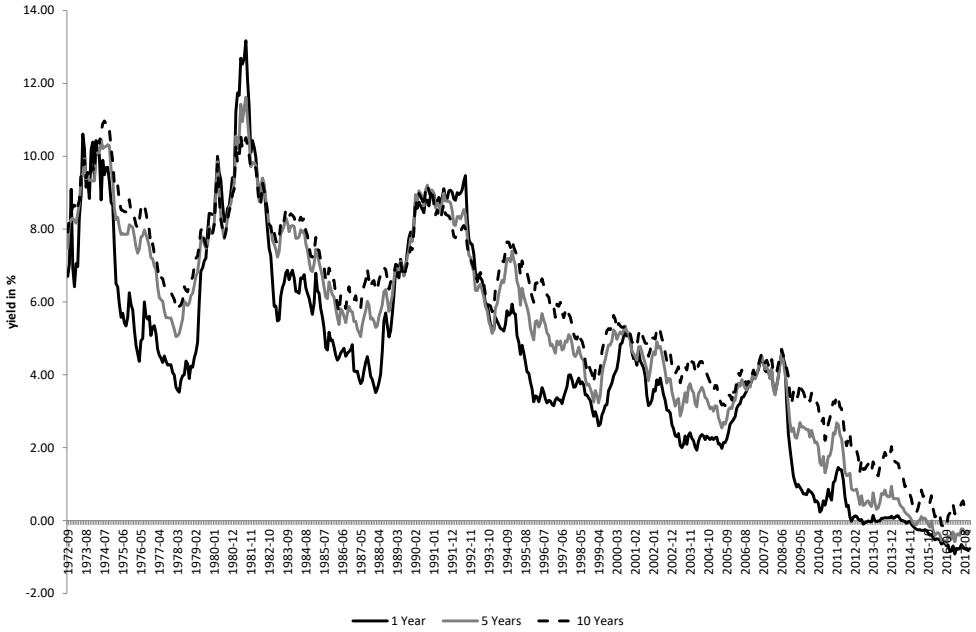
Source: Deutsche Bundesbank 2017; EBA 2017

3 Data and Methodology

Used Data

This analysis focusses on the German market and wants to quantify the risk of maturities up to ten years, modelled by a gliding 10-year strategic position (see Reuse and Svoboda 2014b, p. 378). Therefore, German sovereign bond yields with maturities from 1 to 10 years are used (see Deutsche Bundesbank 2017, BBK01.WZ3400 to BBK01.WZ3409). These yields are chosen, because they offer the longest history and reflect a nearly riskfree ratio. The theoretical optimal credit risk free OIS (overnight index swap) curve is not available for such a long time. The data is available for 46 years, from 1972-09 to 2017-11. Figure 2 shows the development of the 1, 5 and 10-year history.

Figure 2 Development of the 1, 5 and 10 Year German Sovereign Bond Yields



Source: Deutsche Bundesbank 2017

The figure shows that the yields follow a decreasing path and become negative in 2012. The main assumption for e.g. the historical analysis, a history free of a trend, cannot be stated. This special situation increases the necessity to improve IRRBB measurement methods.

Description of Methodology

The paper uses an idealized portfolio representing the gliding 10-year position. This portfolio eliminates effects of reinvestments and reduction of the residual maturity. The forecast is computed with a disposition horizon of one year and a confidence interval of 99.0 percent. In Accordance with the EBA scenarios, absolute changes of the yield curve are used as risk factors for calculation. The forecast quality is determined by comparing the ex-ante risk forecast with the ex-post performance.

Thus, the data history and also the number of risk factors for calculating the VaR increases over time. Essential parameters like mean and standard deviation for the variance/covarianceapproach is estimated for each calculation date.

Copulas can be constructed with the empirical dependence structure and empiricial marginal distribution on the one hand and by using a parametric distribution for the dependence structure and marginal distribution on the other hand. The empiricial Copula is based on discrete data. As a result, the Copula is not clearly mathematically defined. However, the distributions are fitted by analyzing the QQ-plots of the empirical data and the parametric distributions. This is done via visual inspection by comparing the plots (Jorion 2007, pp. 208 and Daníelsson 2012, pp. 28). In accordance with the variance/covariance-method, the parameters for the Copulas are estimated for each calculation.

The VaR of the 10-year position is determined by variance/covariance, historical simulation and the following Copulas:

Table 2 Used Copulas

	dependence structure	marginal distribution
Normal Copula	normal distribution	normal distribution
t-Copula	student-t-distribution, degrees of freedom= 6	student-t-distribution, degrees of freedom= 6
Normal Empiric	normal distribution	empirical distribution
Empiric Normal	empirical distribution	normal distribution

Source: own figure

Besides the empirical distribution, the normal distribution and the t-student distribution are implemented. The main advantage of the student-t-distribution is that fat tails can be modelled better. These fat tails are able to include macroeconomic shocks or asymmetric market movements (Jorion 2007, pp. 208).

Computing a Copula-construction every time bucket of the gliding 10-year-position is set as a marginal distribution. Thus, it is necessary to construct the Copulas with 10 dimensions. Basis for the parametric distributions are 10.000 uniformly distributed random numbers, which are transformed into the desired distribution using the inversion method. The random numbers are generated by using a Monte Carlo simulation. Afterwards the uncorrelated random numbers are transferred to correlated random numbers by the Cholesky decomposition. In order to isolate the dependence structure, the correlated random numbers or empirical data are converted to a unit-square. Dependence structure and the marginal distribution are linked by a quantile-mapping. At least the VaR estimation of the gliding 10-year position is provided as a difference of a quantile of the confidence interval and the expected value. The analysis of the results and the comparison of the estimated VaR with the EBA scenarios are presented in section 4.

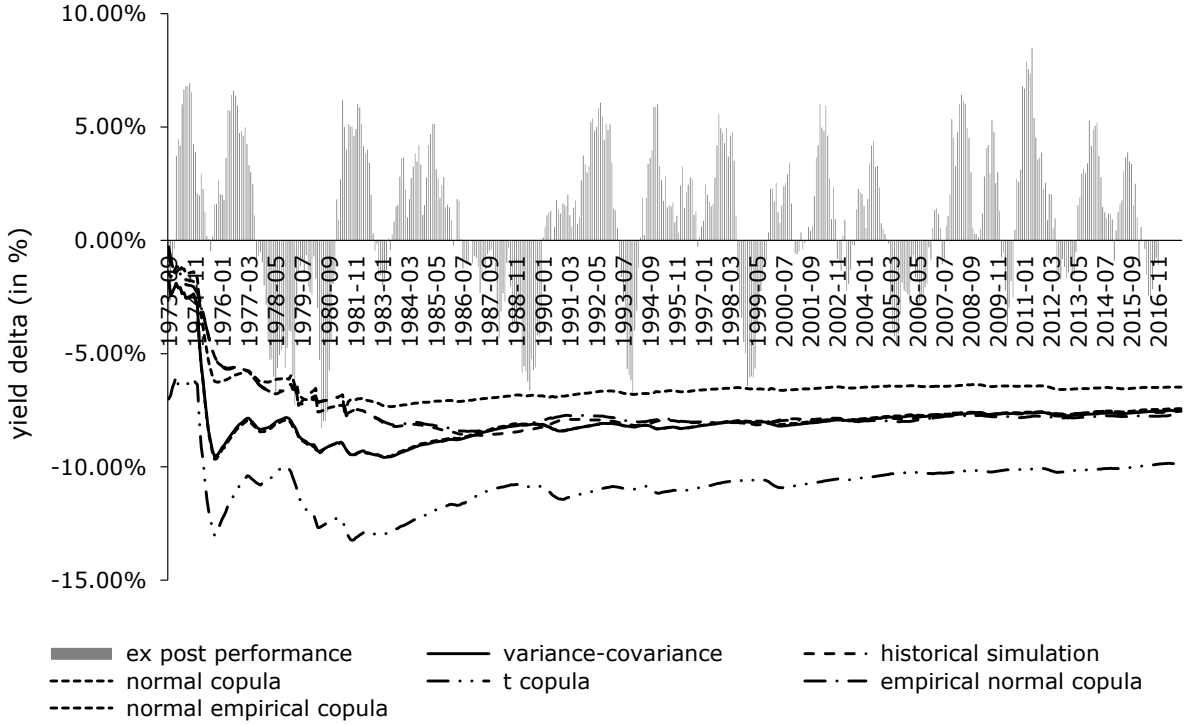
4 Discussing the Results

Comparing Copulas to Variance/Covariance and Historical Simulation

Figure 3 offers the results of all six evaluation methods including the ex post analysis. At the beginning of the analysis, we observe a period of high volatility in the first third of the time period, which implicate an increasing risk forecast. The risk figures decrease over time. Decreasing risk leads to the low interest rate environments, which states lower changes of interest rates. Furthermore, we observe a decreasing variance. Due to the high-risk factor changes in the past, the risk values are systematically overestimated in phases of low interest rates (Wegner/Sievi 2017, pp. 4 f.). Thus, absolute changes are generally not independent of the interest rate level. In addition, we can observe an increasing present value in periods of low interest rates. The time series has two structural breaks: German reunification and introduction of the euro.

Basically, there are only a few VaR-outliers (comparing risk forecast and ex post performance). The small number of outliers can be observed in volatile market phases, which derives the general volatility for the risk estimation. The last outlier can be observed 1980. The student-t-Copula predicts the highest risk figures. The variance/covariance VaR and the student-t Copula VaR have no backtesting-outliers. The tail dependence of the student-t-Copula overestimates the decreasing risk figures. This attribute is particularly interesting in periods of rising interest rates. The distribution of the gliding 10-year position seems to be leptokurtic. The normal distribution overestimates the risk. In addition, the high volatility at the beginning of the time series influences the risk. The Copula with normal distributed marginal distributions and empirical dependence structure forecasts the lowest risk figures.

Figure 3 Ex post Performance and Risk Forecast, 1-year-holding-period, 99.0% Confidence



Source: own calculations

Table 3 visualizes the backtesting of the risk values.

Table 3 Relative Forecast Goodness-of-fit

	VaR excesses (in %)
variance-covariance	0.000%
historical simulation	1.186%
copula: normal-distributed marginals, normal-distributed dependency structure	0.000%
copula: t-distributed marginals, t-distributed dependency structure	0.000%
copula: empirical-distributed marginals, normal-distributed dependency structure	1.186%
copula: normal-distributed marginals, empirical-distributed dependency structure	1.186%

Source: own calculations

According to the Basel model risk traffic light approach relative VaR excesses above 1% are not "green". Hence, for these excesses there is a detailed analysis necessary.

In fact, the consideration of empirical distribution components (marginal distribution, dependence structure or both (historical simulation)) leads to the rejection of the prognosis quality. Only the parametric distribution methods have a sufficient forecast-quality over the whole time. For that risk measures we could not observe any outlier for about 35 years. Although, all outliers could observe until 1980 and may draw the conclusion, that these outliers should not be over-interpreted. Hence, the stationarity assumption respectively the representativeness of ex post changes for a risk forecast could questioned.

The variance/covariance-method shows good results and is a simple model. The Copula models cannot generate a better forecast quality than the variance/covariance-approach (using a long data history). In addition, Copulas have a higher model risk and require more computational effort. The reduction of the risk figures suggests a misallocation of risk taking capacity.

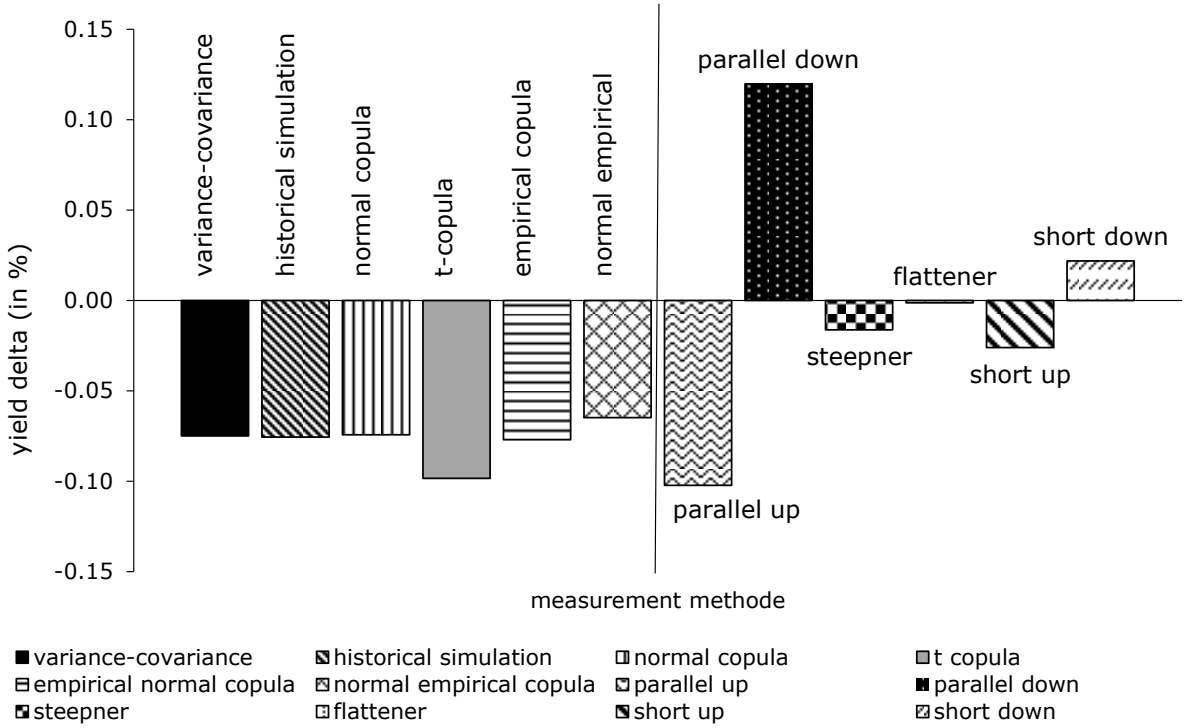
At least, all VaR-methods have a good forecasting quality, but overestimate the risk. The overestimation of the risk figures is caused by the high volatility at the beginning of the time series. Particularly this overestimation can be observed in the current low-interest-

rate phase. The higher level of risk forecasting results can be explained by high absolute risk factor changes in the first third of the time series.

Comparing Copulas to the EBA Scenarios

Comparing the VaR-methods with EBA scenarios is illustrated in figure 4.

Figure 4 Risk Forecast of the Quantitative Risk Methods and the EBA Interest Rate Risk Scenarios



Source: own calculations

The parallel up shock (+200 basis points) forecasts the highest risk. This scenario is already calculated today and estimates regularly higher risk figures than the institute's own measurement methods. All other scenarios show significant lower risks. In expectation of rising interest rates in the future and in accordance with decreasing present values, this low risk forecasting has to be discussed. A further flattening of the yield curve shows no further risk potential for the gliding 10-year position. The scenario short up generates the second highest risk figures of the EBA scenarios. In line with the low interest rate survey, the expectation of rising interest rates shows the highest risk potential for most institutions.

5 Conclusions

Summing up the main results leads the following aspects:

- All VaR-risk measurement methods lead to a high risks that bind too much economic capital.
- Copulas are a flexible method o quantify and aggregate risk.
- The t-student Copula seems to generate the best backtesting results.
- The historical simulation and the variance/covariance approach lead to better results than expected.
- The EBA scenarios do not offer additional perception. It is surprising that the parallel up shift, often discussed as a bad scenario, leads to a risk value similar to the VaR approaches. The other five scenarios underestimate risk.

In the next step, the two academic research questions have to be answered. Table 4 sums up the results.

Table 4 Research Questions

Research Question	Argumentation	Result
a) Which VaR approach fits best to quantify IRRBB?	The existing VaR approaches lead to better results than expected, but the Copulas, especially the t-Copula lead to reliable results as well. Nearly all VaR methods overestimate risk in an ex post analysis.	✓
b) Are the six EBA interest risk scenarios an adequate measurement approach?	No, only the 200 BP shock leads to comparable results. The other five scenarios do not offer additional findings.	✓

Source: own figure

Last it hast to be stated that Copulas can enrich the risk management of IRRBB and should be implemented at least in big European banks.

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Random Strategy Versus Technical Analysis Strategy: The Case of GBP/USD Intraday Trading

Miroslav Svoboda[1], Tomáš Plíhal[2], Pavel Sedláček [3]

[1] Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 603 00 Brno, Czech Republic
E-mail: 254801@mail.muni.cz

[2] Masaryk University
Institute of Financial Complex Systems
Lipová 41a, 603 00 Brno, Czech Republic
E-mail: 370621@mail.muni.cz

[3] Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 41a, 603 00 Brno, Czech Republic
E-mail: 369947@mail.muni.cz

Abstract: *This paper provides a comparison between the strategy based on technical analysis and the strategy based on random trading on a highly liquid GBP/USD foreign exchange market. We analyze six months of data, and in every intraday trading session, only a single position will be opened. Technical analysis strategy uses essential indicator relative strength index (RSI). Every trading position will have the risk-reward ratio (RRR) 3 to 1. In addition, another trading positions on the GBP/USD currency pair will be opened at the same time each day, without technical analysis. The time of entry into position will be indicated by past high liquidity on a given currency pair at a given time with a similar risk-reward-ratio (RRR) 3 to 1. We want to answer the question whether it is preferable to use the technical analysis indicators or to open a trading position randomly in intraday trading. In other words, this article aims to compare the strategy of technical analysis and the random strategy in intraday trading concerning the profitability of these trades. On the basis of our preliminary results, we expect that the random strategy will show us higher profitability or lower loss ability than the strategies based on the technical analysis indicators in the observed period.*

Keywords: technical analysis, investment decisions, foreign exchange markets, currency markets, random strategy, backtesting

JEL codes: G11, G12, G15, G17

1 Introduction

Technical analysis deals with making decisions of investors based on the historical price and other readily available market data. Use of the technical analysis in FX markets has been confirmed by many surveys like Taylor and Allen (1992), Menkhoff (1997), Lui and Mole (1998), Oberlechner (2001), Gehrig and Menkhoff (2004), and Menkhoff and Taylor (2007).

A trading strategy based on technical trading rules that is profitable in the long term is inconsistent with the weak form of the efficient market hypothesis. Some earlier studies supporting the profitability of technical analysis in the foreign exchange markets (Sweeney 1986; Levich and Thomas, 1993; Neely, 1997; LeBaron, 1999, 2002). In theory, the foreign exchange market should be efficient because of very high turnover and domination of professional traders that should not be influenced by the sentiment of retail investors (Sager and Taylor, 2006; Menkhoff and Taylor, 2007)

Some of the recent studies like Hsu and Taylor (2013) and Coakley, Marzano, and Nankervis (2016) analyze technical trading rules of large samples in the foreign exchange market applying stepwise-SPA test. They also include transaction costs and control for data snooping bias, and they found little or no evidence of profitability of these rules. On the

other hand, Coakley, Marzano, and Nankervis (2016) found that relatively new trading indicators like Bollinger bands, RSI and MACD remains robustly profitable even after controlling for data snooping bias. Zarrabi, Snaith and Coakley (2017) used FDR analysis and concluded take over 20 years up to 75% from 7650 trading rules have predictive ability. However, it is necessary to update portfolio at least monthly because no set of trading rules holds for a long time.

Our paper aims to test selected strategy based on technical analysis and compare the results with simple random strategy. We try to show that on the foreign exchange market the most straightforward strategy is usually able to provide better results than more sophisticated ones, at least in the long term. Moreover, we want to motivate our future research in this field that will use much bigger dataset and more currency pairs.

The rest of the paper is organized as follows. Section 2 contains methodology and data. Section 3 presents results and discussion, and the section 4 concludes.

2 Methodology and Data

For our research, we use two investing strategies on the forex market (FX). The first strategy (RSI strategy) is based on one of the most popular indicators of technical analysis – Relative strength index (RSI) developed by Wilder (1978). The second strategy (random strategy) does not use any indicator of technical analysis.

For backtesting, we choose currency pair GBP/USD from 1/1/2017 to 5/30/2017. Risk-reward-ratio (RRR) has been set to 3 to 1. It means that stop-loss was set to 20 pips under the opening price and target was set to 60 pips above the opening price. We executed both types of orders, such as buy orders and sell orders. We compare two investment strategies, so there is no need to include commissions and spreads. In real trading, our strategies would be less profitable. The fees would be around 1-2 pips per position according to the rules of a particular broker. The following Table 1 shows the basic characteristics of our analysis.

Table 1 Basic Characteristics

Currency pair	**GBP/USD**
Chart time frame	H1
Type of chart	Candlestick
Time period	1/1/2017 – 5/30/2017
RRR	3 to 1
Profit	60 pips
Loss	20 pips
Time zone	UTC +1

Source: Author's calculations

RSI strategy

Relative strength index is one of the most popular momentum indicators. RSI informs investors about price changing in advance, which is the main difference from other indicators of technical analysis. Therefore we have chosen RSI indicator for our strategy. RSI indicator oscillates between 0 and 100, above 70, the market is overbought, and below 30, the market is oversold. Our RSI strategy is summarized in the Table 2.

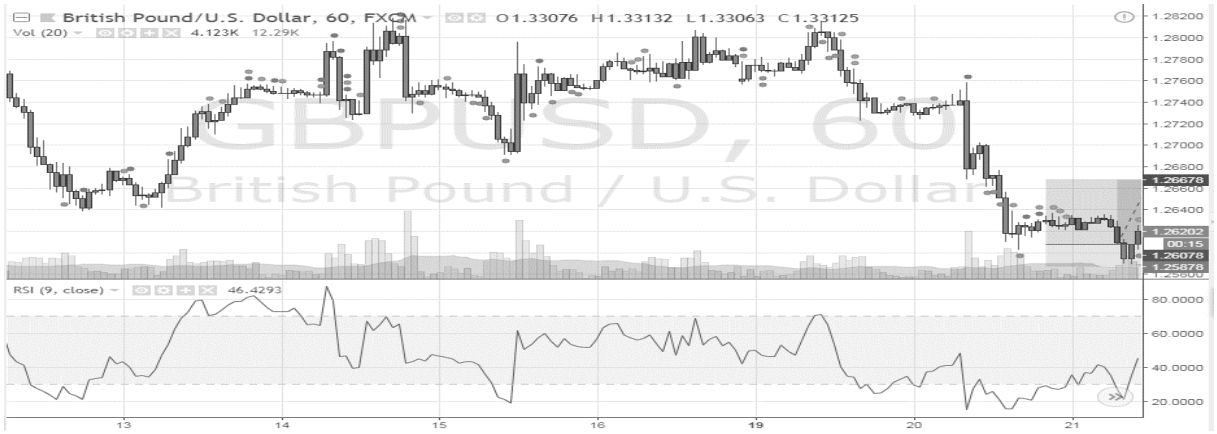
Table 2 Characteristics of RSI Strategy

Period of RSI	**9**
Limits of overbought	70
Limits of oversold	30
Signal to buy	First closed candle after RSI rise up from 30
Signal to sell	First closed candle after RSI drop down below 70
Close position	Break through stop loss or target

Source: Author's calculations

The following Figures 1 and 2 demonstrate the signal to open the position (buy position in this example) and signal to close the position for our RSI strategy.

Figure 1 Signal to Buy



Source: Author's calculations, tradingview.com

Figure 2 Close Position (break through target)

Source: Author's calculations, tradingview.com

Random strategy

Our random strategy is based on trading without technical and fundamental analysis. We choose random parameters to enter trading positions. Trading positions are executed at 9 a.m. (UTC +1) every trading day (without weekends). The hour was selected for opening trading hours in Britain. That is why we expected a higher rate of currency pair deals. We have entered the sell position each odd day, and we have entered the buy position each even day. The reason for the alternation of positions was the removal of imbalances in the

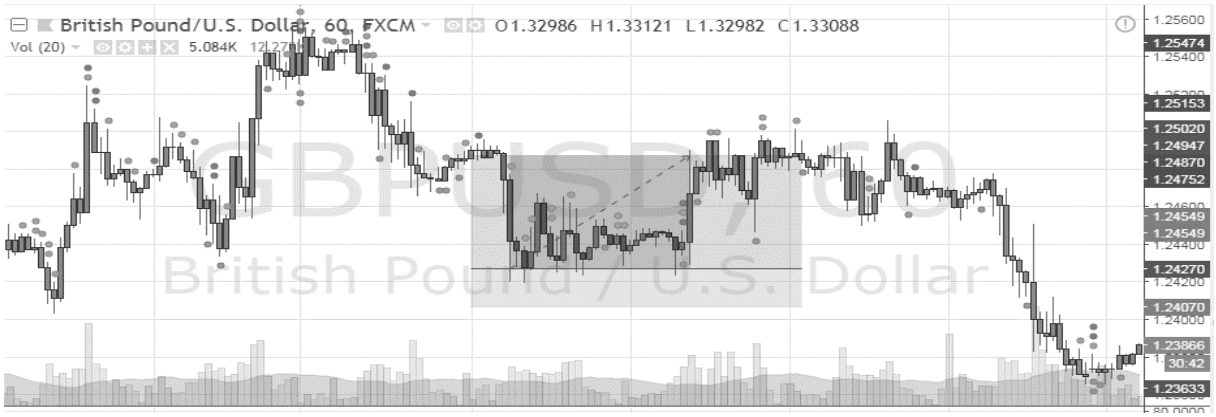
case of long-term currency pair trend. The Table 3 sums up the rules for opening and closing random strategy.

Table 3 Characteristics of Random Strategy

Period of trading	Every day, without weekend
Signal to buy	9:00, UTC + 1, even day
Signal to sell	9:00, UTC + 1, odd day
Close position	Break through stop loss or target

Source: Author's calculations

Figure 3 Even Day, 9:00, UTC +1



Source: Author's calculations, tradingview.com

The Figure 3 shows an example of opening and closing position according to our random strategy. It is an even day, therefore we open a buying position at the time 9:00 UTC +1. After reaching our target 60 pips the position is closed.

3 Results and Discussion

We use six months of data and manually backtest our strategies presented in the previous Chapter 2. In the Table 4 are our result for both strategies. The random strategy opened one position every trading day, and it resulted in 129 positions in total. For RSI strategy, we also tried to open one position a day, but there are some days without a signal. Therefore, no position was opened, and we have only 109 observations.

We can see that approximately half of all positions was opened as long and the other half in short position. For random strategy, it is evident due to our rules for entering the position (even days buy, odd days sell), but this also holds for RSI strategy.

Table 4 Results

	RSI strategy	Random strategy
Number of open positions	109	129
Number of long positions	51	63
Number of short positions	56	66
Number of profitable positions (60 pips profit)	34	44
Number of loss positions (20 pips loss)	75	85
% of success	31.19 %	34.11 %
Total profit	540 pips	940 pips
Average profit per position	5 pips	7,3 pips
Time period	6 months	6 months

Source: Author's calculations

Further, we should notice the accuracy (the number of successful positions). With RRR 3 to 1, we have to correctly open at least 25 % of positions to be break even. Both positions end in green numbers with more than 30 % of profitable positions. The random strategy did a little bit better job with a success rate of 34.11 % in comparison with 31.19 % from the RSI strategy. Total profit was 540 pips (5 pips per position on average) for RSI strategy and 940 pips (7.3 pips per position on average) for random strategy.

4 Conclusions

In this paper, we compared two trading strategies. The first one uses RSI indicator and the second one was randomly opened every day at the same time. We tested both strategies on GBP/USD currency pair for six months from 1/1/2017 to 5/30/2017 and set risk-reward-ration to 3 to 1.

According to our results, both strategies were profitable even when considering fees, but random strategy performs better. To be able to decide which of these strategies is better we naturally need much longer timeframe and also try different currency pairs. However, it will be the objective of our future research, when we want to focus more on a comparison of simple random trading strategies with more sophisticated trading rules. Our results in this paper only suggest, that there is some potential for random strategy and it could be interesting to investigate this issue more deeply.

Acknowledgments

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Business Entities and Loans in the Czech Republic

Libuše Svobodová[1], Jaroslava Dittrichová[2]

[1] University of Hradec Králové
Faculty of Informatics and Management, Department of Economics
Rokitanského 62, 500 03 Hradec Králové, Czech Republic
E-mail: libuse.svobodova@uhk.cz

[2] University of Hradec Králové
Faculty of Informatics and Management, Department of Economics
Rokitanského 62, 500 03 Hradec Králové, Czech Republic
E-mail: jaroslava.dittrichova@uhk.cz

Abstract: *The aim of the article is to monitor and to analyze value and types of loans in the Czech Republic as a source of financing for business entities. The first section focused on statement of problem briefly describes the situation on the loan market. Main part is focused on results that analyzes the development of provided loans to entrepreneurial subjects in the Czech Republic. Interest is focused on the value of loans in the Czech currency and in foreign currency. Values and ratios of both sources of financing are compared in the article. Subsequently, the value of loans according to type of loan are analyzed. Data from the Czech National Bank were used to process the article. The results are clearly presented in processed graphs. Results show that entrepreneurs have used in the biggest value long-term loans instead short-term and medium-term loans to finance liabilities in recent years. Even in the context of increased foreign trade, the share of foreign currency financing is growing. Medium term loans have from 2010 the biggest ratio between Czech and medium currencies.*

Keywords: comparison, development, loan, statistics, value

JEL codes: G21, M21

1 Introduction and problem statement

The objective of financing a business entity is to efficiently secure the necessary amount of capital, emphasizing the minimum cost of capital acquisition and avoiding the financial risk of the enterprise. Loans are the basic sources of financing consumer demand for businesses. There are several classifications of bank loans. We will use classification according to time and type of currency. According time consumer loans are divided on short, medium and long term maturities. Financing of long-term property can be done with long-term resources. Long-term assets change into money over a longer period of time. Long-term funding sources should therefore be used as a short-term loan could put the company in financial distress. Circulating of non-fixed assets states that those assets change their form from material to money and vice versa. The resources in short-term assets tied for a short period of time, the structure should be flexible, mainly due to changes in time, scale and structure. Loans for short-term cash needs provided by financial institutions may be debit balances on current accounts and overdraft accounts. Consumer loan, credit card, overdraft account, bill of exchange, revolving loan, lombard credit, business loan or bank guarantees are the short or medium types of financing.

Regulation of consumer credits includes the rules of negotiations of subjects on financial market with consumers. The Consumer Credit Act was extended with a range of entities subject to the Czech National Bank supervision with effect from 1 December 2016. It applies to all providers of consumer credit and consumer credit agents. The regulation concerns persons referred in Section 44 (1) of the Act on the Czech National Bank in the performance of activities performed by such persons on the basis of a authorization, license or registration of the Czech National Bank (CNB) or a similar permission to operate in the Czech Republic by a foreign authority in the field of consumer protection.

A well-functioning internal market in consumer credit also requires a harmonized approach within the European Community that will adapt the laws to future forms and the

development of consumer credit in the context of the mobility of European consumers according to Directive 2008/48/EC of the European Parliament and of the Council of 23 April 2008 on credit agreements for consumers.

The credit conditions survey and the development of consumer loans serve for users (central banks, banks, financial agents) to provide valuable information on developments in the consumer credit market. The qualitative information is obtained, for example, by the CNB in the form of a structured questionnaire survey directly from a representative sample of banks operating on the Czech credit market participating in this survey (CNB, Lending survey, 2018a) or European Central Bank for all European countries (ECB, 2018).

The CNB started to do a survey in summer 2012. The questionnaire focuses on both sides, the credit supply side (credit standards and terms and conditions for approving loans as stipulated by banks) and the credit demand side (demand for loans among households and corporations as perceived by banks) and assesses the most significant factors underlying changes in supply or demand. The CNB survey covers not only the observed evolution of credit standards and credit demand in the previous quarter, but also the expected developments in the three next months. The CNB publishes the results of the regular quarterly rounds of the survey as an electronic text publication containing graphic illustrations and as data files containing aggregate results in late January, April, July and October. (CNB, Lending Survey, 2018a) European Central Bank also presents results fourth in a year.

According to news reports, indebtedness is still growing in the Czech Republic. The Czech Economy is rising, unemployment is declining and financial institutions motive with low interest rates to borrow money. Due to market developments and previously published articles that have been devoted by the author of the paper earlier (Hedvičáková, Svobodová, 2015, 2016, 2017), we know that mortgage loans were almost still growing. Question is whether it is in total for business entities. Business entities in the Czech Republic use leasing, long-term loan, mortgage loan or bonds as a source of long-term finance. The World Bank Group (2018) evaluate the ease of obtaining credit for businesses in relation to "doing business", which was dealt in Svobodová, Hedvičáková (2015). For managing of long term finances it is substantially to be as stable as possible (Černohorská, 2015). The calculator of bank service calculations and mortgage loans was dealt by Hedvičáková, Soukal (2012). Allen and Paligorova (2015) dealt with lending in Canada during the financial crisis, when lending was restricted to public companies, but not to private companies. They lent to private businesses because they could get excessive revenue. Godlewski, Sanditov (2018) investigate the effect of the network of financial institutions on the certification value of bank loans using data on syndicated loans to European companies. They find that the presence of more central leaders in a syndicate substantially increases the stock market's reaction to loan announcements. Kim et. al. (2018) founded that firms with a reputation for IT capability tend to have more favorable price and non-price terms for loan contracts and are less likely to have their credit rating downgraded or to report internal control weaknesses than firms with no IT reputation. Isynuwardgana, Muslih, (2018) presented that through the implementation of governance will decrease the cost of debt the company. Research Wlodarczyk, Szturo (2018) analyse the factors affecting the credit availability and their influence on development of Polish small and medium companies, such as company's size and age, financial results or the length of relationship with the banking institution, as well as the features characterizing the banking sector. The results demonstrate that in Poland, similarly to other European countries, small and medium companies have a more limited access to credit availability than large companies. Moreover, a significant dependence of bank credit availability from the size of the company, liquidity, profitability and the situation in the banking sector was demonstrated.

2 Methodology and Data

Goal of the paper is to analyse the situation on the loan market in the Czech Republic that were provided to non-financial business entities in 1993 – 31.3. 2018 in their values and according to type.

As for applied methodology, primary and secondary sources were used. Data illustrating the issue on the loan scene were gained from the Czech National Bank and the European Central Bank. Data from the Czech National Bank were always used in period as they are presented by the Czech National Bank. There were used the oldest and the newest data that are available. Results are presented in graphs that were done by the authors of the article. They are accompanied by the comments. Secondary sources include websites, technical literature, information gathered from professional journals, discussions and participation at professional seminars and conferences. Then it was necessary to select, categorize and update available relevant information from the collected published material so that basic knowledge about the selected topic could be provided.

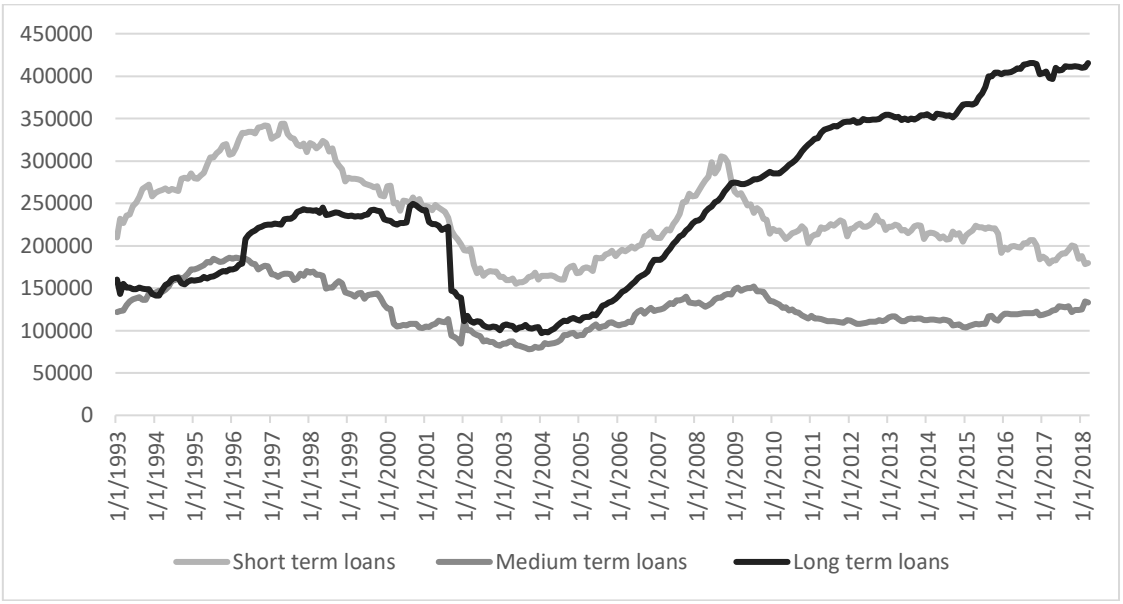
3 Results and Discussion

Credit standards remained broadly unchanged for loans to non-financial corporations in 2018 Q1. Most factors had a neutral impact. An easing of standards was fostered by competitive pressure and a good liquidity situation of banks. The terms and conditions for approving corporate loans were eased. Average interest margins declined, but much less broadly than in the past. The recent broad decrease in interest margins on corporate loans thus halted. The easing of terms and conditions was more marked for large corporations, occurring mainly through lower collateral and maturity requirements. Corporations' demand for loans rose in 2018 Q1 (net percentage of 17%). Financing of fixed investment and working capital was an important factor. Part of the banking market perceived a rise in demand for financing of mergers and acquisitions and corporate and debt restructuring. The still low interest rates also had a favourable effect. By contrast, demand for loans was reduced by the use of alternative forms of financing by corporations, i.e. generation of internal funds and issuance of debt securities. Banks expect no change in credit standards and an increase in demand for loans (an NP of 18%) in 2018 Q2. Credit standards for loans to sole traders were unchanged and demand for such loans fell further (net percentage of 6%). (CNB, Bank lending survey, 2018a)

Loans to nonfinancial corporations

Chart in Fig. 1 presents the results of loans and receivables from non-financial corporations in the Czech Republic in Czech crowns. The data were available from January 1, 1993 to March 31, 2018 in the Czech National Bank's statistical data. The chart shows the data for each year. The most stable trend in values was recorded by loans and receivables over the medium term. At the same time, until 1995-1996, it is the least used product of comparable solutions. Short-term loans up to one year were by 2009 the most used instrument. The largest amount of money was lent to this instrument in 1996-1997, when entrepreneurs lent CZK 350 billion. Then, their volume began to decline until 2004. Since 2005, the volume has begun to increase again until 2009 and has fluctuated since 2010 with a declining trend. In terms of long-term loans, they recorded the largest fluctuations and changes. Their popularity grew until 2001, and then dropped significantly. By 2005, they remained at a similar level. However, the change occurred in 2006, when lending of this type began to grow again. Between 2011 and 2015, they were rather stagnant (reason may be financial crisis) and then continued to grow until 1.1.2018.

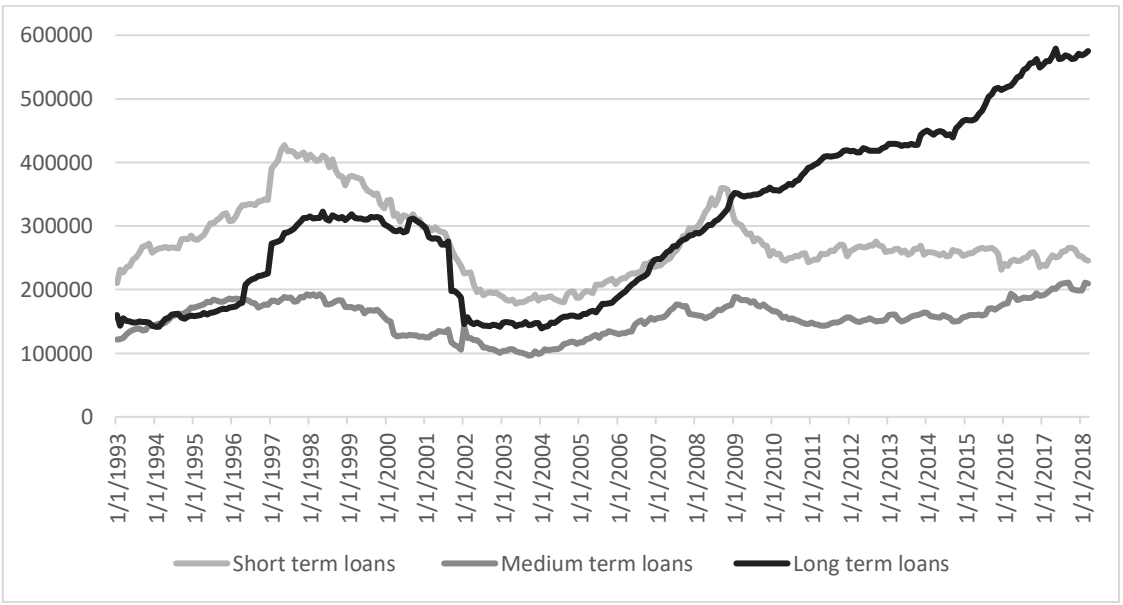
Figure 1 Non-financial Corporations - Loans by Term (CZK)



Source: own elaboration based on Czech National Bank (CNB, 2018b)

Until December 31, 1996, foreign currency loans were not recorded in the tables of the Czech National Bank (CNB, 2018b). It is the reason why differences were not recorded until 1997 and increase in values is evident from the graph in 1997. The graph has similar axis shapes and trends as in the previous graph (fig. 1). Long term loans again recorded higher values since 2009 before short term loans and medium term loans. It is not surprising because long-term loans are usually associated with a higher loan amount than short or medium term loans.

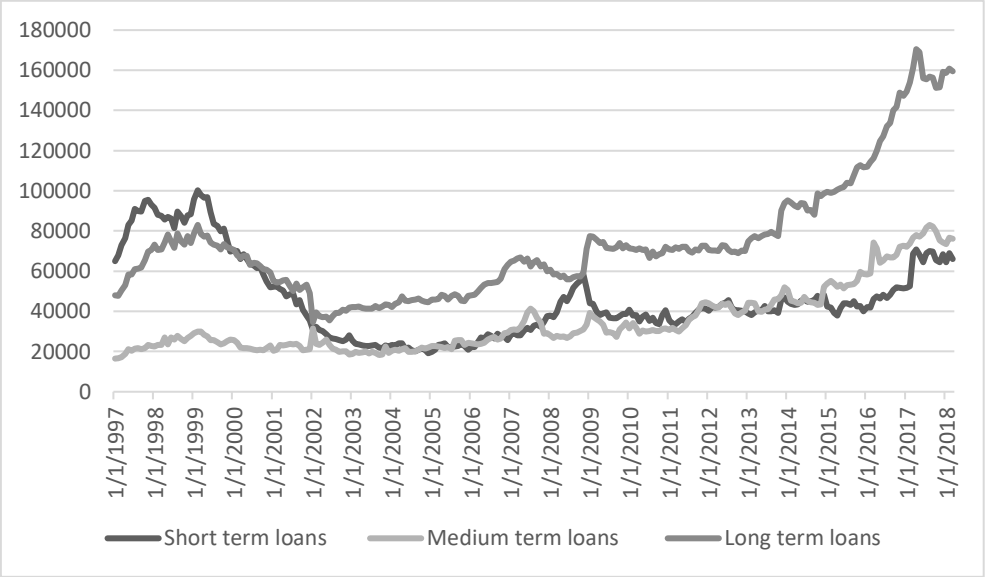
Figure 2 Non-financial Corporations - Loans by Term (CZK+FC)



Source: own elaboration based on Czech National Bank, (CNB, 2018b)

The next section will compare the amount of loans in foreign currencies and the percentage distribution of credits in the Czech crowns and foreign currencies. Foreign currency data is reported in the CNB's statistical data from 1.1.1997. For this reason, the data will be compared from 1.1.1997 to the latest data.

Figure 3 Non-financial Corporations – Comparison of Loans by Term According to Value of CZK and Other Currencies

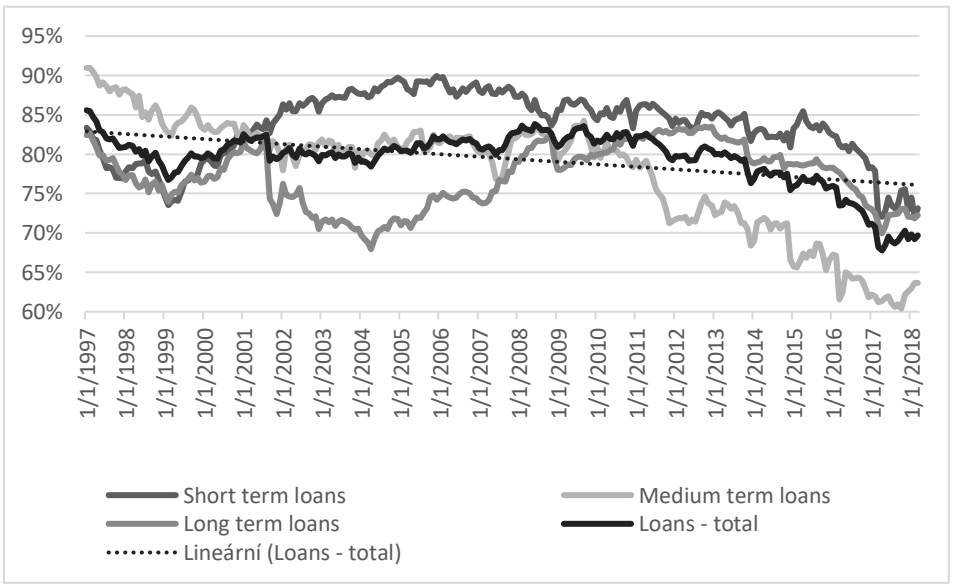


Source: own elaboration based on Czech National Bank, (CNB, 2018b)

In 2018, long-term resources were funded by a foreign currency of 160 billion. Since 2002, they have been used at the highest value for foreign currency financing. However, the record was recorded as at 30.4. 2017 when foreign currency was lent more than CZK 170 billion. The breakthrough occurred in 2002 when short-term and medium-term loans were higher than long-term loans. Interesting are the trends. While long-term and medium term loans provided in a foreign currency have a growing linear trend, short-term loans have declined in the monitored period.

If we focus on the share of financing in CZK and in foreign currencies, it is evident from the graph in Figure 4 that the share of foreign currency financing to CZK increased from 14% to 30% in 31th of March 2018 from 1st of January1997. In some monitored periods in 2017, the proportion was up to 32%. Despite the recorded fluctuations, the linear function of total loans and their ratios of financing in CZK are decreasing.

Figure 4 Non-financial Corporations – Comparison of Loans by Term According to Ratio of CZK and Other Currencies



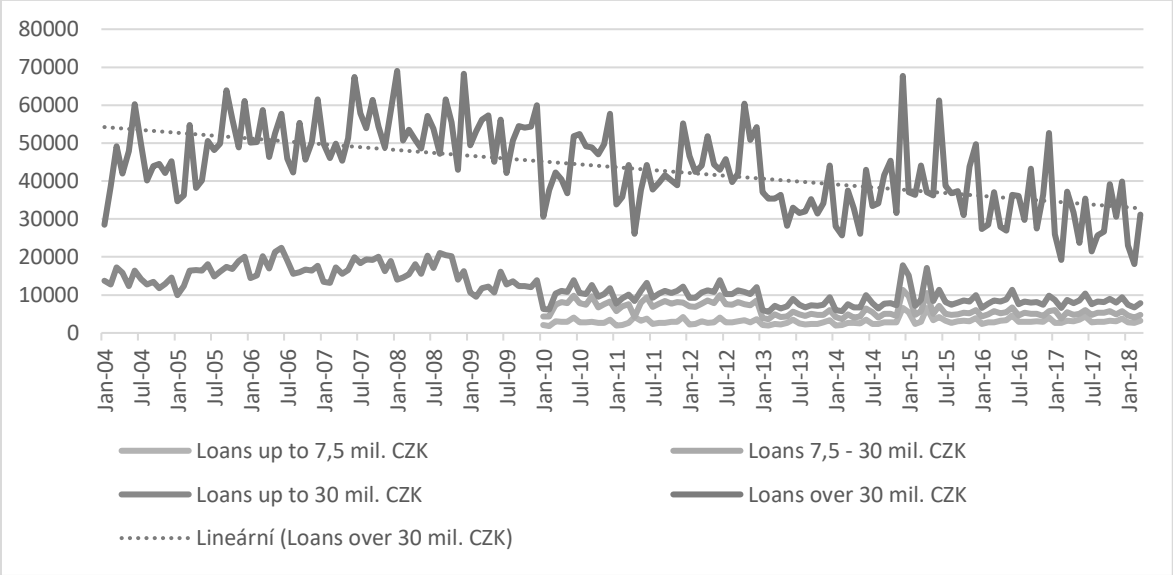
Source: own elaboration based on Czech National Bank, (CNB, 2018b)

Even though medium term loans were the least used in the year 2017 compared to CZK and foreign currency, since 31 July 2010 their percentage share recorded the biggest difference. Medium term loans were in 2017 used in foreign currency 40% of values.

Loans to nonfinancial corporations according to value

If we focus on loans according to the amount, debts for loans over CZK 30 million and loans up to CZK 30 million were most borrowed in value, see fig. 5. Other lending also agree with the loan amount. The smallest total amount was borrowed for loans with a value of up to CZK 7.5 million. For the two lowest categories, the data were released only from 1.1.2010. If we add a linear trend line, in all categories it is decreasing, to the lowest loans up to CZK 7.5 million, which shows a small increase.

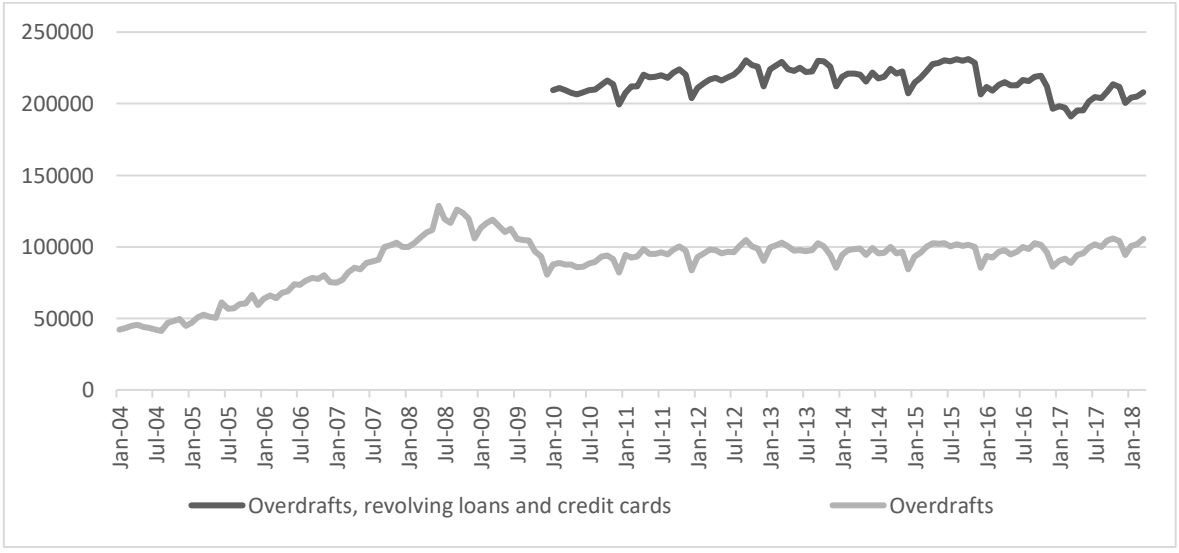
Figure 5 Non-financial Corporations – Comparison of Loans by Value of Loan, New Businesses



Source: own elaboration based on Czech National Bank, (CNB, 2018c)

The latest graph, fig. 6 shows that the most used tool for new business is overdrafts, revolving loans and credit cards.

Figure 6 Non-financial Corporations – Comparison of Loans by Value of Loan, Overdrafts, Revolving Loans and Credit Cards, New Businesses



Source: own elaboration based on Czech National Bank, (CNB, 2018c)

The CNB has monitored separately overdrafts that show a linear upward trend. By contrast, overdrafts, revolving loans and credit cards together show a declining linear trend. The chart shows that there have not been significant fluctuations in overdrafts since 2010. Overdrafts, revolving loans and credit cards are subject to greater fluctuations in the reference periods.

4 Conclusions

According to the data from the Czech National Bank (2018a) entrepreneurs have used in the highest value long-term loans instead short-term and medium-term loans to finance liabilities in recent years. It is interesting to monitor market developments. Financing of business entities significantly affects development and innovation in companies, as consumer and mortgage loans or other types of long loans usually represent investments in fixed assets. Long term loans have lower interest rates than the consumer credits or other products used for short or medium-term of financing. The disadvantage of mortgage loan is real estate collateral and greater administrative burden. Real estate may not need to be secured in some cases, for example, when providing an American mortgage. However, this is usually linked to a higher interest rate and subsequently an APR (annual percentage rate). Other long-term loans or medium-term loans depends on the negotiation between companies and bank institutions. The most often used products by companies in the financial institutions how to borrow the money are the overdrafts. They are classified as the short-term of medium-term funding. New businesses of loans by value of loan were from January 2004 recorded the highest value of loans more than 30 mil. CZK and loans from 7,5 mil. CZK to 30 mil. CZK. In the context of increased foreign trade, the share of foreign currency financing is growing in the Czech Republic and also values of those type of financing are rising.

Acknowledgments

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Recent Changes in the Polish Deposit Guarantee Scheme

Łukasz Szewczyk

University of Economics in Katowice
Department of Banking and Financial Markets
1 Maja St. 50, 40-287 Katowice, Poland
E-mail: lukasz.szewczyk@ue.katowice.pl

Abstract: *Deposit guarantee scheme is an important pillar of every modern financial safety net. During the global financial crisis, those schemes have undergone significant changes, which were the result of the need to cope with challenges caused by the recent crisis. In Poland, deposit guarantee scheme, which was established in 1994, plays an important role in providing financial stability in the financial system. In the new financial rules, introduced by the EU Deposit Guarantee Scheme Directive (2014/49/EU), some important changes have been introduced into its functioning, to provide greater level of harmonization of solutions between systems within EU. The main objective of this study is to present the most important changes introduced into Polish deposit guarantee scheme and to show some of the possible consequences of these changes for the Polish banking sector. A main research method used in this paper will be critical analysis of the literature connected with this subject and reports issued by the Polish deposit guarantee scheme. Results of this research will help to understand current problems of deposit protection in the Polish banking system.*

Keywords: deposit guarantee scheme, global financial crisis, resolution, financial stability

JEL codes: G21, G28, G01

1 Introduction

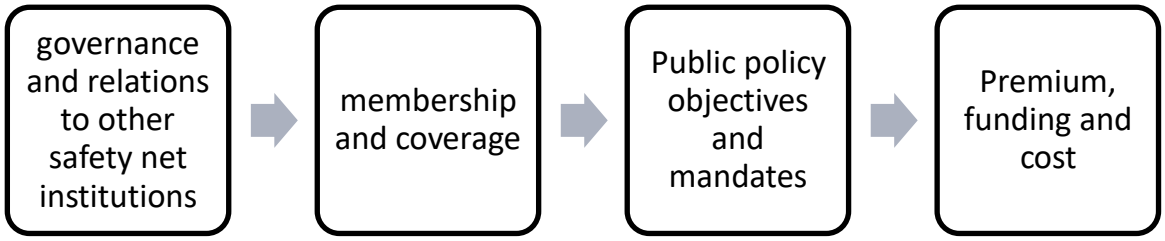
Deposit guarantee schemes play an important role in modern safety nets. They are responsible for protecting depositors in case of bank bankruptcy and therefore they have an important influence on financial stability. During the global financial crisis most of the systems have undergone some important changes, adapting them to the new conditions. Some systems introduced new, unconventional measures as a response to the crisis and some of these changes have been made permanent. Bank Guarantee Fund has also gone through some adjustment process, although global financial crisis didn't have very big impact on Polish financial system. This adjustment has been connected with the new rules introduced in EU, when adopting new Directive on Deposit Guarantee Schemes in 2014. It resulted in the adoption of the new Act on Deposit Guarantee Fund in 2016. This act introduced some changes in the construction of the system. On the other side recent years have brought some important challenges for the System. The year 2014 have brought bankruptcy in credit unions. In 2015 and 2016 two cooperative banks collapsed, bringing necessity to reimburse the depositors.

The paper presents some of the most important changes in the Polish deposit guarantee scheme and it focuses on some important aspects of its functioning in the recent period of time. Results of this research will help to understand current issues of deposit protection in the Polish banking system and its meaning to financial stability

2 Deposit protection- theoretical studies

Deposit insurance has been the subject of a number of studies, both theoretical and empirical. The history of research can be divided into four periods (from the creation of first systems in the 1930s, through their increasing popularity in the 1970s and 1980s, 1990s which are connected with attempts to regulate them on international level, especially in EU, up to post 2008 time, which saw the great change in their constructions as a result of global financial crisis). The main problems covered in these studies are shown on figure 1.

Figure 1 Deposit Guarantee Schemes Research Fields



Source: Pruski and Kerlin, 2015

The major sources of the research of DGS are not only the works of academics but also reports published by international organizations, e.g. International Monetary Fund, OECD, Financial Stability Board (Financial Stability Board, 2012) or International Association of Deposit Insurers. The last institution has begun doing such research to support policy makers responsible for the functioning of deposit guarantee schemes in their jurisdictions. The dynamics of global financial crisis has made some extra space for research to fill. It is important to say that the post- crisis reality is completely different from the pre-crisis state of affairs. The scale of the crisis and the number of bank failures means that deposit guarantee schemes have faced the big challenge and it should be pointed out in the research (Pruski and Kerlin, 2015). During the global financial crisis the expansion of financial safety net was substantial, especially for crisis countries and extended beyond traditional deposit insurance. The main activities in this area consisted of (Demirguc- Kunt et al., 2014):

- increasing statutory coverage,
- abolishing co-insurance,
- introducing a government guarantee on deposits,
- introducing a government guarantee on non- deposit liabilities,
- introducing a government guarantee on bank assets,
- undertaking a significant nationalizations of banks.

It is important to say that during global financial crisis policy makers pointed out many problems, which deposit guarantee schemes have to overcome. The main problems observed in the area of DGS were mainly (Szewczyk, 2015):

- unsustainable funding, which was mainly connected with the lack of risk sensitive funding arrangements,
- limited possibility to use DGS in a crisis situation, especially towards systematically important financial institutions,
- possible negative impact on financial stability, especially through weakening of market discipline,
- incompatibility of individual systems which may lead to unefficiency in crisis management.

3 Deposit insurance in Poland- selected issues

Bank Guarantee Fund (BGF) in Poland was established in 1994 by adoption of the Act of BGF. The Fund is an independent legal person with its office in Warsaw and was established to maintain stability in the Polish banking sector. The operations of the BGF focus on guaranteeing, aiding, controlling and analysing. It is intended that the Fund reimburse, in the event of the bankruptcy of a bank and credit union which is a participant in the guarantee scheme, funds accumulated in a bank up to the amount specified by the Act on the BGF. This is the so-called "pay-box function". The second basic task of the Fund is to make available financial assistance to its participants which have found themselves faced with a loss of solvency and are engaging in independent reforms, and also to support processes concerning the merger of endangered banks with strong banks. This is known as the "risk-minimizer" function in that the BGF may play an important role in crisis

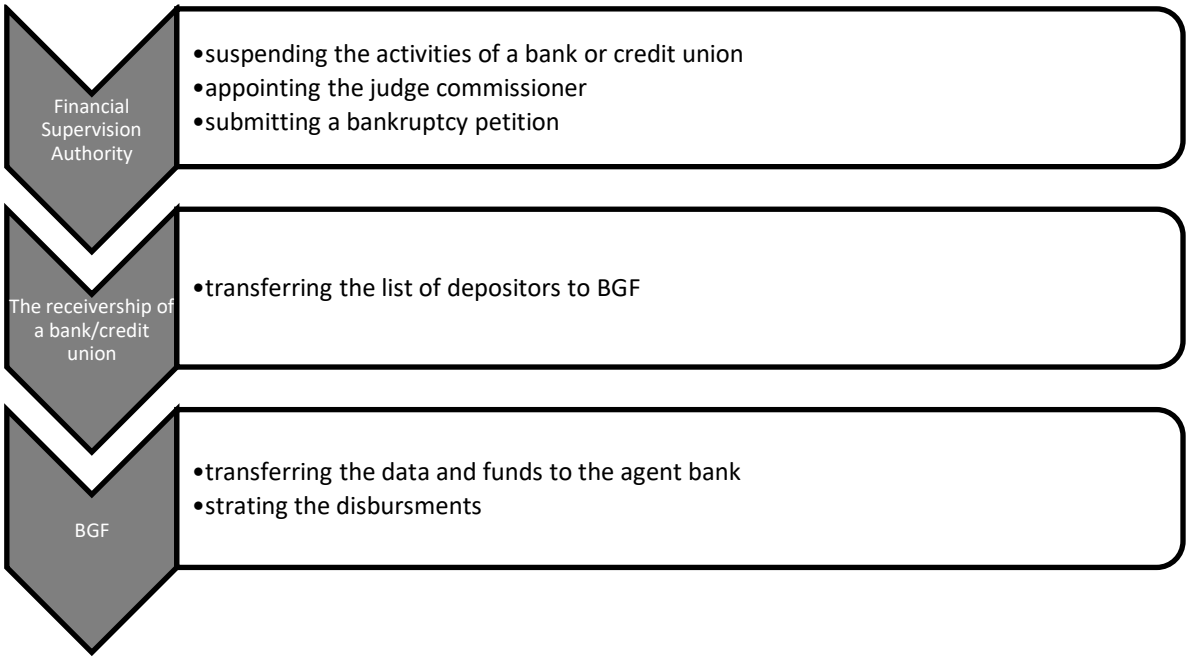
management by providing additional liquidity to credit institutions, mitigating the risk of instability of the banking sector (Zawadzka, 2011).

To sum up, the most important functions of the Fund are (Bankowy Fundusz Gwarancyjny, 2016):

- guaranteeing each depositor a payout of its deposits held in bank or credit union up to the statutory limit (100 000 EUR),
- preparing and updating resolution plans and assessing their feasibility,
- participating in resolution colleges,
- conducting resolution,
- writing down and converting capital instruments,
- executing the tasks in the scope of restructuring of credit unions,
- collecting and analyzing the information,
- developing analysis and forecasts for early identification of the threats in the banking sector and credit union sector,
- participating in the works of the Financial Stability Committee,
- participating in the works of the EBA permanent committee for resolution,
- providing financial assistance to banks from the cooperative banks restructuring fund.

The process of reimbursement of depositors is shown on figure 2.

Figure 2 Depositors Reimbursement Process



Source: Bankowy Fundusz Gwarancyjny, 2016

The main objective of this process is that the depositors will be disbursed in as short time as possible. Before the global financial crisis, the time that BGF had to conduct the procedure of disbursement was limited to three months. In the opinion of EU policy makers, this time was too long, and when adopting the new Directive it has been shortened and now it is limited to seven working days from the day of bankruptcy of credit institution. It is important to say that in recent years some of the credit institutions in Poland collapsed and it resulted in payments of guaranteed funds to depositors of failed institutions. Recent disbursements are shown in table 1.

Table 1 Disbursements Done by BGF in 2014-2016

Name of entity	Date of fulfilment of the guarantee conditions	Number of depositors	Liabilitis to depositors (PLN million)	Total disbursements until the end of 2016 (PLN million)
SKOK Wspólnota	18.07.2014	74 042	817,5	810,6
SKOK w Wołominie	12.12.2014	45 449	2 246,6	2 240,3
SBRiR w Wołominie	23.11.2015	33 144	2 037	2 028,3
SKOK Kujawiak	08.01.2016	17 200	183,9	182,7
SKOK Polska	25.02.2016	8 343	170,2	167,0
SKOK Jowisz	25.04.2016	7 380	81,9	79,8
SKOK Arka	11.05.2016	13 937	93,1	91,4
SKOK Skarbiec	22.07.2016	8 348	88	85,0
BS w Nadarzynie	24.10.2016	5 666	145,7	141,6

Source: Bankowy Fundusz Gwarancyjny, 2016

Among failed institutions were seven credit unions and two cooperative banks. The number of bankruptcies in the credit unions sector shows that they are in a difficult financial situation and it is necessary that their depositors are protected by BGF. It's also in line with the EU guidelines, according to which depositors of every type of credit institution should be protected in case of its bankruptcy. BGF has become responsible for deposit guaranteeing in credit unions in 2013.

In this particular area of BGF activity it is important to say that Polish banking sector is stable nowadays. When looking at the number of reimbursements in the period of 1995-2016 it can be seen that most of bankruptcies took place between 1995-2001 (so at the first period of the function of BGF). It can be explained with the fact that Polish banking sector after transition to the market economy was very weak and it resulted in some fails among banks (especially cooperative banks), as presented in table 2.

Table 2 Disbursements Done by BGF in 1995-2016

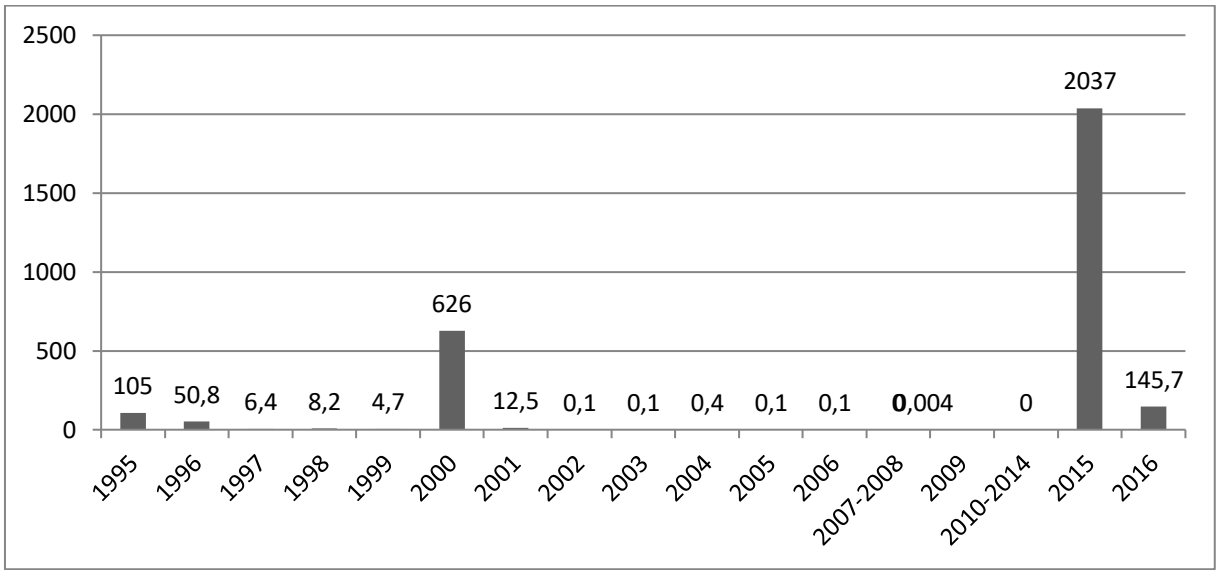
Year	Commercial banks	Cooperative banks	Credit unions
1995	2	48	-
1996	1	30	-
1997	-	6	-
1998	-	4	-
1999	1	-	-
2000	1	1	-
2001	-	-	-
2002-2013	-	-	-
2014	-	-	2
2015	-	1	-
2016	-	1	5

Source: Capiga et al., 2017

When looking at the problem of funds used to disburse depositors, it can be seen that in terms of value the biggest financial burden occurred in 2015 when SBRiR (cooperative

bank) collapsed and 2 037 million PLN had to be reimbursed. Second biggest bankruptcy happened in 2000, when one of the biggest Polish banks (Bank Staropolski) collapsed and about 147 thousands of depositors had to be reimbursed (figure 3).

Figure 3 Funds Allocated to Guarantee Disbursements in Banks (PLN million)



Source: Bankowy Fundusz Gwarancyjny, 2016

The Fund has also got new powers in providing financial help in the process of restructuring of credit unions. Help can be transferred not only to the insolvent credit union but also to the bank, which participates in the process of restructuring. In the years 2014-2016 BGF granted support in the form of subsidies for the total amount of 458,5 million PLN (table 3).

Table 3 Financial Support Granted in the Forms of Subsidiaries in 2014-2016

List	Year of granting	Subsidy (PLN thousand)
Alior Bank SA (SKOK Św. Jana z Kęt)	2014	15 895,8
Pekao SA (SKOK im. Mikołaja Kopernika)	2015	101 926,3
PKO BP SA (SKOK Wesoła)	2015	278 858,4
Alior Bank SA (SKOK im. S.K. Wyszyńskiego)	2016	52 533,74
Alior Bank SA (Powszechna SKOK)	2016	9 310,12

Source: Bankowy Fundusz Gwarancyjny, 2016

All actions taken by BGF which involve its funds lead to the problem of funding model adopted by deposit guarantee scheme in Poland. This problem is highly complex, but it is worth mentioning that the funding model has changed significantly in recent years. It is a consequence of the adoption of the new Directive on deposit guarantee schemes, followed by the adoption of new Deposit Guarantee Scheme Act in 2016 in Poland. The main aspect of this new funding model is to adopt risk premiums in place of flat premiums paid by the credit institutions. According to this model credit institutions that cause higher risk in the system, pay more than less risky one. The risk is evaluated upon the set of indicators covering such aspects as capital, liquidity, assets quality, business model and management and possible losses of the fund. There is a set of indicators in every aspect, that are evaluated and on this basis a premium is set. The main objective of this new model is to build a stable fund, which will enable to cover the costs of reimbursements in case of large bank failure and through this, it will have positive impact on financial stability.

4 Resolution process- BGF as a resolution authority

The single resolution mechanism is an important mechanism introduced after the global financial crisis. The last financial crisis revealed that the Member States of the European Union did not have tools appropriate for liquidation of large financial institutions being under the bankruptcy threat which were not able to continue their business independently due to their weak financial situation. At the same time, the systemic risk occured. There were fears that uncontrolled bankruptcy of „too big to fail" financial institutions would pose a threat to their clients and to the economy as a whole. Having no appropriate tools at their disposal, the Member States granted aid to threatened entities from their national budgets. The European Commission came to the conclusion that taxpayers should not bear the costs of rescuing the „too big to fail" financial institutions. The decision was taken that the responsibility should be borne in the first place by owners and then by creditors of entities under the bankruptcy threat (www1).

BGF has been chosen to act as a resolution authority in Poland and it is authorised to (BFG, 2016a):

- sell shares of a threatened entity,
- sell the business of a threatened entity or its part,
- establish a bridge institution – a special institution to which good assets and liabilities (deposits) of a threatened entity will be transferred,
- burden owners and certain creditors of a threatened entity with its losses, so as to rebuild its capital and enable it to continue its operation (bail-in) – burdening with the losses takes place via write down of shares of the owners and possibly via conversion or write down of liabilities of certain creditors,
- transfer low-quality assets to a special institution,
- file to a court for bankruptcy or liquidation of a residual entity remaining after a partial or total sale of its business,
- conduct liquidation of the discontinued business of the entity.

Main resolution tools adopted in the Deposit Guarantee Act from 2016 are presented in table 4.

Table 4 Resolution Tools

Sale of business	**This instrument enables the Bank Guarantee Fund to transfer in whole or in part the business of an entity being under the bankruptcy threat to another financial institution of good financial standing or to sell its shares to a new investor, which will ensure stability and development of the said entity**
Bridge institution	In the case of the bridge institution tool a special purpose vehicle established by the BGF, in the form of a bank or a brokerage house is the acquirer of property rights of the entity under resolution and acquires them in exchange of assumption of liabilities of the said entity. The whole process of „the sale" of property rights of the entity under resolution takes place under the terms analogous to those applied in the case of the sale of business tool.
Write down or conversion of liabilities	In some cases, due to scale, profile or internal interconnectedness of an entity, it may be impossible to find an acquirer willing to acquire the business in its entirety. In such a case, the BGF may write down a part of liabilities of an entity under the bankruptcy threat or convert them into shares in order to cover losses and rebuild own funds
Asset separation	The asset separation tool involves a transfer of selected property rights of an entity under resolution to a special purpose vehicle established by the Fund

Source: BFG, 2016b

It is important to add that this resolution mechanism is new and it hasn't been used in Polish banking system so far. None of the credit institution that failed in recent years has been considered systemically important. The only resolution in EU that has been carried out so far involved Banco popular Espanol S.A. in 2017 (European Parliament, 2017).

5 Conclusions

Global financial crisis proved that although deposit guarantee schemes are important institutions in the financial safety nets, some changes in their construction have to be made. The construction of these systems differ among individual countries, except EU, where a specific Directive unifies most of the aspects of their construction.

In Poland, Bank Guarantee Fund has gone some changes as a result of the crisis and new rules within EU. It is seen that crisis didn't affect Polish banking system very much but in recent years some problems in credit institutions have arisen and some credit institutions collapsed. It led to the necessity to reimburse their depositors and started a broad discussion whether the Fund will be able to handle a situation in which a large bank collapse. The solution in this regard may be an introduction of a new funding model, which makes the contribution paid by credit institutions risk-dependent.

Another important change that happened lately was connected with expanding the scope of participants of the system. Nowadays not only banks but also credit unions are members of deposit guarantee scheme, which follows the rule that depositors of every credit institution should be protected.

Finally, deposit guarantee scheme in Poland got an important power to act as a resolution entity, being responsible for conducting the resolution process, if needed.

All of these changes aim to make deposit guarantee scheme stronger and better prepared for the challenges that are ahead of it.

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Profitability Determinants of Polish Outsourcing Service Enterprises from the Point of View of Top and Middle Management

Rafał Szmajser[1], Mariusz Andrzejewski[2], Marcin Kędzior[3]

[1] Capgemini Poland S.A.
Al. Jerozolimskie 96, 00-807 Warszawa, Poland
rafal.szmajser@capgemini.com

[2] Cracow University of Economics
Faculty of Finance and Law, Financial Accounting Department
ul. Rakowicka 27, 31-510 Cracow, Poland
E-mail: mariusz.andrzejewski@uek.krakow.pl

[3] Cracow University of Economics
Faculty of Finance and Law, Corporate Finance Department
ul. Rakowicka 27, 31-510 Cracow, Poland
E-mail: kedziorm@uek.krakow.pl

Abstract: *The aim of the article was empirical verification of the most important operational, human and technological factors affecting profitability of Polish outsourcing service enterprises from the point of view of top and middle management. The most important factors of their profitability were discussed and characterized. Among the statistically verified factors of profitability the following ones were differentiated: providing services from different geographical locations in the world, supporting business by technological solutions in a scope of automation and analytical solutions, a proper level of employee abilities and competences and their position classification determining profitability of outsourcing centers in the financial service sectors, programs of continuous process improvement (e.g. lean, six sigma), developing and procuring talents inside an organization, a greater possibility of scalability of the operating activity, supporting organizations to make mergers and takeovers, an appropriate price model, quickness of implementing changes, standardization and transformation of processes. The analysis was made for the outsourcing businesses in the financial service sector conducting their activity on the territory of Poland. According to the respondents the most important determinants of profitability influencing profitability of operating of the outsourcing centers are: standardization and automation, providing services from many locations, and an appropriate level of employee abilities and competences. The data were collected on the basis of specially prepared questionnaire. The empirical results were verified using ANOVA variance analysis.*

Keywords: corporate profitability, outsourcing service enterprises, technological factors, human factors, process factors, Poland

JEL codes: M41, M42, M21, L6, L2

1 Introduction

In the literature there are lots of analyses, empirical studies on profitability and its factors analyzed in the sector of the listed companies, frequently manufacturing companies. In the literature there were mainly verified factors of a financial character, such as: indebtedness, liquidity, capital intensity, risk, assets turnover, and working capital (Bhayani, 2010; Babalola, 2013; Nunes et al., 2010; Demir, 2009; Lazaridis and Tryfonidis, 2006). The analysis also included factors of a non-financial character, such as: expenditures on research and development, advertising expenditures, market share, market share concentration, development opportunities, age, a size of an enterprise, corporate governance systems etc. (Anastassopoulos, 2004; Grinyer and McKiernan, 1991; Feeny et al., 2005; Bernotas, 2005). There were verified many times the factors of a macroeconomic character such as inflation, economic growth, a level of per capita, economic growth, interest rates, a type and a character of budgetary expenditures (Pervan and Kramaric, 2010; Isshaq and Bokpin, 2009; Asimakopoulos et al., 2009). Some institutional

determinants such as a development of stock exchanges and bank markets, legal systems, a level of economic freedom etc. were also subjected to the analysis (Lee and Hong, 2012; Knight and Shi, 2005; Gugler et al., 2013). There is no more comprehensive verification of the determinants of an operational, technological or human character. Therefore, in the article the following variables having a potential influence on profitability of business entities such as: providing service from lots of geographical locations in the world, supporting business by technological solutions in a scope of automation and analytical solutions, an appropriate level of abilities and competences of employees and a level of their position classification determining profitability of outsourcing center in a sector of financial services, programs of continuous process improvement (e.g. *lean*, *six sigma*), developing and procuring talents inside an organization, a greater possibility of scalability of the operating activity, supporting organizations to make mergers and takeovers, an appropriate price model, quickness of implementing changes, standardization and transformation of processes will be subjected to empirical verification. To the best knowledge of the authors a great majority of them did not undergo an empirical verification in the subject literature.

In the article the outsourcing enterprises in the financial service sector will be analyzed. So far the profitability determinants have been verified empirically only to a limited extent for this group of enterprises. The production sector enterprises were the most frequent subject of analysis (Gill et al., 2011; Love et al., 2009; Czarnitzki and Kraft, 2010; Gedajlovic and Shapiro, 2002), definitely less frequently trading (Asimakopoulos et al., 2009) or financial companies (Aburime, 2008; Beck et al., 2006). The authors do not know either about studies on the determinants of profitability of the outsourcing enterprises in the financial sector services conducting their activity on the territory of Poland.

The objective of this article is to verify empirical factors influencing profitability of the outsourcing centers operating in Poland. The following outsourcing centers, among other things, such as: Accenture Services, Alexander Mann Solutions, Amway, Capgemini, Cisco Systems, Electrolux, Hewlett-Packard, Hitachi Data Systems, HSBC Service Delivery Polska, Lufthansa Global Business Services, MARS Financial Services Europe, PWC, Shell, Sony Pictures Global Business Services, State Street, Tata Consultancy Services, UBS, Zurich Insurance Company, and firms being recipients of the outsourcing services or consulting firms operating in the outsourcing branch - Delphi, EDF, ING, mBank, Staco Polska, Van Gansewinkel, EY and WNS Global Services were subjected to the analysis. The data were collected on basis of a developed questionnaire. The empirical results were verified on the basis of ANOVA variance analysis.

2 Factors influencing profitability of the outsourcing centers

In the world literature on this subject there are few studies determining factors of profitability of the outsourcing center. In the studies performed by KPMG and HfS representatives of middle and higher management from the outsourcing branch, their clients and analysts and consultants were subjected to the survey [*The Global Business Services Industry Study*]. The representatives of the outsourcing service providers constituted 26% of the respondents, the consultants, advisors and the branch analysts – 33% of the respondents, and the mangers responsible for running shared service centers and their internal clients – 41%. The questions concerning priorities of the activity of the particular firms, determinants having an impact on competitiveness and profitability of the activity, including the plans for the future were directed to different groups performing the key functions in the organizations. There were recognized the following significant factors for an organization as having a positive impact on profitability: aiming at reducing costs of the operating activity, improving a quality of operating data used to make management decisions, better use of automation to decrease an influence of human labor, greater scalability of the operating activity, use of information technologies to provide business solutions, increased efficiency of operation management, better co-operation between the particular organization units inside the firm, greater standardization of processes, greater responsibility of operating departments for providing the added value, greater end-to-end

control over the management processes, an integrated purchase strategy in the entire organization.

On the basis of the results of the studies made by the KPMG and HfS firms it can be assumed that the verification of the influence of the profitability determinants having an impact on efficiency of operating of the outsourcing centers should be performed on the following groups of the factors:

- human factors, including: the optimal organization and operating structure, structured ranges of the activity and levels of provided services, employee competences, a proper, selection of location of the provided services, structured career paths, access to talent resources in the organization, continuous trainings and employee development (Sridharan, 2013; Thomas, 1994);
- process factors, including: global standards of processes, active supervision and control over effectiveness of processes, continuous modeling of the finance-accounting processes by use of improving methods, such as: *reengineering*, *lean*, *six sigma* and benchmarking (Bevilacqua and Thornhill, 1990; Du and Liao, 2010; Ohno, 1988; Pyzdek, 2001; Wuellenweber et al., 2009);
- technological factors, including: an optimized set of available technologies based on a set of standard operating systems of the ERP type, use of automation and robotics of processes (Gorla and Chiravuri, 2010; Hirschheim and Dibbern, 2009; Martin and Beimborn, 2009);
- factors of pricing the provided services, including: price strategies adapted to a type of a service and client expectations.

Finally the following factors will be verified empirically: providing service from a number of geographical locations around the world, supporting business by technological solutions, especially via automation and analytical solutions, an appropriate level of abilities and competences of employees and the level of their seniority in the organization, programs of continuous process improvement (e.g. *lean*, *six sigma*), developing and procuring talents inside an organization, a greater possibility of scalability of the operating activity, supporting organizations in mergers and takeovers, an appropriate price model, promptness of implementing changes, standardization and transformation of processes (compare: Gorla and Chiravuri, 2010; Baraka et al., 2013; Behara, 2011; Feuerlicht et al., 2003; Waema et al., 2009).

3 Results and Discussion

The survey was conducted from January 1 to 31, 2016. It was addressed to over 150 respondents representing suppliers and recipients of outsourcing services. The research used a specially constructed questionnaire built using the Survey Monkey program. 97 responses were obtained, 64 responses were complete (66%). Such sample size guarantees at the confidence level 0.9 obtaining the assessment of structure indicators with a maximum estimation error of no more than approx. 10%.

Firstly, the participants of the questionnaire surveys evaluated significance of particular determinants of profitability of the outsourcing organizations/shared service center in a scope of providing the financial-accounting services at present and for 2-3 years. The answers were classified in 5 groups: „no impact", „slight impact", „moderate impact", „big impact" and „very big impact" (table 1).

For the respondents the greatest importance has standardization and automation, next providing services from many locations, and on the third place, the most important determinant is an appropriate level of employee abilities and competence and their position classification.

Table 1 Classification of Answers of Respondents to the Question on an Impact of the Selected Determinants on Profitability of the Outsourcing Organizations/ Shared Service Center at Present

Question no.	No impact	Slight impact	Moderate impact	Big impact	Very big impact	Number of answers
1. Providing services from many geographical locations in the world		2	15	32	10	59
2. Supporting business by technological solutions in a scope of automation and analytical solutions		3	20	27	9	59
3. Appropriate level of employee abilities and competences and their position classification		1	16	35	7	59
4. Continuous process improvement programs (e.g. *lean*, *six sigma*)		2	22	28	7	59
5. Developing and procuring talents inside organization according to the adopted strategy		2	22	28	7	59
6. A greater possibility of scalability of operating activity		3	25	28	3	59
7. Supporting organization to realize mergers and acquisitions	3	14	26	14	2	59
8. Appropriate price model depending on a type of a service (e.g. the transaction fixed price model)		6	15	29	9	59
9. Quickness of implementing changes		4	18	27	10	59
10. Standardization and transformation		3	11	36	9	59

Source: the author's own elaboration on basis of a developed questionnaire

The ANOVA one-way analysis of variance was used in order to investigate if a position held at work can differentiate statistically significant factors influencing profitability of the outsourcing organizations or the center. The results of the one-way analysis of variance include: sums of squares of determinant deviations (*SS Effect*), degrees of freedom (*DF*), sums of squares of error deviations (*SS Error*), an average sum of squares of determinant deviations (*MS Effect*), an average sum of squares of error deviations (*MS Error*), statistic values of test *F* and *p-value*. The *p-value* results lower than 0,05 indicate statistically significant results.

On basis of the data from table 2 it should be noticed that a position held at work differentiates significantly two determining factors influencing profitability of outsourcing organizations/shared service center: an appropriate level of employee abilities and competences and their position, and continuous process improvement programs (e.g. *lean*, *six sigma*)[24]. An influence of an appropriate level of employee abilities and competences and their position now on profitability of the outsourcing organizations/shared service center was evaluated the highest by presidents, and the lowest – managers (table 3). An influence of continuous process improvement programs (e.g. *lean*, *six sigma*) on

[24] In these studies a significance level equal to 0,05 was taken.

profitability of the outsourcing organizations/shared service center was evaluated the highest by presidents, and the lowest – a director.

Table 2 The Results of One-way Analysis of Variance for the Determinants Influencing Profitability of the Outsourcing Organizations/shared Service Center Now Differentiated by a Type of a Position Held at Work

Question no	*SS Effect*	*DF*	*MS Effect*	*SS Error*	*Df*	*MS Error*	*F*	*p-value*
1	0,05304	2	0,02652	31,5740	56	0,56382	0,04704	0,95407
2	0,24753	2	0,12376	35,8541	56	0,64025	0,19331	0,82478
3	4,45841	2	2,22920	20,4907	56	0,36590	6,09229	0,00407**
4	3,81423	2	1,90711	27,0671	56	0,48334	3,94568	0,02439*
5	2,70312	2	1,35155	28,1782	56	0,50318	2,68602	0,07929
6	1,97807	2	0,98903	24,7338	56	0,44167	2,23928	0,11991
7	2,53174	2	1,26587	45,4004	56	0,81072	1,56141	0,21837
8	3,78162	2	1,89081	38,7268	56	0,69155	2,73416	0,07625
9	1,72352	2	0,86175	37,9375	56	0,67745	1,27205	0,28228
10	2,65368	2	1,32684	28,2615	56	0,50467	2,62912	0,08032

Significant differences at the level of : *** p<0,001; ** p<0,01; * p<0,05.
Source: the author's own elaboration on basis of a developed questionnaire

On basis of the data from table 3 it can be stated that the factor influencing profitability at present which was evaluated the highest by the presidents is standardization and transformation, by the mangers - quickness of implementing changes, and by the directors - an appropriate level of employee abilities and competences and their position classification.

Table 3 The Averages and Standard Deviations of Evaluation of the Determinants Influencing Profitability of the Outsourcing Organizations/shared Service at Present According to a Type of a Position Held at Work

Question no	Characteristic	President	Manager	Director	Total
1	Average	3,875	3,814815	3,875	3,847458
	Standard deviation	0,806226	0,786278	0,619139	0,738441
2	Average	3,6875	3,777778	3,625	3,711864
	Standard deviation	0,946485	0,640513	0,885061	0,788951
3	Average	4,125	3,518519	4,000	3,813559
	Standard deviation	0,619139	0,70002	0,365148	0,655864
4	Average	4,000	3,703704	3,3125	3,677966
	Standard deviation	0,632456	0,724028	0,704154	0,729683
5	Average	4,000	3,481481	3,6875	3,677966
	Standard deviation	0,730297	0,70002	0,704154	0,729683
6	Average	3,8125	3,37037	3,500	3,525424
	Standard deviation	0,655108	0,687702	0,632456	0,678638
7	Average	3,2500	2,962963	2,6875	2,966102
	Standard deviation	0,930949	0,758616	1,078193	0,909075
8	Average	3,6875	3,925926	3,3125	3,694915
	Standard deviation	1,014479	0,828619	0,60208	0,856099
9	Average	4,000	3,666667	3,5625	3,728814

	Standard deviation	0,894427	0,877058	0,629153	0,826928
10	Average	4,1875	3,814815	3,625	3,864407
	Standard deviation	0,7500	0,735738	0,619139	0,730083

Source: the author's own elaboration on basis of a developed questionnaire

Table 4 The Results of One-way Analysis of Variance for the Determinants Influencing Profitability of the Outsourcing Organizations/shared Service Now Differentiated by a Type of a Position Held at Work in 2-3 years

Question no	*SS Effect*	*DF*	*MS Effect*	*SS Error*	*Df*	*MS Error*	*F*	*p-value*
1	2,15980	2	1,07990	54,7893	56	0,978381	1,10376	0,33826
2	0,04520	2	0,02259	28,6666	56	0,511905	0,04415	0,95647
3	7,74329	2	3,87164	21,1041	56	0,376860	10,27343	0,0058***
4	2,70092	2	1,35045	33,6041	56	0,600074	2,25049	0,11479
5	3,21536	2	1,60767	29,7338	56	0,530961	3,02787	0,05641
6	1,00220	2	0,50109	31,5740	56	0,563823	0,88875	0,41688
7	3,78457	2	1,89228	56,3171	56	1,005663	1,88163	0,16184
8	7,53566	2	3,76783	47,8541	56	0,854539	4,40920	0,01661*
9	0,59153	2	0,29576	36,5949	56	0,653480	0,45260	0,63827
10	2,83777	2	1,41888	32,7893	56	0,585524	2,42327	0,09787

Significant differences at the level of: *** $p<0,001$; ** $p<0,01$; * $p<0,05$.

Source: the author's own elaboration on basis of a developed questionnaire

A position held at work differentiates significantly two determinants influencing profitability of the outsourcing organizations/shared service center at present (table 4): an appropriate level of employee abilities and competences and their position classification– an impact in 2–3 years, and an appropriate price model depending on a type of a service (e.g. the transaction fixed price model) – an impact in 2–3 years.

Table 5 The Averages and Standard Deviations of Evaluation of the Determinants Influencing Profitability of the Outsourcing Organizations/shared Service Center in 2-3 Years According to a Type of a Position Held at Work

Question no	Characteristic	President	Manager	Director	Total
1	Average	3,500	3,925926	3,9375	3,813559
	Standard deviation	1,032796	1,071517	0,771902	0,9909
2	Average	4,500	4,444444	4,500	4,474576
	Standard deviation	0,730297	0,751068	0,632456	0,703585
3	Average	4,3125	3,555556	4,2500	3,949153
	Standard deviation	0,478714	0,697982	0,57735	0,705245
4	Average	4,0625	3,888889	3,500	3,830508
	Standard deviation	0,680074	0,800641	0,816497	0,79117
5	Average	4,1875	3,62963	3,750	3,813559
	Standard deviation	0,655108	0,791695	0,68313	0,753717
6	Average	4,1250	3,814815	3,875	3,915254
	Standard deviation	0,619139	0,735738	0,885061	0,74944
7	Average	3,625	3,296296	2,9375	3,288136
	Standard deviation	0,957427	0,775332	1,340087	1,017957
8	Average	4,1250	4,111111	3,3125	3,898305

	Standard deviation	0,885061	1,012739	0,7932	0,97724
9	Average	4,375	4,148148	4,3125	4,254237
	Standard deviation	0,619139	0,988538	0,60208	0,800716
10	Average	4,500	4,074074	3,9375	4,152542
	Standard deviation	0,632456	0,828619	0,771902	0,783748

Source: the author's own elaboration on basis of a developed questionnaire

The perspective influence of an appropriate level of employee abilities and competences and their position classification on profitability of the outsourcing organizations/shared service center were evaluated the highest by the presidents, and the lowest – by the managers (table 5). The perspective influence of an appropriate price model depending on a type of a service on profitability of the outsourcing organizations/shared service center was evaluated the highest by the president, and the lowest – by the managers. The determinants influencing profitability in the perspective of 2-3 years which was evaluated the highest by the presidents are supporting business by technological solutions in a scope of automation and analytical solutions and standardization and transformation, and by the managers and directors – supporting business by technological solutions in a scope of automation (table 5).

4 Conclusions

In the new global economy enterprises are forced to undertake initiatives adjusted to changing conditions of the environment and to look for innovatory solutions anticipating the market needs and giving an opportunity to increase competiveness and brand profitability. Such thinking imposes flexibility, a necessity of system reconstruction and structural changes in a firm, what will allow it to implement new procedures and measures in compliance with methods of modern management and the global market principles. The firms which do not have any skills of adaptation to the changing situation on the market and new business challenges, stop developing gradually, and with time they lose an ability to meet environment needs, what results in a decrease of their profitability, or limiting a scale of their activity. It is connected with the fact that operating of enterprises in the age of the market globalization is determined equally by what goes on in its environment and by what goes on in it itself, but external conditions often influence more a possibility of conducting an activity than internal conditions of an enterprise.

To sum up the results of these studies it can be assumed that according to the respondents the most important determinants of profitability influencing profitability of operating of the outsourcing centers are: standardization and automation, next – providing services from many locations, and then –an appropriate level of employee abilities and competences and position classification. In the perspective of 2-3 years the greatest importance for the respondents will have supporting business by technological solutions in a scope of automation and analytical solutions. The second most important factor will be quickness of implementing changes, whereas the third one– standardization and transformation. The results are similar to research prepared by KPMG and HfS. They also paid attention to technological impact, implementing global services, following process and industry trends, operating maturity and readiness. Surprisingly they haven't mention human factor and abilities and competences.

It seems that in the nearest years new technologies and innovations will determine success of the outsourcing enterprises to the greatest extent. In a scope of future trends of studies they should be, undoubtedly, enlarged by the outsourcing centers located also in other states, also including profitability determinants of the outsourcing centers not verified so far.

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Competitiveness of V4 Countries in the Field of Higher Education

Elena Širá[1], Dana Kiseľáková[2], Beáta Šofranková[2]

[1] University of Prešov
Faculty of Management, Department of Economic Sciences and Economy
Konštantínova 16, 080 01 Prešov, Slovak Republic
E-mail: elena.sira@unipo.sk, elena.sira1@gmail.com

[2] University of Prešov
Faculty of Management, Department of Finance
Konštantínova 16, 080 01 Prešov, Slovak Republic
E-mail: dana.kiselakova@unipo.sk, beata.sofrankova@unipo.sk

Abstract: *The aim of the article is to analyse the competitiveness of selected countries in the field of higher education. We choose countries from the group named V4 - the Czech Republic, The Slovak Republic, Hungary and Poland. From the organisations, that evaluate the competitiveness of the countries, we choose the World Economic Forum. This organisation published the Global Competitiveness Index. The fifth pillar of that index is dedicated to higher education and training. So we analyse the position of V4 countries in this 5th pillar during the 5 years period and try to show, which country is the most competitive in this pillar. In the next part of the article, we analyse other factors, which may affect the competitiveness in higher education. The dependence between selected indicators, the position in the 5th pillar of GCI is analysed according to position of the countries in world known ranking from the area of education.*

Keywords: V4 countries, higher education, Global Competitiveness Index

JEL codes: O11, I25

1 Introduction

The first definition of competitiveness was given by Porter (1990). He identifies this phenomenon as the ability of the country to create innovations in order to achieve advantages over other nations. (Despotovic et al., 2016) Competitiveness is regarded in the contribution as the set of institutions, policies, and factors that determine the level of productivity of a country. The total factor productivity is a key factor for economic growth in macroeconomics theory. (Soukup, 2017) Competitiveness is a factor of economic growth, that forces innovation (Mokrišová, 2016) and increases productivity (Vavrek, Adamišin, Kotulič, 2017), (Kowal, Paliwoda-Pękosz, 2017). The basic prerequisite for the growing living standard of the country's population is long-term sustainable competitiveness of the domestic economy, which is conditioned by the competitiveness of its businesses. (Hečková, Chapčáková, 2011)

The role of education in the highlight of competitiveness can be described as follows. The U.S. government reported that high personal education levels equated to greater lifetime monetary earnings. On average, personal income has risen approximately 10 percent for every additional year of schooling. In impoverished nations, the personal income gains can be as large as 20 percent for each additional year of schooling. Research has not shown a linear relationship between the general level of education attainment and a nation’s gross domestic product (GDP). (Krueger, Lindhal, 2001 In Tienken, 2008)

The relationship between education and national economic growth slopes upward at lower levels of education (primary grades K–4), then plateaus at middle school levels (grades 5–8), then falls downward at secondary and postsecondary levels (Krueger, 1999). Increases in the general population’s education level may have a greater influence on the economy in nations (Bednarova et al., 2014) with nonexistent or lower-performing economies than in highly developed economies because economically low-performing countries lack the critical mass of human capital necessary to build a high-functioning economy. Nations with strong economies (e.g., the top 22 nations on the Growth Competitiveness Index)

demonstrate a weaker relationship between increases in education attainment and economic growth. (Tienken, 2008)

To conclude it, we can say, that labour productivity and economic growth are key factors to maintain and improve the competiveness of nations in the global market. It is related to the fact that labour productivity depends on the availability and quality of labour resources and applied technologies. As a result, labour productivity heavily influences the production process and production costs. And production costs affect the competiveness of nations in the global market. (Auzina-Emsina, 2014)

2 Methodology and Data

In this part, we try to set the aim and the methods, which we have used in this study. The aim of the paper is to analyse the competitiveness of selected countries in the field of higher education. From the organisations, that evaluate the competitiveness of the countries, we choose the World Economic Forum. This organisation published the Global Competitiveness Index every year. They are the most famous world institutions dealing with the competitiveness of the national economy. (Gavurova et al., 2016)

The Global Competitiveness Report has long been a globally recognized ranking of country competitiveness and a tool for benchmarking country strengths and weaknesses (Porter, Delgado, Keters, Stern, 2008) The global competitiveness is defined in terms of the set of institutions, policies, and factors that determine the level of productivity of an economy which in turn results in the prosperity of the country. (John, Duangekanog, Wichayachakorn, Vikitset, 2017) This index consists of 114 indicators, which are grouped into 12 pillars. The fifth pillar of that index is dedicated to higher education and training. We try to show, which country is the most competitive in this pillar. To obtain the comparable results, we calculate the average values in case of GCI and the 5th pillar score.

In the next part of this study, we analysed other factors, which may affect the competitiveness in higher education. We have chosen indicators typical for the mentioned area. We analysed:

- Employment rates of young people from 15 - 34 years,
- Young people (15 - 34 years) neither in employment nor in education and training (%),
- Population by educational attainment level (%).

Finally, we have compared our results from analysis with ranking. We have chosen Human Development Index to compare the countries in this world known ranking.

For our study, we have chosen countries from the group named V4 - the Czech Republic, The Slovak Republic, Hungary and Poland. The period for analyses was set to 5 years, from 2013 to 2017. The data sources for our comparison were Eurostat, WE Forum and statistical offices of V4 countries.

3 Results and Discussion

Firstly, we have investigated the competitiveness of the selected countries. According to overall Global Competitiveness Index (GCI) in selected period, we can say, that the best competitive country is the Czech Republic. This economy obtained the best competitive position from V4 countries in the last 3 years. The score of this country has rising tendency. On the second place was Poland. Its score rises every year. (Sawicz, 2017) Slovakia is actually on the third place from V4 countries. Its position rapidly rose up in the last years (Širá et al., 2017).

Table 1 The position of Selected Countries in GCI

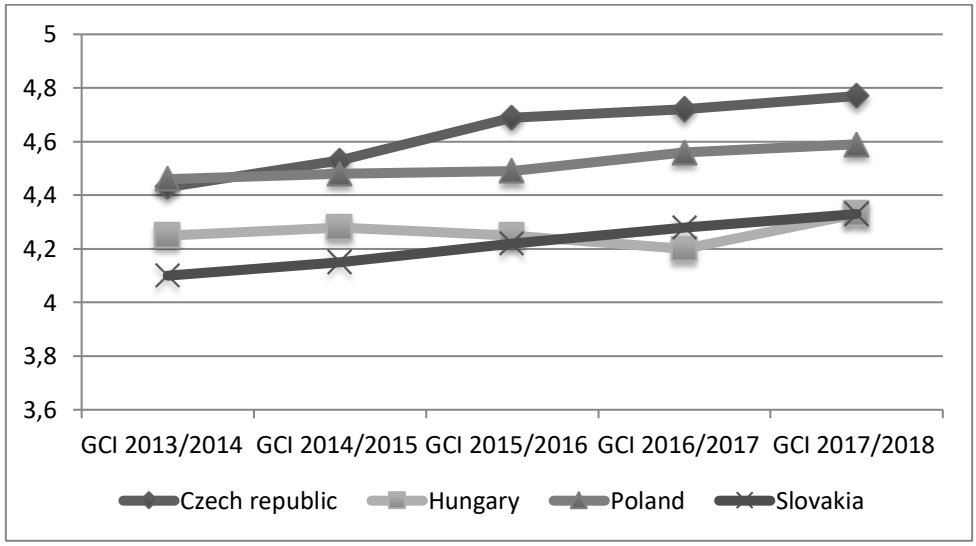
Country	GCI 2013/2014 Score (position)	GCI 2014/2015 Score (position)	GCI 2015/2016 Score (position)	GCI 2016/2017 Score (position)	GCI 2017/2018 Score (position)	ø GCI score

Czech Republic	4,43 (46)	4,53 (37)	4,69 (31)	4,72 (31)	4,77 (31)	**4,63**
Hungary	4,25 (63)	4,28 (60)	4,25 (63)	4,2 (69)	4,33 (60)	**4,26**
Poland	4,46 (42)	4,48 (43)	4,49 (41)	4,56 (36)	4,59 (39)	**4,52**
Slovakia	4,10 (78)	4,15 (75)	4,22 (67)	4,28 (65)	4,33 (59)	**4,22**

Source: own processing according to Global competitiveness reports

When we have compared the scores among V4 countries and have found, that there are little differences among them. We can see this in the case of average scores. But in their positions, there are big differences. It is caused by the large number of analysed countries with similar scores.

Figure 1 GCI Score of V4 Countries



Source: own processing according to data from WE Forum

In the Table 2, we have analysed the position and the score of V4 countries in the 5th pillar of GCI. We can see, that the best position has almost had the Czech Republic. The worst position has Hungary, with the lowest score of all analysed countries. The position of Poland and Slovakia has worsen among the analysed period. When we look at the year 2013, we can see, that Poland, the Czech Republic and Hungary have similar scores. But 4 years later the situation has changed and there are bigger differences among mentioned countries.

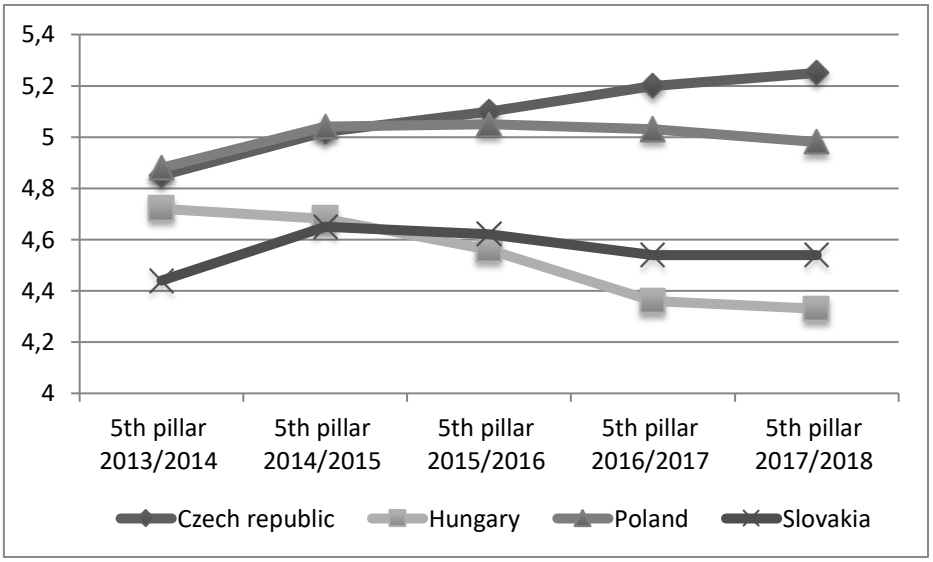
Table 2 The Position of Selected Countries in the 5th pillar of GCI

Country	5th pillar 2013/2014 Score (position)	5th pillar 2014/2015 Score (position)	5th pillar 2015/2016 Score (position)	5th pillar 2016/2017 Score (position)	5th pillar 2017/2018 Score (position)	ø 5th pillar score
Czech republic	4,85 (39)	5,02 (35)	5,1 (29)	5,2 (27)	5,25 (27)	**5,08**
Hungary	4,72 (44)	4,68 (52)	4,56 (57)	4,36 (72)	4,33 (73)	**4,53**
Poland	4,88 (37)	5,04 (34)	5,05 (31)	5,03 (37)	4,98 (40)	**5**
Slovakia	4,44 (58)	4,65 (56)	4,62 (53)	4,54 (61)	4,54 (62)	**4,56**

Source: own processing according to Global competitiveness reports

When we calculate the average score of 5th pillar, we can see, that there are bigger differences among V4 countries, that average score of GCI. Poland and the Czech Republic have similar average score value, about 5. Hungary and Slovakia have similar average of 5th pillar values, about 4,5, too.

Figure 2 5th Pillar Score of V4 Countries



Source: own processing according to data from WE Forum

Now, we have studied development of other indicators typical for the area of education. These indicators will help us to complete our image of education. This is due to the better complexity of analysed area.

Employment of young people is very important. This factor gives us the first view on educational system of the country, because the correct educational system prepares the young people for the labour market. So they do not have any problems to be employed. But, of course, we must take into account the current unemployment rate and from this perspective to analyse the employment of young people.

Table 3 Employment Rates of Young People from 15 - 34 Years (%)

	2013	2014	2015	2016	2017	Overal employment rate 2017
Czech Republic	77,9	78,8	80,2	84,5	87,6	**78,5**
Hungary	69,3	72,8	76,3	80,0	79,5	**73,5**
Poland	71,2	73,3	75,5	78,2	80,4	**70,9**
Slovakia	67,9	69,7	71,5	76,9	77,4	**71,1**

Source: own processing according to data from Eurostat

The best possibilities for young people employment are in the Czech Republic. In Poland and Hungary the situation is similar. In all V4 countries situation has improved during the analysed period. When we compare it with the overall employment rate in the last analysed year, the situation in employment of young people is in all V4 countries better.

Table 4 Young People (15 - 34 years) Neither in Employment Not in Education and Training (%)

	2013	2014	2015	2016	2017
Czech Republic	15,6	15,0	14,9	13,6	12,4
Hungary	20,4	18,1	16,9	15,8	15,0
Poland	17,4	16,7	15,8	15,1	14,3
Slovakia	21,5	21,4	19,9	18,2	18,6

Source: own processing according to data from Eurostat

The lowest values of young people neither in employment nor in education and training were in the Czech Republic. But the other analysed countries have these values on similar level. But the positive of this indicator is, that during the analysed period in all V4 countries, these values have decreased.

Table 5 Population by Educational Attainment Level, Upper Secondary and Post-secondary Non-tertiary Education (%)

	2013	2014	2015	2016	2017
Czech Republic	69,0	68,5	67,8	67,1	66,5
Hungary	57,8	57,7	57,2	57,6	58,0
Poland	61,3	60,7	60,3	60,2	59,8
Slovakia	67,5	66,7	66,5	66,0	64,5

Source: own processing according to data from Eurostat

The last indicator selected from the area of education is educational attainment level. Upper secondary and post secondary educational attainment level was in Hungary and Poland at an unchanging level and in the Czech Republic and Slovakia it was slightly declining. But overall, the level of this indicator is similar in all countries, where the highest values were in the Czech Republic and Slovakia.

Finally, we compare the position of V4 countries in ranking dedicated to educational level of the country.

The Human Development Index (HDI), is a composite statistic index. This index takes into account human health, literacy levels, education and per capita income. (Meričková et al., 2017) These indicators are used to rank countries. When the country score is higher, then the education, lifespan and GDP per capita is higher.

Table 6 HDI index 2015

	Score	Rank
Czech Republic	0,878	28
Hungary	0,836	43
Poland	0,855	36
Slovakia	0,845	40

Source: own processing

When we compare the score of this index in V4 countries in 2015, we can see similar values among the countries. The better position in HDI ranking has the Czech Republic, the worse has Hungary.

4 Conclusions

We have analysed V4 countries according to their competitiveness, especially in the field of education. The best position in competitiveness ranking of the 5th pillar of GCI has

obtained the Czech Republic. This country was the most successful in all analysed indicators from the area of education, too.

The competitiveness of Slovakia was according to average GCI score during analysed period 2013 - 2017 the worst from V4 countries. But in the 5th pillar, the position of Slovakia was higher than in Hungary. When we analysed indicator typical for the area of education, only in one indicator (educational attainment level) was Slovakia on the second place. The development of all indicators show that, Slovakia did not even rank in HDI in the top positions among the analysed countries.

If the country wants to become competitive, it must have, according to our meaning, good results in education area. Because good education system can prepare the young people to be employable, and to best perform their work, and so, we can expect the grow in other macroeconomy indicators and finally the grow in the competitive level of the country.

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Copulas and Credit Risk Models

Yuan Tian

VŠB – Technical University of Ostrava
Faculty of Economics, Department of Finance
Sokolská třída 33, 702 00 Ostrava 1, Czech Republic
E-mail: yuan.tian@vsb.cz

Abstract: *The topic of this paper is copulas and credit risk models. Generally, there is a core implicit assumption of credit risk models that the critical variables are normally distributed, which is too simplified in the reality. There is no compelling reason for choosing the normal distribution. Therefore, the goal of this paper is to find out the real distributions based on the concept of copulas and then better quantify the credit risk. There is a portfolio that consists of ten bonds issued by quoted companies in the Frankfurt Stock Exchange (FSE) with a 10-million-euro total nominal value over one year, from January 9th, 2017 to January 8th, 2018. The credit risk of the portfolio is quantified under the framework of the CreditMetrics™ model, a typical industry example of the threshold models. Two main types of copulas include elliptical copulas and Archimedean copulas. The parameters of a parametric copula are estimated by MLE and then the copula is selected by computing AIC and BIC. Compared with the original CreditMetrics™ model with an assumption of normal distribution, the probability density curve obtained based on copulas are more right-tailed and the credit risk of the portfolio is better quantified.*

Keywords credit risk, copula, CreditMetrics™, distribution function, Value-at-Risk

JEL codes: G11, G21, G24, G31

1 Introduction

Bank regulators encourage banks to devote many resources to better quantify the financial risks they are faced with and credit risk is typically considered the most important financial risk. There is a basic assumption that the critical variables are normally distributed. However, this assumption is too simplified in the reality and there is no compelling reason for choosing the normal distribution, so the goal of this paper is to remove this assumption and try to find out the real distributions based on the concept of copulas. One of typical industry model, the CreditMetrics™ model (Cupton, 1997), is applied to a portfolio consisting of 10 bonds traded on the Frankfurt Stock Exchange (FSE). Each bond is represented equally in a nominal value of 1 million euro. Under the framework of the CreditMetrics™ model, the normal distribution is replaced by the real distributions based on copulas to quantify the credit risk of the portfolio more precisely.

2 Credit risk models and copula functions

Credit risk models can typically be classified into the structural and reduced-form models. The structural models assume that defaults occur when the value of the firm falls below a certain default point and a certain recovery is paid; while the reduced-form models assume that defaults occur exogenously and are unpredictable, and a separately specified recovery is paid. Frey and McNeil (2001) points out that the asset correlations are not enough to describe dependence between defaults and it is the copula of the latent variables that determines the higher order joint default probabilities for obligors, and thus determines the extreme risk in the portfolio. McNeil et al. (2015) proves that the loss distributions implied by threshold models are very sensitive to the copula of the critical variables. Therefore, it is reasonable to calibrate the dependence models for the critical variables based on the concept of copulas.

Threshold models

The threshold models are the multivariate versions of the Merton model for portfolio credit risk over a predetermined time horizon. The threshold models assume that the default occurs when the latent variable (X_i) lie below the critical deterministic thresholds (d_i) at

the maturity (T). In the threshold models, we write $\boldsymbol{V}_t = \left(V_{t,1}, \cdots, V_{t,m}\right)$ and $\boldsymbol{B} = (B_1, \cdots, B_m)'$ in a m-dimensional space, a threshold model therefore can be given by $(\boldsymbol{V}_T, \boldsymbol{B})$. Let $\boldsymbol{X} = (X_1, \cdots, X_m)'$ be the m-dimensional random vector of the latent variables, the model is equivalent to $(\boldsymbol{X}, \boldsymbol{d})$ with:

$$X_i = \frac{\ln\left(\frac{V_{T,i}}{V_{0,i}}\right) - \left(\mu_i - \frac{1}{2}\sigma^2\right)T}{\sigma_i\sqrt{T}}, \ \forall i = 1, \cdots, m, \tag{1}$$

$$d_i = \frac{\ln\left(\frac{B_i}{V_{0,i}}\right) - \left(\mu_i - \frac{1}{2}\sigma^2\right)T}{\sigma_i\sqrt{T}}, \ \forall i = 1, \cdots, m. \tag{2}$$

Mixture models

The mixture models assume defaults of individual companies to be conditionally independent given a set of common factors, which are usually interpreted as macroeconomics variables and stochastically modelled.

The Bernoulli mixture models are special cases of general mixture models, where the dependence is modelled by a vector of random variables $\boldsymbol{L} = (L_1, \cdots, L_m)$, which is called a Bernoulli loss statistic. If all marginal distributions of $\boldsymbol{L}$ are Bernoulli, namely $L_i \sim B(1, p_i)$, the total loss is defined as $L^{(m)} = \sum_{i=1}^{m} L_i$. Given some $p < m$ and a p-dimensional random vector $\boldsymbol{\psi} = \left(\psi_1, \cdots, \psi_p\right)'$, the random vector $\boldsymbol{Y} = (Y_1, \cdots, Y_m)'$ follows a Bernoulli mixture model with factor vector $\boldsymbol{\psi}$ if there are functions $p_i: \mathbb{R}^p \to [0,1]$, $1 \le i \le m$, such that, conditional on $\boldsymbol{\psi}$, the components of $\boldsymbol{Y}$ are independent Bernoulli random variables satisfying $P(Y_i = 1 | \boldsymbol{\psi} = \psi) = p_i(\psi)$.

Let $\boldsymbol{y} = (y_1, \cdots, y_m)'$ in $\{0,1\}^m$ be a random vector that represents which obligors defaulted and which survived. Since the default indicator $\boldsymbol{Y}$ are conditionally independent, so:

$$P(\boldsymbol{Y} = y | \boldsymbol{\psi} = \psi) = \prod_{i=1}^{m} P(Y_i = y_i | \boldsymbol{\psi} = \psi) = \prod_{i=1}^{m} p_i(\psi)^{y_i}\left(1 - p_i(\psi)\right)^{1-y_i}, \tag{3}$$

where the default probability of the company i is given by $p_i = P(Y_i = 1) = E\left(p_i(\boldsymbol{\psi})\right)$ and the unconditional distribution of the default indicator vector Y is obtained by integrating over the distribution of the factor vector $\boldsymbol{\psi}$.

Copula functions

A copula uses a marginally standard uniform representation of a multivariate distribution function. In other words, an m-dimensional copula is a fixed distribution function C: $[0,1]^m \to [0,1]$ of a vector of random variables $(U_1, \cdots, U_m)$, namely $C(u_1, \cdots, u_m) = P(U_1 \le u_1, \cdots, U_m \le u_m)$, where $P(U_i \le u_i) = u_i$ and $u_i \in [0,1]$ for all i. There are three properties that a copula must hold:

- $C(u_1, \cdots, u_m) = 0$ if $u_i = 0$ for any i,
- $C(1, \cdots, 1, u_i, 1, \cdots, 1) = u_i$ for all $i \in \{1, \cdots, m\}$, $u_i \in [0,1]$,
- for all $(a_1, \cdots, a_m), (b_1, \cdots, b_m) \in [0,1]^m$ with $a_i \le b_i$ we have $\sum_{i_1=1}^{2} \cdots \sum_{i_m=1}^{2} (-1)^{i_1 + \cdots + i_m} C\left(u_{1i_1}, \cdots, u_{mi_m}\right) \ge 0$, where $u_{j1} = a_j$ and $u_{j2} = b_j$ for all $j \in \{1, \cdots, m\}$.

The central theorem is called Sklar's Theorem, which provides a valuable result on the uniqueness of copulas for continuous random variables. Let F be a joint distribution function with margins $F_1, \cdots, F_m$. Then there exists a copula C: $[0,1]^m \to [0,1]$ such that, for all $x_1, \cdots, x_m$ in $\overline{\mathbb{R}} = [-\infty, \infty]$,

$$F(x_1, \cdots, x_m) = C\left(F_1(x_1), \cdots, F_m(x_m)\right). \tag{4}$$

If the margins are continuous, then C is unique; otherwise C is uniquely determined on $Ran\, F_1 \times Ran\, F_2 \times \cdots \times Ran\, F_m$, where $Ran\, F_i = F_i(\overline{\mathbb{R}})$ denotes the range of F_i. Conversely, if C is a copula and $F_1, \cdots, F_m$ are univariate distribution functions, then the function F defined in (4) is a joint function with margins $F_1, \cdots, F_m$.

The Gaussian copula C_Σ^{Ga} with the correlation matrix Σ is defined as:

$$C_\Sigma^{Ga}(u_1, \cdots, u_m) \coloneqq \varphi_m(\varphi^{-1}(u_1), \cdots, \varphi^{-1}(u_m); \Sigma), \tag{5}$$

where φ_m is the standard *m*-dimensional normal distribution function, φ^{-1} is the inverse of the standard univariate normal distribution function, and $\Sigma_{ij} = E\left(\varphi^{-1}(U_i)\varphi^{-1}(U_j)\right)$ for $i,j \in \{1,\cdots,m\}$.

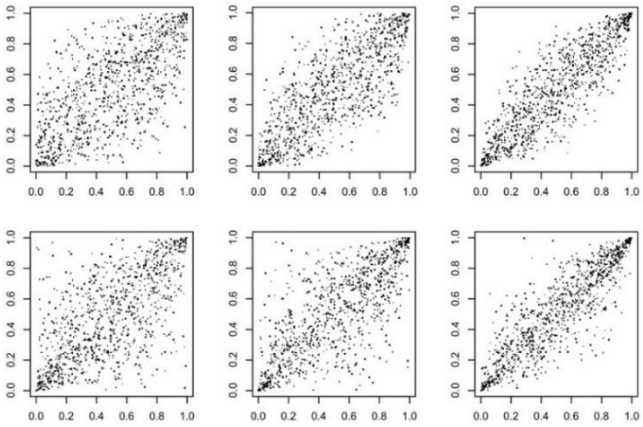
The *t* copula $C_{v,\Sigma}^{t}$ with the correlation matrix Σ and and *υ* degrees of freedom is:

$$C_{v,\Sigma}^{t}(u_1,\cdots,u_m) \coloneqq t_m(t_v^{-1}(u_1),\cdots,t_v^{-1}(u_m);v,\Sigma), \tag{6}$$

where t_m is the *m*-dimensional *t*-distribution with zero mean and t_v is the inverse of the univariate *t*-distribution with *υ* degrees of freedom.

We show 1000 simulated random variates from the bivariate Gaussian copula and the bivariate *t* copula in Figure 1. The first row presents the Gaussian copula with the correlation coefficient equals to 0.7, 0.8, and 0.9, and the second row presents the *t* copula with the degree of freedom equals to 3 and the correlation coefficient equals to 0.7, 0.8, and 0.9.

Figure 1 Generation of 1000 Random Variates from the Gaussian Copula and *t* copula



Source: own processing

Archimedean copulas usually have simple closed forms and are important for modelling the portfolio credit risk. Let the function $\varphi: [0,1] \to [0,\infty)$ be a continuous, convex, and strictly decreasing function, which is subject to $\varphi(0) = \infty$ and $\varphi(1) = 0$. The Archimedean copula based on the generator φ is defined as:

$$C(u_1,\cdots,u_m) = \varphi^{-1}\big(\varphi(u_1) + \cdots + \varphi(u_m)\big) = \varphi^{-1}(\textstyle\sum_{i=1}^{m}\varphi(u_i)), \tag{7}$$

where φ^{-1} is the pseudo-inverse function of φ.

Table 1 below summarizes the three well-known Archimedean copulas include Gumbel copula (Gumbel, 1960), Clayton copula (Clayton, 1978), and Frank copula (Frank, 1979).

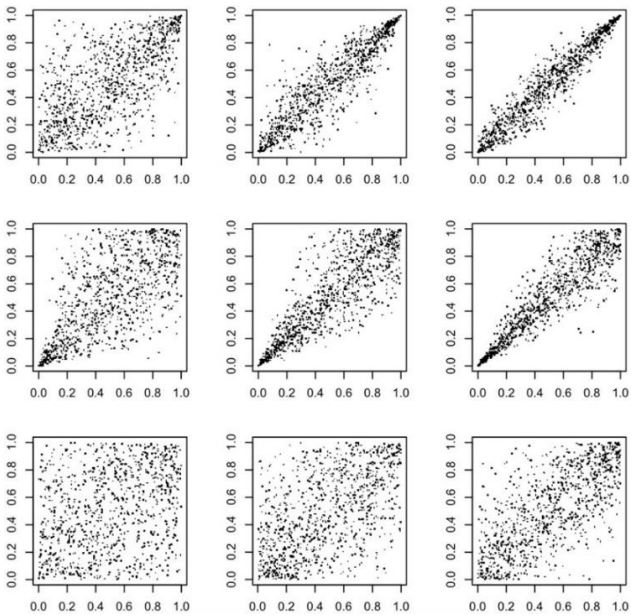
Table 1 Three Important Archimedean Copulas

Name	Generator	Generator inverse	Function	Parameter
Gumbel	$(-\ln t)^{\theta}$	$\exp\left[(-t)^{\frac{1}{\theta}}\right]$	$exp\left\{-\left[\sum_{i=1}^{m}(-\ln u_i)^{\theta}\right]^{\frac{1}{\theta}}\right\}$	$\theta \in [1,\infty)$
Clayton	$\frac{1}{\theta}\left(t^{-\theta}-1\right)$	$(1+\theta t)^{-\frac{1}{\theta}}$	$\max\left[\left(\sum_{i=1}^{m} u_i{}^{-\theta} - n + 1\right)^{-\frac{1}{\theta}}, 0\right]$	$\theta \in [-1,\infty)\backslash\{0\}$
Frank	$-\ln\frac{e^{-\theta t}-1}{e^{-\theta}-1}$	$-\frac{1}{\theta}\ln\left[1+e^{t}\left(e^{-\theta}-1\right)\right]$	$-\frac{1}{\theta}\ln\left[1+\frac{\prod_{i=1}^{m}\left(e^{-\theta u_i}-1\right)}{\left(e^{-\theta}-1\right)^{m-1}}\right]$	$\theta \in \mathbb{R}\backslash\{0\}$

Source: own processing

We show 1000 simulated random variates from the Gumbel copula, Clayton copula, and Frank copula in Figure 2. The first row presents the Gumbel copula, the second row presents the Clayton copula, and the third row presents the Frank copula with the parameter alpha equals to 2, 4, and 6 in three different columns respectively.

Figure 2 Generation of 1000 Random Variates from the Gumbel Copula, Clayton Copula, and Frank Copula



Source: own processing

Fitting a copula to data

The main method of estimating the parameters θ of a parametric copula C_θ is maximum likelihood estimation (MLE). We will estimate margins and construct a pseudo-sample of observations from the copula. Then we will estimate the copula parameters from the pseudo-sample by MLE.

We firstly assume that an individual data vector is $X_d = (X_{t,1}, \cdots, X_{t,d})'$, $t \in \{1, \cdots, n\}$, then the pseudo-sample observations are plotted at the coordinates $\left(\frac{rank\,(X_{t,i})}{n+1}, \frac{rank\,(X_{t,j})}{n+1}\right)$, where $rank\,(X_{t,i})$ is the rank of $X_{t,i}$ in $X_{1,i}, \cdots, X_{n,i}$. Let $\hat{F}_1, \cdots, \hat{F}_d$ denote estimates of the marginal distribution functions, and the pseudo-sample from the copula $\widehat{U}_t$ consists of $\widehat{U}_1, \cdots, \widehat{U}_n$:

$$\widehat{U}_t = \left(\widehat{U}_{t,1}, \cdots, \widehat{U}_{t,d}\right)' = \left(\hat{F}_1(X_{t,1}), \cdots, \hat{F}_d(X_{t,d})\right)'. \tag{8}$$

The MLE is obtained by maximizing:

$$\ln L\left(\theta; \widehat{U}_1, \cdots, \widehat{U}_n\right) = \sum_{t=1}^{n} \ln c_\theta\left(\widehat{U}_t\right), \tag{9}$$

with respect to θ, where c_θ is the copula density given by $c(u_1, \cdots, u_d) = \frac{\partial C(u_1, \cdots, u_d)}{\partial u_1 \cdots \partial u_d}$.

Then we select the copulas by computing Akaike and Bayesian information Criteria (AIC and BIC, respectively) for all available copulas and the copula with the minimum value is chosen. For observations $u_{,j}$, $i \in \{1, \cdots, n\}$, $j \in \{1, 2\}$, the AIC of a bivariate copula c with parameter(s) θ is given by:

$$AIC := -2 \sum_{i=1}^{n} \left[c\left(u_{i,1}, u_{i,2} \middle| \theta\right)\right] + 2k, \tag{10}$$

where $k = 1$ for one-parameter copulas and $k = 2$ for two-parameter copulas. Similarly, the BIC is given by:

$$BIC := -2 \sum_{i=1}^{n} \left[c\left(u_{i,1}, u_{i,2} \middle| \theta\right)\right] + \ln(n)\, k. \tag{11}$$

Note that if the BIC is chosen, the penalty for two-parameter copulas is stronger.

3 CreditMetrics™ based on copulas

There is a portfolio that consists of ten debt assets traded on the Frankfurt Stock Exchange (FSE) with a total nominal value of 10 million euro. Each bond is represented equally in a nominal value of 1 million euro in order to avoid bias caused by high nominal values of bonds. The basic information about these bonds are presented in Table 2.

Table 2 Basic Information of Ten Bonds

Name	Ratings	Coupon	Nominal value	Maturity	Market price	Pcs.
Deutsche Post	A-	2,75%	1 000 €	10/2023	113,67%	1 000
E. ON	A-	5,80%	1 000 €	4/2018	106,69%	1 000
Metro	BBB-	1,50%	1 000 €	3/2025	100,01%	1 000
Volkswagen	A+	2,37%	100 000 €	9/2020	105,80%	10
NIKE	AA-	2,25%	2 000 €	5/2023	99,98%	500
Commerzbank	BBB+	0,08%	1 000 €	6/2023	97,34%	1 000
Bayer	A-	1,87%	1 000 €	1/2021	107,25%	1 000
Nestle Holdings	AA	4,25%	2 000 €	3/2020	104,26%	500
Danone	BBB+	3,00%	200 000 €	6/2022	101,54%	5

Source: Frankfurt Stock Exchange (FSE).

The recovery rate of the senior unsecured class is shown in Table 3.

Table 3 Recovery Rate of the Senior Unsecured

Seniority Class	Mean	Standard Deviation
Senior Unsecured	51.13%	25.45%

Source: Carty & Lieberman [96a].

The values of the risk-free rate from 2017 to 2026 are derived from the interest rate swaps (IRS), which can be found on the official website of the Deutsche Bundesbank. The forward rates are shown in Table 4.

Table 4 Spot Rates (IRS) and Forward Rates (f_n^F) from 2017 to 2026 (%)

Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
IRS	-0.16	-0.18	-0.12	-0.03	0.08	0.20	0.32	0.45	0.56	0.68
f_n^F	-0.16	-0.19	-0.01	0.23	0.51	0.82	1.02	1.38	1.49	1.69

Source: Deutsche Bundesbank.

We can use the `VineCopula` package in R to select an appropriate bivariate copula by maximum likelihood estimation according to AIC and BIC through the function `BiCopSelect`. Note that we transfer the selection algorithm into the pseudo-observations in the interval of [0,1] using the function `pobs`. Let us take the calculation of the correlation coefficient between Deutsche Post and E.ON as an example. Note that we narrow the range of the possible families to select from for the simplification, which means we select the appropriate copula only from the basic elliptical and Archimedean copulas we introduced, namely Gaussian, *t*, Gumbel, Clayton, and Frank copula.

```
library("readxl")
DP <- read_excel("Credit Risk_Copula.xlsx")[,1]
EON <- read_excel("Credit Risk_Copula.xlsx")[,2]
library(VineCopula)
u1 <- pobs(as.matrix(cbind(DP,EON)))[,1]
u2 <- pobs(as.matrix(cbind(DP,EON)))[,2]
selectedCopula <- BiCopSelect(u1,u2,familyset=1:5)
selectedCopula
```

Bivariate **copula: t (par = 0.58, par2 = 3.44, tau = 0.39)**

The fitting algorithm select a *t* copula for the input data. It estimates that the rho is 0.58, degree of freedom is 3.44, and Kendall's tau is 0.39. Then we can use the `copula` package to double check the parameters by the suggested copula.

```
library(copula)
t.cop <- tCopula(dim=2)
set.seed(500)
m <- pobs(as.matrix(cbind(DP,EON)))
fit <- fitCopula(t.cop,m,method='ml')
coef(fit)
    rho.1          df
0.5772656   3.4360974
```

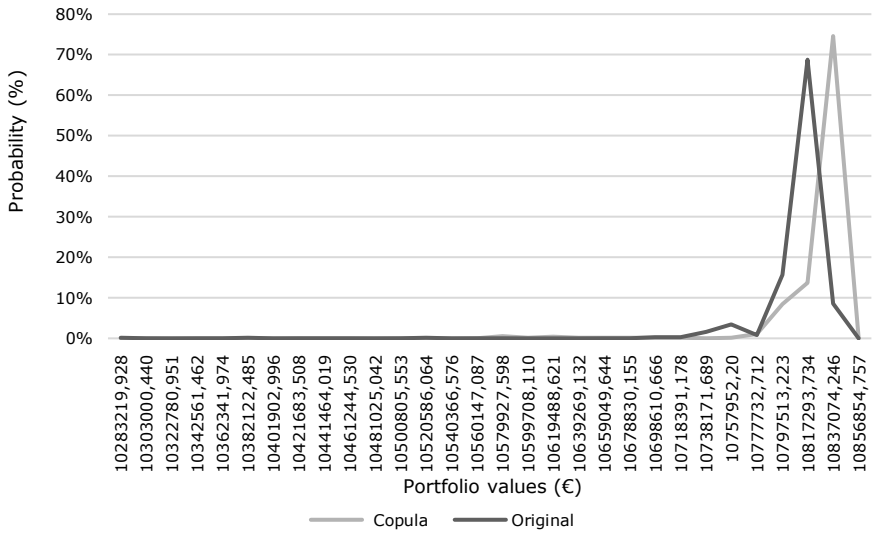
It is good to see that the parameters of the fitted copula are nearly the same as those estimated by the function `BiCopSelect`. We then can build the copula and obtain the correlation coefficient. The function `rCopula` generates the random variables.

```
u <- rCopula(254,tCopula(dim=2,rho,df=df))
cor(u,method='spearman')
          [,1]      [,2]
[1,] 1.000000  0.552392
[2,] 0.552392  1.000000
```

We can obtain all correlation coefficients in the similar way and establish the correlation matrix of the portfolio based on the copulas.

Under the framework of the CreditMetrics™ model, we can obtain the probability density curve of the portfolio value as presented in Figure 3. It is obvious that the results based on copulas are more right-tailed and the peak point is greater compared with the original results, because the real data in the portfolio follow the student's *t*-distribution, which is better at reflecting the extreme values than the normal distribution. For the original results, the maximal probability is 68.76% when the portfolio value is 10,796,195 €; while for the results based on copulas, the maximal probability is 74.59% when the portfolio value is 10,838,269 €.

Figure 3 Probability Density Curve of the Portfolio Values

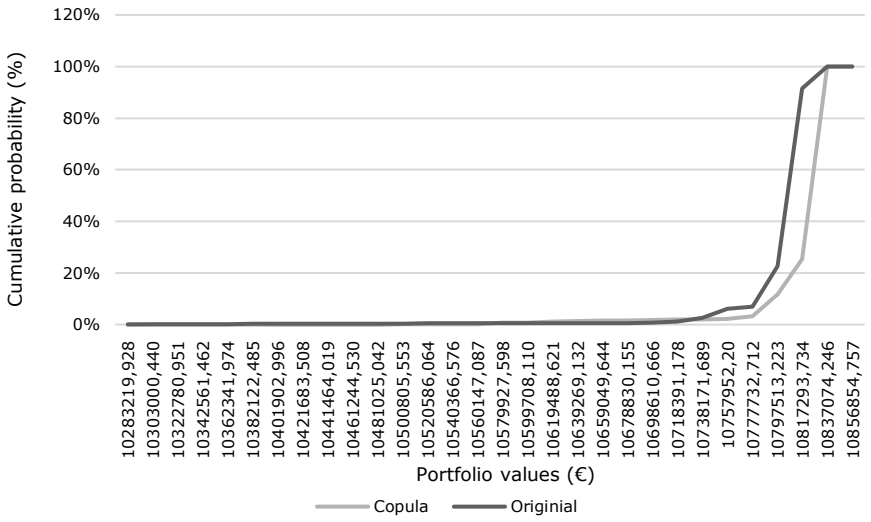


Source: own processing

Besides, the probability distribution of the portfolio values are shown in Figure 4, which also illustrates that the results obtained from copulas are more right-tailed than the original results. When the cumulative probability is equal to 100%, the maximal portfolio value

based on copulas is 10,880,342 €; while the original maximal portfolio value is 10,856,855 €, which is slightly lower.

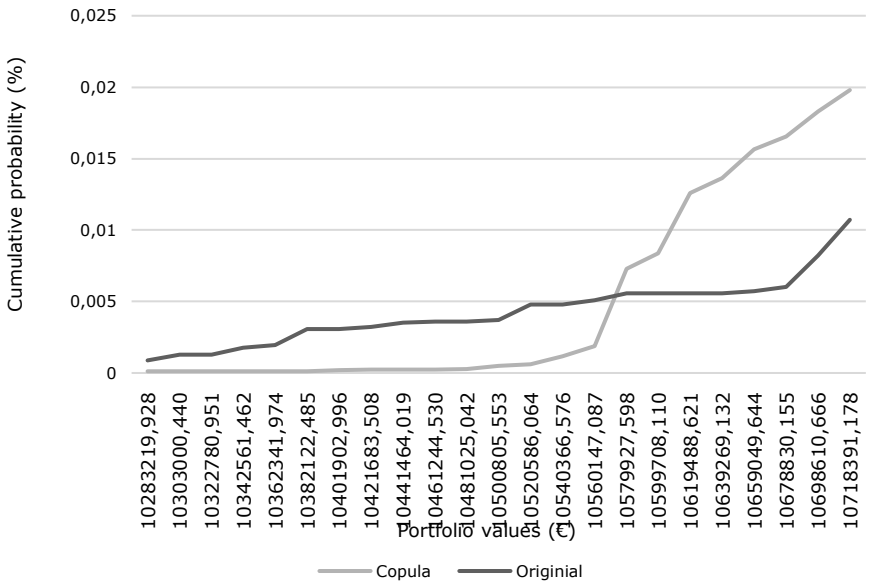
Figure 4 Probability Distribution of the Portfolio Values



Source: own processing

Furthermore, we can adjust the scale of the probability distribution of the portfolio values to focus on the portfolio values with low probabilities as shown in Figure 5. It is now more visual to find the portfolio value with one certain selected probability, for example, when the probability is equal to 0.5%, the portfolio value based on copulas is around 10,579,928 € while the original portfolio value is approximately 10,560,147 €.

Figure 5 Probability Distribution of the Portfolio Values – Adjusted Scale



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4 Conclusions

The main assumption that the critical variables are normally distributed is applied to most credit risk models. However, there is no compelling reason for using the normal distribution for the critical variables, so we can remove this assumption and obtain the real distributions based on the concept of copulas from the pseudo-sample by maximum likelihood estimation (MLE). The CreditMetrics™ model is applied to a portfolio consisting of 10 bonds

traded on the Frankfurt Stock Exchange (FSE). After comparing the original results and the results based on copulas obtained under the framework of the CreditMetrics™ model, it is able to find that the credit risk is usually underestimated if the normal distribution is assumed, and the extreme values cannot be reflected precisely. Therefore, it is reasonable to combine the copulas and credit risk models to better quantify the credit risk. Furthermore, copulas are widely applied to the pricing of the credit portfolio instruments, such as CDO tranches and basket credit derivatives.

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Impact of Mergers on the Company Performance

Petr Valouch, Josef Nesleha

Faculty of Economics and Administration, Department of Finance
Lipova 41a, 602 00 Brno, Czech Republic
E-mail: petr.valouch@econ.muni.cz
josef.nesleha@econ.muni.cz

Abstract: *The paper deals with the impact of a merger on the company financial profitability. A merger usually leads to a stronger position on the market as this is the most frequent reason why companies decide to venture into such a form of synergy. For the purposes of this research, the following criterion has been taken into account when defining the company performance: ROE (Return On Equity). The test is based on a comparison of the indicators at the moment of the merger and five years after the moment of the merger. To enhance the validity of the test, companies that experienced a merger and companies that have not experienced it are used. The usage of both of the files should help to confirm that the merger itself stands for the indicators improvement. In total, the data file consists of 277 merged companies and 232 companies that have never merged.*

Keywords: Merger, impact, profitability, ROE, statistical test

JEL codes: G34, M41

1 Introduction

Mergers are usually based on several economic motives. The main motives of mergers in the Czech Republic are administration simplification, tax optimization, operational synergy, unification of control structures, stronger market position, simplification of ownership relations and better access to loans (Sedláček, Hýblová and Valouch, 2015). The main goal of the merger is usually to increase the economic efficiency of the merged company compared to the overall efficiency of all merging companies. From this reason the mergers are the object of many financial and economic analysis trying to identify the main opportunities or barriers of mergers in the area of economic and financial efficiency, especially in the US (Brouwer, 2008; Hensel, 2010), or China (Yan, Tian, 2014). Other papers analysed new approaches to efficiencies in mergers and merger analysis (Kwoka, 2015). Many empirical studies suggest that the general view is that mergers tend to increase shareholder wealth but decreases efficiency for the target firm (Li, 2016). The Czech Republic has only a few basic analyses of merger efficiencies (Režňáková, Pěta, 2016; Valouch, Sedláček, Králová, 2016). Recent studies have also researched the factors affecting efficiency of mergers and their economic impacts as well as the relations between merger development trends and particular microeconomic and macroeconomic factors (Dorata, 2012; Komlenovic, Mamun and Mishra, 2011; Marks, 1997; Vu, Shi and Hanby, 2009). Unanswered question remains whether the mergers in the Czech Republic influence positively the efficiency of merged companies or the changing efficiency is caused by other reasons like economic cycle, GDP growth, inflation rate, unemployment rate, etc. This paper should bring the answer to this question.

2 Methodology and Data

The main aim of the paper is to identify whether the mergers realized in the Czech Republic influence the economic results and efficiency of merged companies in the period five years after the merger. For the purposes of this paper, the company performance is defined by indicator ROE (Return on Equity). The sample of 277 merged companies has been compared to the sample of 232 unmerged companies and their economic performance has been analysed. As mentioned, we have analysed one basic indicator in both samples – Return on Equity (ROE). We have used five years period to compare the indicator across both samples. The data required for the analysis of both the merged companies and companies that have never merged were obtained from the Commercial Bulletin and the Commercial Register of the Czech Republic.

The test is based comparison of two samples (for each of the groups – merged and unmerged companies). As we talk about dependent variables, pair tests are supposed to be employed. The first variable (level of Return on Equity at the first moment) and the second variable (level of Return on Equity at the second moment (in five years)) are dependent each other. Therefore, we do not use two-sample independent tests.

The test is based on the following null hypothesis (H_0) and alternative hypothesis (H_1):

- H_0: The mean of Return on Equity (ROE) is the same for both of the analyzed moments
- H_1: The mean of Return on Equity (ROE) is not the same for both of the analyzed moments

Originally, we intended to apply parametric tests (pair t-test). Yet this procedure has failed as a consequence of non-compliance with the normality. For any t-test, the data needs to be derived from the normal statistical distribution. Taking into account the significance level 5% (alfa=0.05), the following tables (Table 1 and Table 2) confirms that the normality has been rejected for all of the variables (for the first variable, for the second one and also for the variable computed as a difference between the first two variables).

Table 1 Results of Normality Test of Merging Companies (for Return on Equity)

Variable/Statistics	Computed value of statistics	p-value
ROE(0)/D	0.4281	<0.01
ROE(0)/SW-W	0.1417	0.0000
ROE(5)/D	0.4119	<0.01
ROE(5)/SW-W	0.1175	0.0000
ROE(difference)/D	0.3905	<0.01
ROE(difference)/SW-W	0.1958	0.0000

Source: Own computation, processed in STATISTICA

The same conclusion has been revealed in case of the second group of companies. Again, all of the variables have been proven as samples not fulfilling the normal statistical distribution.

Table 2 Results of Normality Test of Companies Without Merger (for Return on Equity)

Variable/Statistics	Computed value of statistics	p-value
ROE(0)/D	0.419	<0.01
ROE(0)/SW-W	0.1047	0.0000
ROE(5)/D	0.4266	<0.01
ROE(5)/SW-W	0.1568	0.0000
ROE(difference)/D	0.393	<0.01
ROE(difference)/SW-W	0.2135	0.0000

Source: Own computation, processed in STATISTICA

As a result of the non-compliance with normality tests, non-parametric statistics have been run. To support the validity of results, the following two tests have been conducted for each data group:

- Wilcoxon Matched Pairs Test
- Sign Test

Although t-test is a stronger and more validate statistical tool, such procedure cannot be correctly used as long as the dataset is not derived from the statistical normal distribution. Therefore, these non-parametric tests have been employed in order to verify the null hypothesis.

3 Results and Discussion

The results are divided into 2 parts. In the first, only the companies that merged between 2001 and 2010 are analyzed. As the normality tests failed (see the results in the chapter 2 Methodology, particularly Table 1 and Table 2), non-parametric tests are used. Prior to the tests themselves, there is a table summarizing basic descriptive statistics of both of the variables (ROE at the moment of the merger and ROE at the moment of five years after the merger).

Table 3: Descriptive Statistics for ROE at the Moment of the Merger and the ROE after Five Years

Variable	Valid N	Mean	Median	Standard Dev.
ROE(0)	277	-0.185339	0.051301	3.454844
ROE(5)	276	-0.051702	0.069916	2.619096

Source: Own computation, processed in STATISTICA

Even the table containing only descriptive statistics indicates that the indicator Return on Equity has improved. While at the moment of the merger, the average value reaches -0.185, five years later it (on average) reaches the value around -0.05.

Table 4: Results of the Wilcoxon Matched Pairs Test

Pair of Variables	Valid N	T	Z	p-value
ROE(0) & ROE(5)	276	18772.00	0.256923	0.797238

Source: Own computation, processed in STATISTICA

The results of Wilcoxon Matched Pairs Test do not confirm that there is an impact of a merger on the indicator Return on Equity. The computed p-value is not small enough to reject the null hypothesis of the test. In other words, we have not proven that there is not an impact of the merger, yet we also failed to confirm that there is an impact.

The second applied test – Sign Test – reaches the same conclusion. The p-value value in the amount of approximately 0.3 fails to reject the null hypothesis, meaning that the impact of the merger on the company performance (measured by the indicator Return on Equity) has not been confirmed.

Table 5: Results of the Sign Test

Pair of Variables	Valid N	Percent v<V	Z	p-value
ROE(0) & ROE(5)	276	53.26087	1.02328	0.306176

Source: Own computation, processed in STATISTICA

Although neither of the tests rejects the null hypothesis, looking back at the data of the table 3 (Descriptive statistics for ROE at the moment of the merger and the ROE after five years), there is a visible improvement in Return on Equity between the moment of the merger and five years after the merger.

The same procedure has been conducted for the data file consisting of companies that did not merge (the data is for the same period of time so that other conditions and market conditions are similar for all the tested companies). As well as for merging companies, the first table (Table 6) summarizes the basic descriptive statistics. In case of companies that not merged, it is clear that the average value of Return on Equity has dropped between the first and the second moment. The same period of time has been used – particularly five years.

Table 6: Descriptive statistics for ROE at the first and the second moment

Variable	Valid N	Mean	Median	Standard Dev.
ROE(0)	232	0.568843	0.12144	5.118506
ROE(5)	232	0.428147	0.07477	5.900436

Source: Own computation, processed in STATISTICA

The table 7 summarizes results of the first employed test (Wilcoxon Matched Pairs Test). The law p-value rejects the null hypothesis of the test, which also indicates the high value of the test statistics.

Table 7: Results of the Wilcoxon Matched Pairs Test

Pair of Variables	Valid N	T	Z	p-value
ROE(0) & ROE(5)	232	10189.00	3.248993	0.001158

Source: Own computation, processed in STATISTICA

The same conclusion has been verified in the second test, Sign Test. The p-value almost hits zero claiming that there has been a significant gap between Return on Equity at the first moment and at the second moment. As well as in the previous test, the p-value confirms that there is a statistically significant discrepancy between the first and the second measured moment when it comes to the indicator Return on Equity. However, looking back at the table 6 (Descriptive statistics for ROE at the first and the second moment), it is obvious that Return on Equity has dropped between the first and the second moment. This leads us to an important difference between both of the groups. While the movement of Return on Equity of the first group (merged companies) was not rendered statistically significant, the basic descriptive statistics show that there might be some tendency between the first and the second moment in the favour of the second moment (five years after the run merger).

The means of the second group of companies (unmerged companies) has been proven to be different, yet higher values are measured in case of the first moment. In other words, while merger might have some positive effects on the company performance (defined by the indicator Return on Equity), companies that not merged and have been a part of this study have suffered from a decrease in the same indicator.

Table 8: Results of the Sign Test

Pair of Variables	Valid N	Percent v<V	Z	p-value
ROE(0) & ROE(5)	232	37.500	3.742233	0.000182

Source: Own computation, processed in STATISTICA

From the results of the descriptive statistics, therefore, it is quite interesting to conclude that, in the case of the merged companies, the average results of return on equity and the increase in the median of this indicator were improving in the period under review. However, the average return on equity of the merging companies in a given sample remained negative for five years after the merger. This conclusion is not very optimistic. On the other hand, there is a positive trend to improve (increase) this indicator. Therefore, it seems that it is true that a relatively long time after the merger is needed to achieve the significant positive results of the merger. However, the results indicate that a merger can contribute to improving the financial performance of the merging companies and should become a legitimate tool considered by the management of companies and their owners, in particular, to maximize the efficiency of corporate governance and possibly solve their financial problems.

This fact has to be mentioned even more so that in the control sample of unmerged companies even a statistically significant decrease in the return on equity was statistically proven in the period under review. From the point of view of the trend of improving the return on equity in the period under review, it can be stated that the merged companies have performed significantly better than the unmerged companies.

On the other hand, however, it cannot be forgotten that the starting conditions of the merging companies were significantly worse than for unmerged companies, and despite the positive development of the return on equity of the merged companies and the deteriorating tendency of the unmerged companies, unmerged companies and their medians of return on equity are still significantly better than those of companies that merged. However, the difference in these values between the two analyzed groups of

companies 5 years after the merger has significantly decreased in relation to the initial difference between these two figures. Thus, another potential question arises as to how companies that were not merged at that time would have gone if they joined the merger. It is possible that even in their case the results of their profitability could be better than it actually was.

4 Conclusions

The goal of the contribution has been to identify whether the mergers realized in the Czech Republic influence the economic results and efficiency of merged companies in the period of five years after the merger. To verify this hypothesis, two non-parametric tests have been run - Sign Test and Wilcoxon Matched Pairs Test after what we rejected the normality of the analysed samples.

The results have shown that merged companies have increased their Return on Equity between the moment of the merger and five years after the merger. However, it needs to be mentioned that this difference has not rendered to be statistically significant. Roughly said, the utilized non-parametric tests have failed to reject the null hypothesis, saying that average values for both of the moment are the same. On contrary, in case of unmerged companies, it has been confirmed that the average of Return on Equity at the first moment is different from the average measured at the second moment. Nevertheless, the movement has been negative. The group of unmerged companies has suffered from a decrease in the value of Return on Equity (ROE).

Based on the results of the analysis, it appears that it can be concluded that the ROE indicator was improved from the point of view of the merged companies as compared to the companies that have not merged in the analysed period. It, therefore, seems that the merger contributes to the improvement of this indicator (despite the fact that this influence was not proved statistically). On the other hand, it is also necessary to state that the average value of the ROE of the merged companies is still lower than in the case of unmerged companies. Therefore, it seems that under the terms of the analysed set of companies, mergers of companies in the Czech Republic occur mainly in situations when these companies solve already serious financial problems, often associated with a negative return on equity. The merger is likely to serve as one of the last possibilities for the financial stabilization of the merging companies. However, the return on equity of the merged companies is getting better after the mergers, but the question remains whether this improvement is sufficient to prevent companies experiencing financial difficulties before the merger from being able to definitively eliminate these problems after the merger. Research results suggest that this is probably not the case for all companies. On the other hand, if the merger did not take place, the results of these companies could still be significantly worse, as the results for a control sample of unmerged companies indicate.

However, although the statistical effect of mergers on the improvement of ROE of the merged companies has not been proven, the results of descriptive statistics show an improvement in this indicator for the merging companies. It can be said that the merger can contribute to the improvement of the return on equity and its realization should be considered as one of the possibilities for potential improvement of the profitability of the companies in the Czech Republic as well as for possible solution of the financial problems of these companies.

At the same time, it must be borne in mind that the manifestation of positive merger results takes some time. Five years after the merger, it is possible to observe already improving results in the values of the equity of the merged companies represented by the descriptive statistics of these indicators, but even during this period, the impact of the merger on this improvement was not statistically demonstrated. However, a comparison with the sample of unmerged companies shows quite convincingly that a merger can make a significant contribution to this improvement as it is able to effectively solve some of the financial inefficiencies of the merging companies and thereby can contribute to improving their profitability for the owners measured by the ROE indicator.

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Technical Provisions As One of the Risk Management Modes of Commercial Insurance Companies Operating on the Czech Insurance Market

Eva Vávrová[1], Lenka Přečková[2]

[1] Masaryk University
Faculty of Economics and Administration, Department of Finance
Lipová 507/41a, 602 00 Brno, Czech Republic
E-mail: eva.vavrova@econ.muni.cz

[2] Silesian University in Opava
School of Business Administration in Karviná, Department of Finance and Accounting
Univerzitní nám. 1934/3, 733 40 Karviná, Czech Republic
E-mail: preckova@opf.slu.cz

Abstract: *The aim of this paper is to identify differences between classical approaches to the creation and investment of technical provisions and the approaches resulting from the implementation of the Solvency II Regulatory Directive into insurance markets in the European Union member states. With regard to the interpreting the results of the analyses, the subsequent aim of this paper is to draw specific conclusions to evaluate the adequacy of the creation and investment of technical provisions in selected commercial insurance companies operating on the Czech insurance market and to propose recommendations in the case of identified deficiencies.*

Keywords: commercial insurance company, creation and investment of technical provisions, insurance market, risk management, Solvency II Regulatory Directive

JEL codes: G11, G22

1 Introduction

Technical provisions must be set up by commercial insurance companies and reinsurers to settle all insurance/reinsurance obligations that are probable or certain, but their amount and the time at which they arise are uncertain. Technical provisions represent the very important and the largest part of the liabilities of an insurance company. Creation of technical provisions depends on the types of insurance (Burling, Lazarus, 2011). Other volume of technical provisions is created in the case of risk-based types of insurance and another volume is created in the case of reserve-based types of insurance. For the reserve-based types of insurance, technical provisions are created from the whole amount of received premiums written, while for the risk-based types of insurance the technical provisions are created from a certain part of the received premiums written, and the technical provisions compensate for the time, local and material inconsistency between the received premiums written and the indemnity payments. The technical provisions for risk-based types of insurance must prove liquidity in the short term, so it is suitable for short-term investment on the financial market, unlike reserve-based types of insurance which is used for long-term investment. Different technical provisions can therefore be observed in life insurance companies and in non-life insurance companies (Ducháčková, 2015). In the year 2015, the amount of the technical provisions of non-life insurance companies was CZK 55 654 162 thousand for Czech Insurance Association (ČAP) members. The amount of the technical provisions created by life insurance companies was CZK 274 323 310 thousand in 2015 (ČAP, 2017). Thus, the size of the technical provisions for life insurance exceeded more than five times the size of the technical provisions for non-life insurance.

The view of technical provisions differs within the classical approach and within Solvency II Regulatory Directive. The classical approach can be characterized as an accounting-based approach, while Solvency II Directive uses a market-consistent approach. Within the legislation, Solvency II distinguishes only three types of technical provisions: for life insurance liabilities, for non-life insurance premiums and for indemnities/insurance benefits in non-life insurance. Within Solvency II Directive, another difference is that the technical

provisions are created with help of an optimal estimate of future cash flows that are related to the reserved liability. Additionally, these estimated cash flows should be discounted at the time of the estimate and then increased by the risk premium that is related to the risk of the estimated procedure and the risk-free interest rate used for discounting the cash flows (Cipra, 2015).

$$TP = \text{discounted BE} + RM, \tag{1}$$

where TP ... technical provisions; BE ... best estimate; RM ... risk margin.

The amount of technical provisions is calculated as the sum of the best estimate and the risk premium. It is, in fact, the amount that an insurance or reinsurance company would have to pay for the transfer of all insurance/reinsurance liabilities to another insurer or reinsurer (Hull, 2015). BE corresponds to the expected size of future cash flows related to a specific liability for technical provisions. Discounted BE uses a risk-free interest rate to get the current value of future cash flows (Cipra, 2015). The risk premium is determined as the present value of the cost of holding the solvency capital requirement (SCR) for unsecured risk throughout the portfolio period using the risk-free interest rate (Courchene et al., 2008). For the calculation of technical provisions, financial market information and other available data of underwriting risks are used. Technical provisions are calculated in a prudent, reliable and objective manner.

Under Solvency II, information must be reliable, consistent, realistic assumptions, appropriate actuarial/statistical methods (Mesršmíd, 2015). Solvency II focuses primarily on coordinating the calculation of technical provisions. For example, methods and procedures need to be developed and used to assess the accuracy with which reserves reflect reality. The calculation shall comply with the requirements of the Directive and the degree of uncertainty in the technical provisions shall be assessed and explained. In addition, Solvency II emphasizes ensuring the suitability of methods, models and assumptions, evaluating data quality in calculations, best estimate analysis, evaluation of underwriting policies, assessing adequacy of collateral, reporting to managing and supervisory bodies (Brosemer, Lepschi and Lord, 2011).

The Solvency II Directive requires insurance and reinsurance companies to have internal processes and procedures to ensure the suitability, completeness and accuracy of the data used to calculate the technical provisions. In order for data to be considered as suitable, they must meet at least the following criteria: there is no undue estimation error resulting from the scale or nature of the data, the data are consistent with the methods and assumptions used to calculate the provisions, and the data appropriately reflect potential risks. For the completeness of the data, the following assumptions must be met: the data include sufficient information to identify trends and assess the potential risk signs, data are available for each homogeneous risk group in the calculation, and no relevant data are excluded from the calculation without justification. Data accuracy requires following: data do not contain significant errors, data from different time periods used for the same estimate are consistent, and recording data is consistent over time and done in a timely manner (Dreksler, 2013).

There are different methods to determine the best estimate for both life insurance companies and non-life insurance companies. According to Brosemer, Lepschi and Lord (2011), the best methods for life insurance companies are following: one method is to derive DAV tables. The portfolio is divided into risk groups that are as homogeneous as possible. However, individual sub-portfolios are steadily decreasing with gradual differentiation according to risk characteristics and will soon become too small for the right conclusions. The rates derived vary considerably and subject to a high degree of uncertainty. Another method is using generalized linear models (GLMs) that offer solutions to this problem. These are, in fact, statistical models in which risk factors are analyzed at the same time. Rates serve as a starting point and are tailored for individual groups to reflect risk, allowing valid conclusions even for smaller groups. GLMs allow for a better understanding of portfolios, revealing correlations, interactions in data, and thus bringing more than traditional methods. For the best estimate of non-life insurance company

provisions, the following items must be calculated (Brosemer, Lepschi and Lord, 2011): loss allowance for losses already incurred, technical provisions for liabilities that have not yet been incurred. All cash inflows and outflows, such as premiums, various payments, etc., have to be included. The best estimate methods for non-life insurance companies are the Chain-ladder method, the Additive method, and the Bornhuetter-Ferguson method.

Also, a number of studies have been launched to examine how the size of technical provisions has changed under the new Solvency II regulatory framework. Cipra (2015) states that according to various quantitative impact studies, the provisions created under Solvency II are significantly lower than within Solvency I, up to 10-15%. It is mainly for the following reasons: discounted cash flow, no implicit risk margins, account shall be taken of investment income from unearned premiums, and the absence of equalization provision. Also, the authors Peleckienė, Peleckis (2014) confirm that the technical provisions for life insurance companies calculated using the best estimate method plus the risk margin tend to be less than the provisions calculated according to previous methods because the implicit prudence that existed under the former regime is eliminated and thereby the available solvency capital is increasing. The level of technical provisions for non-life insurance companies decreased by 10-15% because of discounting. The average ratio of technical provisions created under Solvency II and under Solvency I varies more for the non-life branch (70-100%) than for the life branch (90-102%). Courchene et al. (2008) states that according to the fourth quantitative impact study (QIS4), technical provisions created under Solvency II are typically lower by about 17% than created under Solvency I.

Under the Solvency II methodology, neither investment instruments nor asset allocation are clearly identified, according to Kriele and Wolf (2014). Regulation is included in the internal control system of the insurance company and becomes a part of the market risk and credit risk assessment within the solvency capital requirement (SCR). However, Ducháčková (2015) identifies the following approaches to investing:

- Investments only in assets that are identifiable for the insurance company, can be measured, monitored, managed, controlled and reported. Therefore, assets need to be invested so as to ensure the liquidity and security of the entire portfolio.
- If some assets are intended to settle liabilities, it is necessary to invest them proportionately to the nature and duration of those obligations and in the best interests of all participants and beneficiaries.
- Diversification should be done in such a way that there is no dependence on a particular asset, issuer, group of persons or geographical area. There should be no large accumulation of risk in the portfolio as a whole.
- Derivatives are only negotiated if their liabilities lead to risk mitigation.

Höring (2013) addresses whether the new capital requirements for market risk arising from the Solvency II regulatory framework will significantly affect the investment strategy of European insurance companies. He compares the standard Solvency II market risk capital model with the S & P evaluation model for a fictitious but representative European life insurance company. The standard Solvency II model remains less capital intensive than the S & P rating model. For insurance companies with a good rating and permanent regulatory solvency, a significant change in the asset allocation due to the introduction of the Solvency II regulatory requirements is not expected. Indeed, surveys by European insurance companies show that the reduction of shares and their alternatives is not expected. Similar results are expected in typical investment portfolios of non-life insurance companies dealing with property and accidents (Zweifel and Eisen, 2012).

Braun, Schmeiser and Schreiber (2017) examine in their study the influence of capital requirements on the selection of life insurance portfolio under the Solvency II Directive. The authors argue that, as a result, it can lead to the allocation of assets that is not beneficial to policyholders or shareholders. There is a risk assessment of portfolios and the role of expected returns is totally ignored. The effects of diversification are taken into account only marginally. This approach is not able to distinguish between investments based on risk/yield profiles and correlation. Capital requirements strongly prevail. There are some serious consequences. First, portfolios that include stocks, corporate bonds, real

estate, and hedge funds are penalized inadequately under Solvency II, so that balanced asset allocation is only available with a large volume of equity. Especially in life insurance companies it can cause problems. Expected portfolio returns, which consist mainly of money market instruments and government bonds, may be too small to cover the interest rate guaranteed over a long period of time. Second, insurers may be led to choose the asset allocation that will increase instead of reducing the volatility of their equity. Third, effective portfolios are not systematically preferred over inefficient portfolios, as some companies may need to expose themselves to a higher than the required level of market risk to cover capital costs.

2 Methodology and Data

The aim of this paper is to identify differences between classical approaches to the creation and investment of technical provisions and the approaches resulting from the implementation of the Solvency II Regulatory Directive into insurance markets in the European Union member states. With regard to the interpreting the results of the analyses, the subsequent aim of this paper is to draw specific conclusions to evaluate the adequacy of the creation and investment of technical provisions in selected commercial insurance companies operating on the insurance market in the Czech Republic and to propose recommendations in the case of identified deficiencies.

Two commercial insurance companies were analyzed, namely DIRECT pojišťovna and Česká pojišťovna. These two commercial insurers were chosen for comparing creation of technical provisions and their investments in the case of both, non-life and universal insurance companies. The data and other information were received from the annual reports, reports of solvency and financial situation (SFCR) of the individual insurance companies and from the individual results of the members of the Czech Insurance Association (ČAP). Subsequently, adjusted ratios indicate the adequacy of creating technical provisions. According to Vávrová (2014), the following indicators were used:

technical provisions / net premiums written; investment / technical provisions; technical provisions / equity; technical provisions / net premiums earned.

In the next part, the investments of individual insurance companies were analyzed, and a comparison of investments with other insurance companies was performed taking predefined criteria in account. The data of the individual insurance companies was obtained from the annual reports and from individual results of the members of the Czech Insurance Association (ČAP). Further, a discussion of the information obtained in the previous part follows and recommendations are suggested. Then, the authors summarize the results.

3 Results and Discussion

Thus, technical provisions with other balance sheet items are compared. Calculation of ratios helps to show the adequacy of technical provisions.

Table 1 Adjusted Ratios Calculated for DIRECT pojišťovna (2012-2016)

	2012	**2013**	**2014**	**2015**	**2016**
technical provisions / net premiums written	1.431	1.363	1.553	1.493	1.149
investment / technical provisions (%)	115.7	103.5	**99.9**	**87.5**	**82.6**
technical provisions / equity (%)	348.7	**614.0**	**378.3**	227.6	189.1
technical provisions / net premiums earned (%)	143.4	140.9	146.4	138.4	118.4

Source: calculation based on annual reports of the insurer (2013-2017)

The first indicator (see Tab. 1) measures technical provisions and net premiums written. The recommended value is not given as it is necessary to monitor the development. In 2016, when there was the first obligation to create technical provisions under the Solvency II regulation, technical provisions compared to net premiums written declined by 23.04%. According to various studies, an average decrease of 15% is expected. As a result, the DIRECT pojišťovna dropped more. The indicator measuring investment and technical provisions has been declining. The recommended value is higher than 100%. In 2016, the share of investment to technical provisions was less than 83%. In the last years, therefore, all technical provisions have not been invested. DIRECT pojišťovna should therefore increase the volume of investment at least to the extent corresponding to the size of the technical provisions. Another indicator measures technical provisions and equity. The recommended value is less than 350%. In 2015 and 2016, the indicator was already below this threshold. In 2013 and 2014, the DIRECT pojišťovna could have difficulties in fulfilling its obligations. The last indicator measures technical provisions and net premiums earned. The recommended value is between 100% and 150%. However, this indicator never went beyond the recommended value.

Table 2 Adjusted Ratios Calculated for Česká pojišťovna (2012-2016)

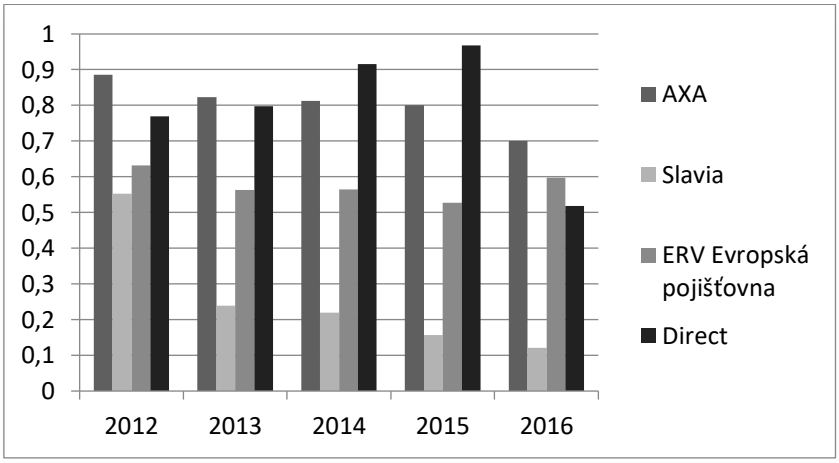
	2012	**2013**	**2014**	**2015**	**2016**
technical provisions / net premiums written	1.407	1.457	1.584	1.259	1.206
investment / technical provisions (%)	125.1	126.2	137.5	147.8	160.7
technical provisions / equity (%)	**363.4**	**353.1**	289.6	230.6	207.8
technical provisions / net premiums earned (%)	140.6	132.6	**158.4**	125.8	120.6

Source: calculation based on annual reports of the insurer (2013-2017)

Again, modified ratios were used. These adjusted ratios should optimally be used for non-life insurance. According to Tab. 2, the indicator of technical provisions in relation to net premiums written declined by 4.21% in 2016 and in 2015 by 20.52%. The second indicator measures investment with technical provisions. The recommended value is higher than 100%. This indicator has been above this threshold. Another ratio is the ratio of technical provisions to equity. The default value is less than 350%. According to this indicator, the insurance company could have difficulties in fulfilling its obligations in analyzed years 2012 and 2013. The last indicator measures technical provisions and net premiums earned. The recommended value is between 100% and 150%. This indicator was calculated for non-life insurance only. Only in 2014 was the value slightly outside limits, namely 158.4%.

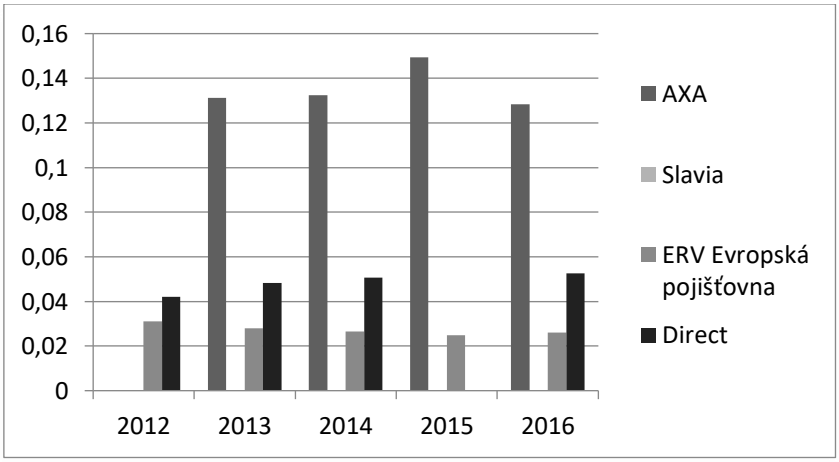
For comparison of individual investment items with DIRECT pojišťovna, three insurance companies were selected: AXA pojišťovna, Slavia pojišťovna and ERV Evropská pojišťovna. All of them, they are members of the ČAP and their premiums written in the non-life insurance branch is comparable, according to the methodology of the ČAP. All insurers, except for Slavia pojišťovna, invest the largest amount of funds in debt securities – see Fig. 1, 2. Slavia pojišťovna, on the other hand, prefers deposits with financial institutions.

Figure 1 Share of Debt Securities on Investments of Insurance Companies (2012-2016)



Source: graph based on annual reports of the insurers (2013-2017)

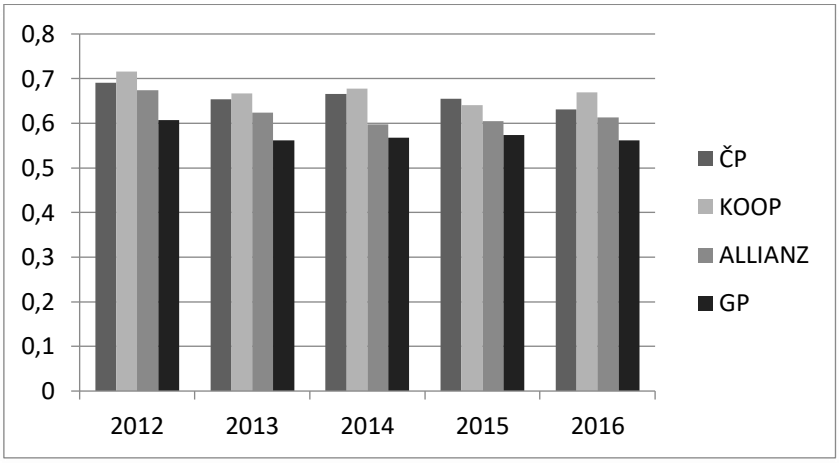
Figure 2 Proportion of Shares in Investments of Insurance Companies (2012-2016)



Source: graph based on annual reports of the insurers (2013-2017)

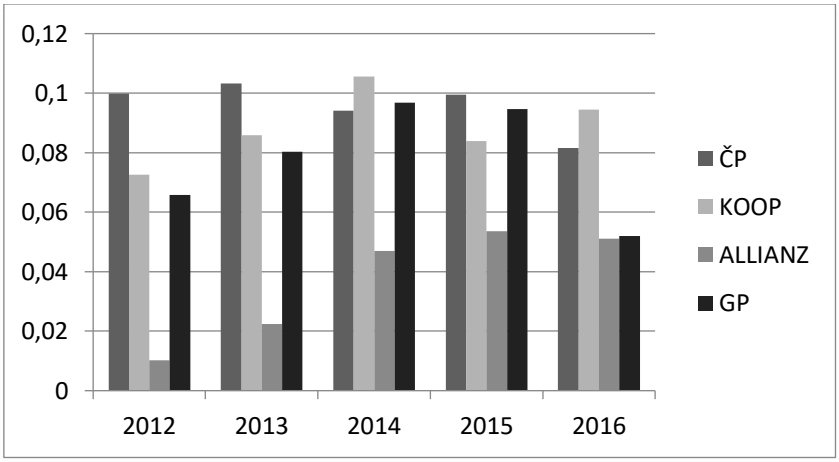
To compare the investment items with Česká pojišťovna (ČP), the following insurance companies were chosen: Kooperativa pojišťovna (KOOP), Allianz pojišťovna and Generali Pojišťovna (GP). All these insurance companies are members of the ČAP, they offer both life and non-life insurance and they are among the insurance companies with the highest premiums written, according to the methodology of the ČAP. All four selected insurance companies invest the most of their finances in debt securities, as seen in Fig. 3. In this respect, therefore, they do not differ. They differ by investing in other financial instruments (see Fig. 4, 5).

Figure 3 Share of Debt Securities on Investments of Insurance Companies (2012-2016)



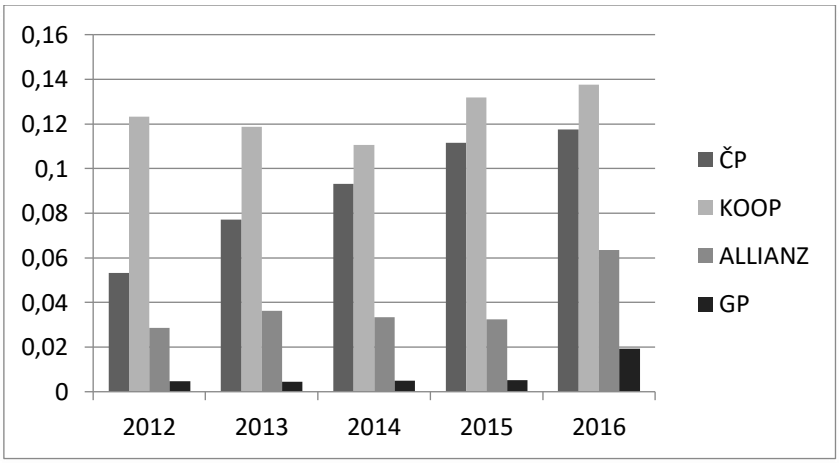
Source: graph based on annual reports of the insurers (2013-2017)

Figure 4 Proportion of Shares in Investments of Insurance Companies (2012-2016)



Source: graph based on annual reports of the insurers (2013-2017)

Figure 5 Share of Investment in Business Groupings in Financial Placements of Insurance Companies (2012-2016)



Source: graph based on annual reports of the insurers (2013-2017)

Compared to the other three largest insurance companies, Česká pojišťovna almost does not use another interesting investment, i.e., investment in land and buildings. The problem

may be lower liquidity. On the other hand, some land and real estate are appreciated in last years.

4 Conclusions

The aim of this paper was to identify differences in the existing approaches to the creation and investment of technical provisions resulting from the new Solvency II regulation, to interpret the results of the analyses and draw specific conclusions to evaluate the adequacy of the creation and investment of technical provisions in selected Czech commercial insurance companies. Technical provisions in the insurance companies DIRECT pojišťovna and Česká pojišťovna were analyzed, the adequacy of technical provisions was determined using adjusted ratios, and investments were compared with financial placement of technical provisions in similar insurance companies.

For DIRECT pojišťovna, the calculated ratios have revealed insufficient volume of investment considering technical provisions since 2014 and in the years 2013-2014, the insurance company could have problems meeting commitments caused by too low equity to technical provisions. Even Česká pojišťovna could have difficulties in fulfilling its commitments in some years, as the volume of equity to technical provisions was too low. In 2016, when the Solvency II Regulatory Directive became applicable, investment in bonds fell sharply in DIRECT pojišťovna, and its investment grew to a large extent in other lending and loans and deposits with financial institutions. Also, investment has increased to a certain extent in shares and other land and buildings. Investment of Česká pojišťovna in bonds, investment funds and shares declined moderately, investment in loans increased.

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Activities Classification for Controlling Purposes in the State Administration Unit

Jana Vodáková[1], Nela Sglundová[2]

[1] Masarykova univerzita
Faculty of Economics and Administration
Lipová 507/41a, 602 00, Brno, Czech Republic
E-mail: Jana.Vodakova@econ.muni.cz

[2] Univerzita obrany
Faculty of Military Leadership
Kounicova 65, 662 10 Brno, Czech Republic
E-mail: nela.sglundova@unob.cz

Abstract: *This paper deals with activities proceeding within the Ministry of Defence of the Czech Republic (MoD CR) included into the Czech state administration and their classifications for planning, budgeting and accounting purposes. The main aim of the paper is to analyze existing planning, budgeting and accounting classifications of activities and evaluate their mutual linkage and applicability for controlling purposes. Authors come to the conclusion that though planning, budgeting and accounting classifications are not identical at present they may be relatively easily modified and harmonized and so used for cost controlling purposes. Main data sources represent scientific articles, legal directives and regulations, internal directions and MoD CR internal databases. In the first part of the paper the authors analyze and compare planning, budgeting and accounting documentation, in the second part of the paper they select one representative planned activity and link it with its real costs utilizing MoD CR controlling software RON and Data cube.*

Keywords: controlling, management accounting, state administration, activity, public sector accounting

JEL codes: H83, H72, H11, M41

1 Introduction

Implementation of the accrual basis to the Czech public sector accounting has enabled to record full range of assets, liabilities, expenses and revenues, and communicate financial statements in similar structure as businesses from 2011. This step has extended not only information capability of accounting data towards external users, but also internal ones. Across the public sector units, i.e. also the state administration, it was consequently possible to continue in a deeper internal classification and analysis of main accounting categories through any proper analytical (managerial) tool. Similar drift is known of course longer time from other developed countries when an effort called new public management (Hood, 1991) was launched.

Nowadays a relatively vast evidence of business-like methods and tools utilization from various units included to the public sector all over the world is available. Quite often managerial tools are used for evaluation of health-care services (for example from recent years Silva and Macedo, 2015 or Macuda, Baran and Kludacz-Alessandri, 2016), social or educational services – controlling utilization (Pavlik, 2017). But an evidence of the provable cost savings or even efficiency increase seems still rare. Some authors suggest that gathering various analytical data remain still rather administrative procedure without any wider managerial utilization (Sanger and Bryna, 2013, Monro, 2003 or Poulsen, 2009). Probable reasons of this situation differ among experts. Some of them ascribe it to business tools unsuitability for the area of the public sector, but majority of them attributes it to improper or inconsistent implementation of business-like tools (Monro, 2003, Reichborn-Kjennerud, 2013 or deVries, 2010) and some point out of course political reasons too. Some studies then deals with a role of management accounting in new public management

or a linkage between (management) accounting and management framework in the public sector (for example Silva and Macedo, 2015 or Hirsch, Nitzl and Schauss, 2015).

The Ministry of Defence of the Czech Republic (MoD CR) included to the Czech state administration similarly as other public sector units has decided to implement any suitable managerial tool to support economical and efficient drawing of financial sources too. Therefore in 2013 it published new economic conception (MoD CR, 2013) and introduced an intention to implement controlling mainly as an official system of cost control. From 2014 when the economic conception came into force till 2018 relatively economically separated cost centres were founded within MoD CR and controlling on the level of these cost centres were implemented. Though there still exist any methodical and technical issues to solve it can be concluded that relevant costs are allocated to every relating cost centre at present.

2 Methodology and Data

This paper deals with controlling implementation process in the terms of the state administration units. From a broader view controlling can be understood as a managerial tool contributing to achievement of unit´s aims. For purposes of the paper we concentrate mainly on controlling of costs, i.e. monitoring planned and real costs using mainly financial and management accounting data. Such controlling concept was introduced by the Ministry of Defence of the Czech Republic (MoD CR, 2013) and it is gradually implemented at present. In our former research we have analysed implementation process development with its strengths and shortcomings (Vodáková and Sglundová, 2017) and its actual state. It can be summarized MoD CR is able to allocate majority of real costs directly to partial cost units (or cost centres) and their sub-units at present which is definitely an important step forward. However the problem is that existing monitoring is not able to record costs of activities which would be evidently more beneficial for managerial purposes such as planning, budgeting or performance measuring.

The main aim of the paper is to examine whether it would be possible to allocate planned, budgeted and real costs to partial activities of a selected cost centre and whether there exist any suitable attribute linking planning, budgeting and accounting classification of activities. Examining sample represents one cost unit, i.e. a rapid deployment brigade including 6 sub-units, command and staff. Command and staff provide the whole cost unit with management and administrative activities and so record mostly administrative costs. 4 cost sub-units ensure combat (operating) activities as firing, tactic, topographic or driving training, 2 supporting sub-units carry out activities as maintenance of the long-term assets logistic support and so on. We monitored activities performed by above described cost unit and its sub-units within one year time period.

As for research procedure, firstly we have analysed planning, budgeting and accounting documentation, mostly relating internal directives of MoD CR. We have considered either to record partial real activities proceeding at a selected cost centre and their frequency for a certain period of time, or to use any existing classification of activities. Because of lesser difficulty and an effort to utilize any existing and practical tool we have chosen the second variant. So we have analysed planning documentation, i.e. methodical direction RMO No 66/2012 (MoD CR 2012) and yearly prepared Activity plan of MoD CR elaborated for our selected cost unit. Further we have examined any possible linkage between classification of activities for planning, budgeting and accounting purposes. We have compared the content of activity and its technical attributes. For this objective we have used Application Software – Planning (APV-VP) included into Staff Informational System (SIS) managed by the MoD CR Planning Section. To verify a technical possibility of cost allocation to selected cost unit we have used applications Data cube and RON (cost allocation) included into Financial Information System (FIS) managed by MoD CR Economic Section. Finally we have chosen one representative activity, i.e. 14-days battalions training and allocated relevant costs to our selected cost unit and its sub-units. So we have verified our preliminary assumption as for technical and methodical feasibility of such solution.

As main data sources were used scientific papers, relating legal regulations and internal directions. We also worked with MoD CR databases coming from SIS and FIS systems, mainly we used data from 2017 and 2018. Besides RON cost allocation method we used basic scientific procedures as description, analysis, comparison, and synthesis of main findings.

3 Results and Discussion

This chapter summarizes main findings of our research. The first part compares planned, budgetary and accounting classification of activities within the MoD CR. The second part analyses costs of selected activity realized by specific cost centre included into MoD CR.

Analysis of planning and budgeting classification of activities

On the base of planning and budgeting materials analysis we have found a considerably extensive documentation. There exist planning and budgeting internal orders, directions or instructions. Within MoD CR a relatively high number of plans is prepared for long-term time period (15 years), middle-term (5 year) and one –year time period (i.e. Activity plan which is the basic document to manage all activities within the MoD CR in the calendar year). All plans of entities directly subordinated to MoD CR are based on this document.

Probably the most important methodical document for planning represents RMO No 66/2012 (MoD CR, 2012) that besides other defines main terms as objective, measure, task, activity and so. In fact these terms mean specific levels of aims (or planned activities) elaborated consequently from the top to the lowest level of management and the lowest level represent the most detailed activity. Because of limited extent of the paper it is not possible to depict all terms and levels of aims. We can conclude there exist 8 levels of aims at minimum from planning point of view and we have found that our selected cost unit works with aims of 4th to 8th level.

Our analysis further proved a proper link between Activity plan and Budgetary structure (MoD CR, 2018) which serves not only to budget, but also to accounting classification. Budgetary structure (a list of numerical characteristics) is interconnected with Activity plan on a certain level. This linkage represents the attribute CIL (column 5, see table 2). In our opinion this linkage can be well utilized for tracking planned, budgeted and accounting costs of activities. As table 2 implies an attribute CIL may contain 12 numerical marks that describe specific levels of aims.

Table 1 Budgetary Structure Scheme

UCS	UUS	NS	SU	AU	PVS	CIL	FIN	ZDR	PAR	POL	PRJ	ORG	UZ	ZJ	MD	DAL
		6	**3**	**4**	**10**	**12**	**3**	**10**	**6**	**9**	**12**	**15**	**9**	**3**	**15**	**15**

Source: MoD CR (2018): Methodology of the Budgetary structure, version 1.11. No MO 11294/2018-8201

Unfortunately, we have also found a certain discrepancy between terminology used for levels of aims by planning and budgetary methodology. Especially terminology used for aims of 4th a 5th levels that are in the sphere of our interest is confusing. To avoid misinterpretation, we would recommend to clarify and harmonize it.

Comparing the Activity Plan of our selected cost centre with the Budgetary structure, i.e. 5th level of Activity plan vs. 5th level of aim (9th and 10th digit) in Budgetary structure, we can confirm the same activity identification, i.e. concretely Preparation and achievement of full operational capabilities of battalion. Thus, all real activities related to unit training will be provided (and covered) under this identification.

Within an analysis of our selected cost unit activities we have tracked its Activity plan on the above described level and identified 896 specific objectives (or partial activities). It is clear that tracking nearly nine hundred indicators is unrealistic and probably useless. Also we should take into consideration that meanwhile we operate on the 5th level of aims. When we would want to monitor activities on 3 lower levels, it would be necessary to carry

out a thorough revision of aims (activities) and reduce them for purposes of controlling to a reasonable number to meet managerial needs.

Another problem represents evaluation of plan´s fulfilment. The present system is set up for verbal evaluation (fulfilled / unfulfilled / running, event. with a brief explanation of activity postponing) in the APV-VP module. It is evident that such evaluation rather does not meet managerial needs, as a consequence, we could claim that the cost unit works, employees are paid for their work, defence is secured. Interconnection of planning, budgeting and accounting activities classification would enlarge a range of evaluation criteria at least for financial indicators based on costs or others.

As mentioned above, the classification of activities used for planning purposes is very close to the budget one. Additionally, APV - VP planning module is partly prepared for cost evaluation. In fact some financial flows are tracked by the system even now. The point is these data are recorded on the cash basis only, i.e. only expenditures of the 3rd level aims are monitored at present. Moreover, financial plans are based on historical data and not on the real needs of MoD CR. So it would be desirable to determine total expenses of each training, preparation of a unit for a mission, time demand for administrative activities not directly related to training and meeting, or the main aim, i.e. ensuring defense of the Czech Republic by the ACR forces. Then, based on these data a plan for next year could be created and necessary funds for the next time period negotiated. To use the Activity Plan for tracking costs of main activities, a minor modification of the Budgetary structure is required, because currently it is possible to allocate costs only to a specific cost unit. We suggest 2 options how to interconnect costs and activities.

1st option: The Budget structure can be extended by a new attribute that would include a numerical indication of a specific activity. This would be feasible, but demanding on software modifications and maybe costly. Also it would be necessary to create new classification of activities, that would reflect specific needs of every single cost centre which carry out diverse tasks and the scale of branches involved in is huge. This large scale of activities might be confusing and complicated to manage.

2nd option: Attribute CIL may be extended by a numerical characteristic of an activity. This option consists in extending the attribute by another 6 positions, which would exactly correspond to a numerical code of the 8th level of activities. On this level it would be possible to identify clearly costs related to them. This indicator could be inserted into CIL as a part of controlling process when invoices are liquidated (in the case of services acquired) or material is consumed. Similar process is used at present for determining the place of origin of costs. In this case, ORG attribute is used for determining cost unit which is responsible for these costs. So it would be possible to filter out all costs associated with the activity of a certain level by entering its numerical code into the controlling journal within Data cube.

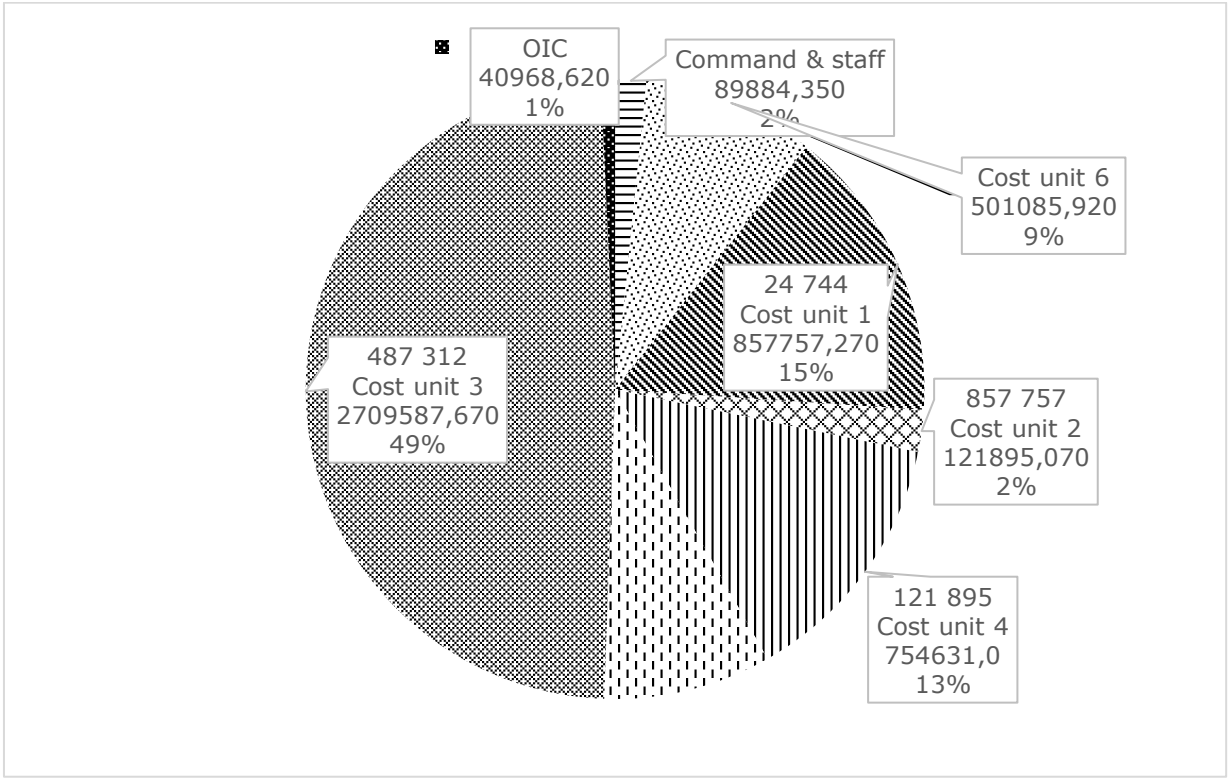
Cost allocation of a selected activity

To determine real costs of any planned activity at present seems relatively time-consuming and inexact because it is possible only manually. For purposes of our research we used management accounting data from RON and Data cube and interlinked them manually to one selected activity in Data cube. We have found that this procedure can be used only in the case of important activities (i.e. battalion trainings, maintained a high level of military preparedness, mission preparation, etc.). Only for such (important) activities, the kind of consumption (material, fuel, ammunition etc.) is recorded into internal evidence, and then lodged to the logistic system. Cost data then appear in the Data cube (the logistic system is linked to the financial system). For purpose of our examining we have chosen one representative activity which is 14-day military training. It was necessary to analyse and identify attributes of all related primary documents which we carried out manually in cooperation with the responsible accountant and to enter them into the controlling journal. Then the system allocated all costs to our selected activity.

In fact it was only all direct costs but still they can depict relevant consumption of sources for one specific activity. Figure 1 below illustrates not only total costs per 14 days training,

but also absolute and relative shares of partial sub-centres on the total costs of selected activity. We can see that the total costs per activity exceeded 5.5 million CZK, while the highest share on total costs was recorded by cost unit (sub-centre) 3, i.e. 49 % of total, sub-centre 1, i.e. 15 % and sub-centre 4, i.e. 13 %. On the other hand, the lowest share is recorded by command and administrative sub-units (take into consideration that only direct costs were included (consumption of material, fuel, foodstuff, ammunition).

Figure 1 Costs of Selected Battalion (cost centre) per 14 Days Training



Source: Processing by authors on the base of internal MoD CR data from Data cube (2018)

As it was stated before, we are not able to allocate all costs for now because Data cube does not offer a possibility to allocate centrally acquired or recorded costs to partial activities (for example costs of using the training ground etc.). The cost-allocation base has to be defined firstly by Controlling department of MoD CR which is the main gesture of controlling implementation. After implementation of proper cost-allocation bases it will be possible to supplement total costs by indirect costs which definitely will increase information capability of controlling data.

To determine the purpose of public sources spending more precisely, it would be appropriate, in our opinion, to specify also closer areas (or categories) of consumption. We have identified more than one thousand ongoing activities proceeding in selected cost centre (based on analysis of Activity Plan). We have found that more than ½ of activities is identified on the lowest (non-compulsory) 9^{th} and 10^{th} levels. These levels of activity classification are too detailed in our opinion and the value of output information in comparison with the burden for its acquiring is at least debatable; also the utility for managerial purposes seems low. For this reason we abstracted from them in our further analysis. But still there stayed about 500 activities that we divided into four categories:

1. administration (51 % of activities);
2. public events and representations (19 % of activities);
3. training (16 % of activities);
4. courses (14 % of activities).

It was relatively surprising for us that more than 50 % of all planned activities of the 8th level belong to administration and only 16 % to training or courses (14 %). Even public representation include more activities (19 %). We think that this finding should be a subject of discussion within MoD CR as far as one of the most important aims of ACR is combat readiness.

Incorporating this information into the Budgetary structure, we would be able to track how much funds MoD CR spends in the given areas and for what. For this purpose ZJ attribute in Budgetary structure could be used. Suggested numerical designation could be inserted into the ZJ attribute as a part of the controlling process when invoices are liquidated again. So we could approach to defined long-term goal of MoD CR controlling, i.e. to create a Cost Plan that would contribute to comparison of planned and real costs with accordance to 3E principles.

4 Conclusions

To conclude our research we could state that controlling in MoD CR is able to monitor total costs of specific costs centres at present. However for managerial purposes (planning, budgeting, analytical) it would be more beneficial to track costs of proceeding activities rather than static cost centres. On the base of planning, budgetary and accounting documents and application analysis we claim there exist a linkage between planning, budgetary and accounting classification of activities that could be comfortably used for this purpose.

There exist several options how to accomplish it technically, probably the easiest way would be to supplement attribute CIL interconnecting all above mentioned classification by several numeric marks. But firstly it would be necessary to harmonize some terminological discrepancies and reduce amount of tracked planned activities, in our opinion, by 2 lowest level.

In the second part of the paper we selected one representative (training) activity and recorded its direct costs, so we proved our preliminary assumption concerning possibility of the procedure. Total costs allocated to selected activity we further divided into sub-centres which may enable to compare and evaluate consumption of sources by sub-centres or even individuals. Such evidence may be used for planning, budgeting, standard-setting, and various analytical purposes.

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Banking System Development and Economic Growth: Evidence from a Sample of High Income Countries and Low & Middle Income Countries

Lukáš Vodička

Masaryk University in Brno
Faculty of Economics and Administration, Department of Finance
Lipová 507/41a, 602 00 Brno, Czech Republic
E-mail: 421426@mail.muni.cz

Abstract: *This paper evaluates the relationship between banking system development and economic growth using data from 141 countries over the 1998 – 2015 period. Observed countries are also divided into two groups: high income countries and low & middle income countries. The set of explaining determinants describes three characteristics of the banking system – depth, efficiency and stability. The data is collected from following databases: World Development Indicators, Global Financial Development, KOF Index of Globalization and Financial Access Survey. Two-step system GMM estimator is used to address the issue of endogeneity. Robustness of the obtained results is tested with fixed-effects estimator. Using these methods we find that bigger banking system per se does not foster economic output, however its quality does. In case of high-income countries greater effect of banking sector instability on economic growth is observed.*

Keywords: banking, GMM, economic growth

JEL codes: E44, G21, O47

1 Introduction

The earliest work examining the influence of the financial system on the economic growth can be traced to the 19th century. Even though the topic has been subject of debate for a long time, it still attracts the attention of many researchers.

Levine (1997) states that the financial markets and institutions may appear to diminish the problem arising from the information and transaction frictions. The primary function of the financial systems is then to mediate the flow of money and to reduce the impact of information frictions.

However, some authors claim that with improved financial systems, new problems regarding economic growth arise. For example cheaper loans allow to shift budget limitations and increase the consumption over a given period. In macroeconomic growth models, this reduction in savings causes a lower economic growth over a longer period of time. Rajan (2005), as a reason for the possible negative impact of the finance on the economic growth, indicates the increase of the volatility and poor allocation of the capital, especially the human one, where the financial sector attracts educated specialists who would otherwise work in the productive sectors of the real economy. The impact of the banking system on the economic growth according to the existing theoretical framework does not necessarily have to be positive.

The work of Levine and King (1993) can be viewed as a breakthrough in the empirical verification of these theoretical propositions. They have improved the system of proxy variables describing the financial market. Thus, the ratios were used as the volume of bank loans to GDP. This work was absolutely essential for further research, especially by creating a *proxy* variables set-up. These variables captured predominantly characteristics of the banking system, and even in recent studies this approach is often favoured – banking system itself is then used as *proxy* for the whole financial system.

Exploring whether the impact of finance on the economic activity is really positive has been studied by many academics as a follow-up to Levine. Christopoulos and Tsionas (2004), using the OLS panel model, observed that this relationship was positive. In their work,

they used the variables of the banking sector size. Different approaches have been made to similar conclusions, for example, by Durusu-Ciftci et al. (2017).

Especially in the course of years after 2008, studies questioning the positive impact of the banking development on the economic growth emerged. Cecchetti and Kharroubi (2012) argue similarly to Rajan (2005). According to their results, the impact of the banking system on economic growth becomes negative after the ratio of loans to private sector reaches a certain threshold value. Berkes et al. (2012) also came to similar conclusions.

There is also a number of studies that track the negligible or unclear influence of the financial sector on the economic growth, e.g. the work of Hasan et al. (2016) who state that the financial depth does not have any significant impact on the economic growth, on the contrary to the effectiveness associated with a long-term economic growth.

The aim of this paper is to contribute to the evolving discussion on the topic and to assess the impact of the overall banking system and its characteristics on the economic growth of selected countries. The rest of the paper is organized as follows. Section 2 describes the methodology and dataset. Section 3 presents the results. To obtain the estimations of the effects of selected determinants on the economic growth, the GMM (Generalized Method of Moments) system estimator is used. Robustness of the results is tested with fixed-effects estimator. The last section discusses the results and compares them with the results of other works.

2 Methodology and Data

Barro (1991) has suggested a simple equation to determine the growth determinants:

$$Y_{i,t} = \alpha_0 + \alpha F_{i,t} + \beta X_{i,t} + \varepsilon_{i,t} \quad (1)$$

where α_0, α and β are the coefficients, F_{it} indicates a given indicator of the financial development of a country *i* in the course of time *t*, $X_{i,t}$ is the matrix of the control variables for a country *i* in the course of time *t*, $\varepsilon_{i,t}$ is the regression error.

To estimate the parameters, the GMM estimator proposed by Arellano and Bover (1995) and Blundell and Bond (1998) is used. Seven and Yetkiner (2016) report the following three advantages of the GMM (namely the system GMM):

- consistent and effective estimates of regression parameters when the regressors are not strictly exogenous and there are the heteroskedasticity and autocorrelation within the units,
- overcoming the problem of endogeneity using instrument variables which are exogenous,
- the estimator is suitable for studies with short periods of time, but numerous units (small *t* and large *n*).

For these reasons, the GMM estimator, namely the GMM two-step estimator, is selected for this study.

As stated by Bun and Windmeijer (2010), this estimator using the appropriate moment conditions has the following form:

$$\widehat{\alpha_S} = \frac{q'_{-1} Z_S W_n^{-1} Z'_S q}{q'_{-1} Z_S W_n^{-1} Z'_S q_{-1}} \quad (2)$$

where $q_i = (\Delta y_i', y_i')$. For a detailed description of the estimator, see Bun and Windmeijer (2010).

The accuracy of the model specification is verified by Arellano-Bond autocorrelation tests where the zero hypothesis is the absence of autocorrelation. According to Mileva (2007), it is important not to reject this hypothesis in the case of AR (2), as it reveals the autocorrelation at levels. Hansen's test then verifies whether the instruments applied are exogenous, the zero hypothesis is the suitability of the instruments. Both these statistics together with the number of instruments are reported along with the estimation of the coefficients in *Tables 2 and 3*.

The fixed-effect model estimator is not described due to limited space and the fact that the method is basic for panel data analysis, it is well known and widely used, and therefore it is not necessary to describe it here.

Data

An empirical study in this work is based on data for 141 countries in the course of 1998-2015. Countries are divided into two groups: high-income countries and low & middle-income countries according to the World Bank. Using this approach more homogenous panels are obtained and different results for each group can be observed.

Variables can be categorized into the explained variables, explanatory, and controlling variables. For modeling, the data is averaged over the three-year, non-overlapping periods due to the specification of the estimator. The database was compiled on the basis of the existing World Development Indicator database of the World Bank, and databases of the International Financial Statistics (IFS) – IMF, KOF Globalization Index ETH Zürich and GFDD compiled by Čihák et al. (2012).

Table 1 List of Variables

Variable source		Definition **type**
GDP per capita (constant 2010 US$) growth World Bank, WDI	o	ln (GDP per capita$_{t+1}$/GDP per capita$_t$). **dependent**
Gross capital formation (% of GDP) World Bank, WDI	y	Consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. **control**
Trade (% of GDP) World Bank, WDI	ac	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product. **control**
School enrollment, secondary (% gross) World Bank, WDI	ad	Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown **control**
Expense (% of GDP) World Bank, WDI	af	Expense is cash payments for operating activities of the government in providing goods and services. **control**
Overall globalization index KOF	ag	The KOF Globalization Index measures the three main dimensions of globalization: economic, social and political. **control**
CPI World Bank, WDI	ah	CPI (Consumer Price Index) after hyperbolic sine transformation **control**
Initial GDP per capita World Bank, WDI	ai	Controlling for convergence effect. **control**
Liquid liabilities to GDP (%) Cihak et al., GFD	ak	Ratio of liquid liabilities to GDP. Liquid liabilities are also known as broad money, or M3. **depth**
Deposit money bank assets to GDP (%) Cihak et al., GFD	am	Total assets held by deposit money banks as a share of GDP. **depth**

Private credit by deposit money banks to GDP (%)	an	The financial resources provided to the private sector by domestic money banks as a share of GDP.
Cihak et al., GFD		**depth**
Bank deposits to GDP (%)	ap	The total value of demand, time and saving deposits at domestic deposit money banks as a share of GDP.
Cihak et al., GFD		**depth**
Financial system deposits to GDP (%)	cp	Demand, time and saving deposits in deposit money banks and other financial institutions as a share of GDP.
Cihak et al., GFD		**depth**
BD (index for the depth of the banking system)	au (av)	First component obtained via Principal Component Analysis (ak, am, an, ap, cp), (av – quadratic form).
Authors' calculations		**depth**
Bank ROA	bg	Commercial banks' after-tax net income to yearly averaged total assets after hyperbolic sine transformation.
Cihak et al., GFD		**efficiency**
Bank ROE	bh	Commercial banks' after-tax net income to yearly averaged equity after hyperbolic sine transformation.
Cihak et al., GFD		**efficiency**
Bank concentration (%)	bd	Assets of three largest commercial banks as a share of total commercial banking assets.
Cihak et al., GFD		**efficiency**
Bank Z-score	bp	Z-score captures the probability of default of a country's commercial banking system.
Cihak et al., GFD		**stability**
Bank credit to bank deposits (%)	bo	The financial resources provided to the private sector by domestic money banks as a share of total deposits.
Cihak et al., GFD		**stability**
Bank capital to total assets (%)	bq	Ratio of bank capital and reserves to total assets.
Cihak et al., GFD		**stability**
Banking crisis dummy	bu	Dummy variable for the presence of banking crisis (1=banking crisis, 0=none)
Cihak et al., GFD		**stability**

Source: Own data processing

The reasons for the use of these proxy indicators of the financial system are not provided due to limited space. For the reasoning, see the publications in the introductory section. The descriptive statistics are available on request.

3 Results and Discussion

The banking development variables are studied across the single characteristics (depth, efficiency, and stability). Only the coefficients of the regressors representing the financial system will be reported for clarity of results and limited space. The impacts of these variables for each group of the countries are shown in the following tables. The regressors have not been included in a single model because of the limitation of the number of instruments. The control variables are always used. Each table presents an overview of several models with the statistics of the respective tests.

Table 2 Low-income Countries – Estimated Models. Based on the Analysis Performed on Data Collected

	RESULTS			MODEL SPECIFICATIONS			
	Variable	Coefficient	p	AR(2)	Hansen	Instruments	Groups
Depth	au	-0.0204	**0.003**	0.1	0.287	61	75
	an	-0.0217	**0.008**	0.13	0.244	61	75
	av	0.00917	**0.023**	0.06	0.132	61	75
Efficiency	bg	0.01357	0.126	0.05	0.34	61	75
	bh	0.01253	**0.004**	0.08	0.333	61	75
	bd	0.00176	0.989	0.11	0.335	61	73
Stability	bp	0	0.988	0.12	0.292	61	75
	bo	-0.0105	0.394	0.13	0.212	61	75
	bq	0.01495	0.409	0.26	0.779	61	55
	bu	0.0009	0.944	0.06	0.121	46	75

Source: Own data processing

Variables: **au** – index for the depth of the banking system, **an –** private credit by deposit money banks to GDP, **av** – au^2, **bg** – bank ROA, **bh** – bank ROE, **bd** – bank concentration, **bp** – bank Z-score, **bo** – bank credit to bank deposits, **bq** – bank capital to total assets, **bu** – banking crisis dummy

Table 3 High-income Countries – Estimated Models. Based on the Analysis Performed on Data Collected

	RESULTS			MODEL SPECIFICATIONS			
	Variable	Coefficient	p	AR(2)	Hansen	Instruments	Groups
Depth	au	-0.0156	0.064	0.15	0.82	61	47
	an	-0.0458	**0**	0.09	0.76	61	48
	av	-0.0056	0.06	0.12	0.783	61	47
Efficiency	bg	0.03084	**0**	0.07	0.794	61	48
	bh	0.01065	**0.002**	0.1	0.754	61	48
	bd	0.00412	0.815	0.11	0.798	61	48
Stability	bp	0.00347	0.678	0.08	0.754	61	48
	bo	-0.0321	**0.017**	0.03	0.789	61	47
	bq	-0.0008	0.938	0.07	0.875	61	43
	bu	-0.0241	**0**	0.49	0.245	46	48

Source: Own data processing

Variables: **au** – index for the depth of the banking system, **an –** private credit by deposit money banks to GDP, **av** – au^2, **bg** – bank ROA, **bh** – bank ROE, **bd** – bank concentration, **bp** – bank Z-score, **bo** – bank credit to bank deposits, **bq** – bank capital to total assets, **bu** – banking crisis dummy

The statistically significant negative impact of the size of the banking market on the dependent variable can be observed in both groups. The coefficient associated with the quadratic regressor at the banking market is negative (i.e. concave function and declining yields) in case of high-income countries (however, significance of this relationship is rejected, even though by a narrow margin) and positive in case of low-income countries (i.e. after a certain point big banking systems could support economic growth in these countries). According to the results, the size of the banking system does not foster growth of the economy, and it may even reduce it.

The coefficients of banking system efficiency show that the effectiveness of the banking system is statistically significant with a positive impact on the economic growth. The *bd* variable (bank concentration) representing the competition at the banking market is statistically insignificant. This holds in both groups of countries.

The final monitored feature of the banking systems is their stability. The *bo* and *bu* regressors (loans to bank deposits and bank crisis dummy variable) are statistically significant with a negative impact on the economic growth, which is in line with the expectations. However, this relationship is significant only in case of high-income countries. This can be due to the fact that advanced countries with developed financial systems are more likely to be negatively affected by financial crisis.

The robustness of the results is checked with fixed-effects estimator. For simplicity, robustness is checked for the collective data. Therefore the results are slightly different from a quantitative point of view, but from a qualitative point of view the results are comparable.

Table 4 Robustness Check – Estimated Models. Based on the Analysis Performed on Data Collected[25]

Regressor		GMM	FE
Depth			
Credit (% GDP)	an	**-0.0274**	**0.4144**
BD (PCA index for the depth)	au	**-0.015**	**-0.352**
Efficiency			
Bank ROA	bg	**0.015709**	**0.01042**
Bank ROE	bh	**0.104636**	0.0007
Stability			
Credit to deposits (%)	bo	**-0.01519**	**-0.43114**

Source: Own data processing

The results obtained via fixed-effects estimator are more or less in line with results obtained via GMM. In case of *an* variable, the observed effect is opposite, however *au* variable is better *proxy* as it comprises more aspects of banking system. Most results are robust to the FE check.

4 Conclusions

This work contributes to the existing literature on the finance and economic growth by analyzing the main sector of the financial system and its characteristics. Using a wide-ranging spectrum of variables it enables to gain a new insight into the issue and contribute to an evolving discussion on this subject. Countries are divided into two groups: high-income countries and low & middle-income. Using this approach more homogenous panels are obtained and different results for each group can be observed. The data processing uses a two-step estimator GMM system that addresses the endogeneity problem of the variables used – for this reason, it is a popular estimator for a given topic, e.g. work Berkes et al. (2012).

Using this method, estimates of the coefficients of individual indicators are obtained, which show that the quality and quantity represent two conceptually different areas with different effects on the economic growth. While a larger banking system may even have a negative impact on the growth, the stability and the effectiveness of the banking system are crucial to the growth of the economy. The negative impact of the size of the banking system on the economic growth may, for example, be the result of the "too big to fail" policy, where the banks are motivated to take a higher risk and commit moral hazard. This behavior may result in an increased volatility in the financial markets or even in the financial crisis.

[25] Statistically significant estimates are highlighted using the **bold** font.

Another possible reason for the negative impact is the reduction of the household savings, as discussed earlier. The results do not provide clear evidence of a concave relationship between the size of the monitored sector and the performance of the economy, although this function is observed, it is not statistically significant in case of high-income countries. In case of low-income countries a convex function is observed. This result contradicts the work of Berkes et al. (2012). The efficiency then, according to the obtained coefficients estimates, contributes to the economic growth and the same can be said about the stability of the given sector. According to the results high income countries are more affected by the potential instability.

The results obtained are robust to the fixed effects check and in accordance with the conclusions of Hasan et al. (2016). Based on this study, it can be said that not the size, but the quality of the banking system is an important determinant of the GDP growth.

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Equality In Old-Age Security In Poland

Damian Walczak

Nicolaus Copernicus University in Torun
Faculty of Economic Sciences and Management, Department of Financial Management
Gagarina 11, 87-100 Torun, Poland,
E-mail: dwalczak@umk.pl

Abstract: *Defining the scope and form of old-age security should be based, among other things, on the principles of social justice and equality. Equality is the manifestation, and the instantiation of social justice and it means the equal treatment of equals. Therefore, distribution, especially the one made in the pension system, does not have to be equal, but it is to serve everyone, so it has to be fair and based on the cooperation system. Unfortunately, many pension privileges in Poland are not implementing the principle of equality. The study analysed, on the basis of a nationwide survey conducted in 2016, public opinions on equality in the pension system. In addition, in the paper, I show expenditures for retirement benefits of privileged persons in the Polish pension system. The aim of the article is to present the equality in the pension system in Poland, both in the theoretical aspect, and in the practical aspect. The logistic regression method was applied while attempting to reach the research aim of this study. In the paper, also, the following research methods were applied: statistical analysis, economic analysis of the law and analysis of documents.*

Keywords: equality, pension, social security, savings

JEL codes: D14, D31, D63, H23, H55

1 Introduction

The pension system is a tool for dividing the current GDP between the working generation and the generation of pensioners (Chybalski, 2016). However, the manner of this division depends on the adopted regulations within a given system. The current system of defined benefit or defined contribution, introducing a funded or PAYG system influences the division of GDP in different ways. Also, actuarial system balancing, as well as social justice or equality are dependent on detailed solutions (Chybalski, Marcinkiewicz, Fabian, 2018; Kurach, 2017; Mešťan, Šebo, Králik, 2017).

Social justice may be understood as "the form of claims against the incomes and property of fellow citizens through collective schemes for redistribution", of course this claims has to be related to the fairness of exchanges and fairness of contracts (Jordan, 1998). In turn, equality is the manifestation and the instantiation of social justice and it means the equal treatment of equals (Antonów, 2015; Pacud, 2015). However, equality may refer to equal of meritas, needs, conditions, opportunities, access or outcome (Ratajczak, 2017). Therefore the equality should be always the dominant principle of distributive justice, upon which a pension system is founded (Deutsch, 1975). However, distributive justice may have three totally different meanings:

a) the perception of the individual about fairness of rewards they receive from the organization (Iqbal, 2013),
b) fair distribution of goods within a group (Schweizer-Ries, 2008). It could be only intragenerational fairness (Fenge, 2005) or, also, intergenerational fairness (Zuber, 2016), or both together,
c) equal distribution of income in the whole life (it means adequacy of pension, Attias et. al. 2016). This area obviously also correlates with the state's duties to appropriately shape the pension system, in order for the abovementioned smoothening of consumption within a lifecycle to be realized.

Thus in the case of equality we are talking about matters related to objective and subjective equality, as well as equality in terms of individual income within the whole lifecycle.

The aim of the article is to present the equality in the pension system in Poland, both in the theoretical aspect (theory of equality – presented above), and in the practical aspect (actual pension and public opinion about equality in the Polish pension system).

2 Methodology and Data

The article has been based on the study entitled "Wiedza i postawy wobec ubezpieczeń społecznych" ("Knowledge of and attitudes towards social insurance") conducted by Social Insurance Institution (the institution in charge of social insurance in Poland, which employs over 45,000 people), later in the paper – "SII study" (SII, 2016d). The study was conducted in July and August 2016, and its aim was to provide information about the state of knowledge about social insurance in the Polish society. It was carried out on a random sample representative of the total population of Poland aged 15-75. The sample size was N=1,030 people. The sample was a random-quota one and it was selected from the Main Statistical Office's address database. The process was carried out by using the CAPI technique (computer-assisted personal interview).

Due to the low level of knowledge on the topics related to the pension system in Poland (Olejnik, Białowąs, 2015; Musiał, Świecka, 2017) the article deals only with those questions which refer to general matters or subjective opinions on equality-related matters.

In the article (the description of the research method was fully taken from Krupa, Walczak, 2016) the dependence of the characteristics was determined with the use of the chi-square test of independence (χ^2 test). In each of such tests individual indications of respondents were compared with potential characteristics that determine their decisions (the relevant calculations were made with the use of SPSS Statistics 24).

For each pair of characteristics a zero hypothesis H_0 was set and it assumed that the compared characteristics are independent, and the hypothesis H_1 assumed that these characteristics are dependent. If the calculated χ^2 is greater than the critical value $\chi^2_{\mathrm{df},\alpha}$ (for degrees of freedom df: (r-1) (s-1) and a presupposed level of significance $\alpha = 0.05$), then H_0 should be rejected, otherwise there is no reason to reject the null hypothesis.That means that $\chi^2 \geq \chi^2_{df,\alpha}$ and we reject H_0 at the significance level α, and we may suppose that the characteristics are dependent, $\chi^2 < \chi^2_{df,\alpha}$, there is no reason to reject H_0 assuming the independence of characteristics.

The work will also include the presentation of figures concerning the basic equality-related issue in the pension system, which is the average amount of pension benefits in Poland. The figures will be presented based on the data from the Main Statistical Office, Social Insurance Institution and the Agricultural Social Insurance Fund.

3 Results and Discussion

Equality in a pension system can be measured in a number of manners. It can especially take place in Poland, a country whose whole system of old-age security is very diverse (Walczak, 2017). The measures of that equality may be the level of pension contribution, the minimum age of entitlement to pension benefits, or the amount of benefits received. Due to the scope of this work (the other figures would require a separate, lengthy subject analysis), it will present only the amounts of benefits in the Polish pension system. As pointed out in Table 1, Poland demonstrates a lot of variety in the level of aforementioned benefits. Farmers receive about 50% of the benefit received within the general pension system. On the other hand, soldiers, miners, police and prison system officers receive almost twice the amount received within the general system. The highest pensions, however, are received by judges and prosecutors. Their benefits are several times the amount of the ones received by farmers or beneficiaries of the general system.

In the context presented above, it can be stated beyond any doubt that in terms of insurance the system is far from equal. Different professional groups receive benefits in different amounts. At the same time, if one were to analyze the contents of Table 1, it

could not be overlooked that benefits in "The provision pension system" are fully financed from the state budget, in "The farmers' pension system" it is so in about 95%, whereas in "The general pension system" it happens partially. "The general pension system" is theoretically based on the system of defined pension contribution, with the pensions being a derivative of the accumulated capital (Walczak, 2017; Walczak, Pieńkowska-Kamieniecka, 2015). However, due to the minimum pension guaranteed to those with minimum required insurance period (Bielecki, Tyrowicz, Makarski, Waniek, 2015), as well as individuals who receive benefits on the basis of defined benefits rule (Wojdak, Kopański, Bojanowska, 2015) (for example, miners, as well as people born before 1 January 1949), the system needs to be subsidized by the state.

What is the reason for the diversity in the level of pension benefits in Poland? Unfortunately, it is not equality in terms of opportunities or needs, which would justify such a significant diversity. According to Golinowska (2009), the existing pension privileges were shaped in the years 1945-1990, *i.e.*, during the years of Communist control in Poland. Then authorities used the system as an instrument to attain their political goals. Thus, pension benefits in Poland are a derivative of power and privileges acquired in relation to it, not of equality perceived in any way.

Table 1 Average Pensions Value in 2015 (in PLN)

Type of system	Paying institution	Type of benefit	Average pensions
The general pension system	Social Insurance Institution	Average monthly pension	2,096.55
		Miners	3,994.59
		Bridging benefits	2,422.06
		Compensation benefits for teachers	1,552.45
The provision pension system	The Ministry of National Defense	Soldiers and military intelligence and counterintelligence officers	3,395.61
	The Ministry of Internal Affairs	Officers of the Police, Internal Security Agency, Intelligence Agency, Central Anticorruption Bureau, Border Guards, Government Protection Bureau, State Fire Service and State Protection Bureau	3,671.46
	The Ministry of Justice	Prison Service Officers	3,518.32
	Last employer (relevant court or prosecutor's office)	Judges and prosecutors	8,236.12
Farmers' pension system	Agricultural Social Insurance Fund	Farmers	1,209.81

Source: own study based on (CSO, 2016; SII, 2016a; SII, 2016 b; SII, 2016c)

In Table 2 it was pointed out that the Poles opt for leveling the income of all citizens. Out of 1,030 questioned, only 37 strongly oppose the idea. Fewer people, yet still a vast majority of the surveyed, opts for common, i.e. state's responsibility for providing old-age security. The presented results indicate that a small portion of the respondents believe that income-related matters, as well as old-age security, should be left to one's individual decision. According to most, those matters are of such importance that they should bring about the state's action. The Poles thus opt for equality of results, which is a feature of a socialist state.

Table 2 Responses to Questions: "We should aim for the incomes of all people to be relatively equal" (Q1) and "Security for old-age is a topic of importance for the society as a whole and we should all aim for it" (Q2)

Specification	I strongly disagree	I rather disagree	I rather agree	I strongly agree	Hard to say	Total
(Q1)	37	158	465	311	59	1030
(Q2)	82	246	431	171	100	1030

Source: own study based on "SII study"

Analyzing in more detail which respondents were more in favor of the suggested actions by the state, in Table 3 the results of Chi-square test of independence were presented. In contrast to the results of Walczak and Pieńkowska-Kamieniecka (2018), only the variable "gender" does not have any relation with the responses provided. The remaining variables are dependent. It means that people of different characteristics within particular variables have different opinions on the issues presented in the article.

Presenting those issues in more detail (due to its size limitations, the article will not present the figures concerning individual values), it can be noticed that people who have children definitely opt for leveling incomes. 81.5% of people with children strongly agree (or rather agree) with the opinion that people's incomes should be equal, whereas among the childless the rate is 72.2%.

People living in the countryside and smaller towns are much more willing to support the postulate of income leveling. The ones who strongly or rather agree are 81.4% of countryside inhabitants and 68.5% of big city dwellers (cities above 500,000 inhabitants). In the case of education, the dependence amounts to lower support for equality by people with better education. Whereas 75.3% of people with primary education support (strongly or rather) the necessity to level the income of all people, among those with higher education the rate is merely 63.8%.

It is the more educated, however, unlike the topic of income leveling, that opt for the role of state in ensuring equal old-age benefits. As many as 87.2% of people with higher education, in contrast to 77.1% of those with primary education, believe in the state's role in ensuring old-age pension to all citizens. Single persons (77%) are much less likely to support the role of state than married ones (85.2%) and divorced (81.6%). In the case of age, as can be guessed, senior citizens are much more willing to support such a solution. According to age, 85.2% of those aged over 55 are in favor (strongly or rather agree), with 77% of those aged below 35.

In both questions the less well-off are in favor of income equality and old-age security being a topic of common interest. However, in the case of aiming for the incomes of all people to be equal the difference is greater. As many as 82.3% of people with the lowest income (0-1,200 PLN per capita in a household) believe that this is the course of action to be taken, whereas only 68.8% of the wealthiest (income above 2,000 PLN per capita in a household) believe the same.

Table 3 Results of Testing of Dependencies Between Equality-related Questions (Q1 and Q2) and Selected Variables

Dependent Variable	χ^2	Degrees of freedom (df)	$\chi^2_{df,\alpha}$	p-value	Decision[1]	Phi (V-Cramer a)
We should aim for the incomes of all people to be relatively equal (Q1)						
Gender	2.699	4	9.4877	0.609	No reason to reject H_0	-

Age (3 groups: aged 0-35; aged between 35 and 55; aged above 55)	6.245	8	15.5073	0.620	No reason to reject H_0	-
Marital status (single; married; divorced, widow/widower)	14.198	8	15.5073	0.077	No reason to reject H_0	
Having children (yes; no)	11.861	4	9.4877	0.018	Rejection H_0	0.107 (0.107)
Size of the place of residence (4 categories: countryside; towns below 100,000 inhabitants; cities below 500,000 inhabitants; cities over 500,0000 inhabitants)	30.635	12	21.0261	0.02	Rejection H_0	0.172 (0.100)
Education level (4 categories: primary; vocational; secondary; above secondary)	29.385	12	21.0261	0.03	Rejection H_0	0.169 (0.098)
Income (3 categories: below 1,200 PLN; below 2,000 PLN; over 2,000 PLN)	25.976	8	15.5073	0.01	Rejection H_0	0.159 (0.112)
Security for old-age is a topic of importance for the society as a whole and we should all aim for it (Q2[2])						
Gender	0.881	4	9.4877	0.927	No reason to reject H_0	
Age	26.027	8	15.5073	0.01	Rejection H_0	0.159 (0.112)
Marital status	19.008	8	15.5073	0.015	Rejection H_0	0.136 (0.096)
Having children	7.84	4	9.4877	0.097	No reason to reject H_0	
Size of the place of residence	14.214	12	21.0261	0.287	No reason to reject H_0	
Education level	27.734	12	21.0261	0.06	Rejection H_0	0.164 (0.096)
Income	15.718	8	15.5073	0.047	Rejection H_0	0.124 (0.087)

[1] Rejection of H_0 means dependence of indicated variables.
[2] The variables in Q2 have the same categories like in question Q1.
Source: own study based on "SII study"

4 Conclusions

The Polish pension system is definitely not based on equality, regardless of how the equality would be measured. Equality in Poland was transformed into an element of power. Unfortunately, instead of an equality-based system, Poland has an overly diversified one, which in addition requires subsidization from state budget. The subsidy is also not

distributed equally, but goes only to some privileged groups, since the beneficiaries receive retirement pensions of different amounts.

Very high variability in the amount of benefits may have negative results in the future, as then the people may come to the conclusion that the principle of income leveling that they postulate is not followed in the pension system. As a result, they may demand benefits to be leveled, even to the extent of taking away the acquired pension rights in the name of "equality".

The Poles believe that old-age security should be a topic of common social interest, which means that they indirectly opt for increasing the state's activity in terms guaranteeing benefits to senior citizens. Due to that, as mentioned above, they probably also expect that those benefits would also be made equal. The group especially in favor of this solution are senior citizens, whose numbers will continuously grow. A similar opinion is also shared by poorer people, who are a growing group of future pensioners.

The studies described in the paper allow for formulation of two most important conclusions:

- the Polish pension system does not follow the principle of equality,
- the Poles expect leveling of incomes and activity of the state in ensuring old-age security.

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The Use of Different Methods of the Tax Base Estimation in Income Taxes in the Light of SAC Rulings in 2017 in Poland

Radosław Witczak

University of Lodz
Faculty of Economics and Sociology, Institute of Finance
Narutowicza 68, 90-131 Lodz, Poland
E-mail: radoslaw.witczak@uni.lodz.pl

Abstract: *Important issue for public finance is tax evasion. This problem concerns also income taxes. In order to protect the interests of the State Treasury and to ensure fair competition in the economy, measures must be available to prevent the occurrence of such attempts. One way to combat tax evasion is estimation of the tax base. The Polish legislation points out different methods of the tax base estimation. The provisions provide tax authorities with a list of six tax base estimation methods they can use. However, tax authorities may use other methods serving the same purpose, but the law (the Tax Ordinance Act) does not indicate what these methods should be. The aim of the article is to indicate methods of the tax base estimation used by the tax administration in the light of SAC rulings in 2017. The analyse of using the methods of estimating of tax base by the tax authorities was given. The scope of the analyse were different cases from the administrative court. The cases concerned different types of methods of tax estimation used by the tax administration. In all analysed cases the other methods than pointed out in the provisions were used. The implementation of rules concerning other methods of estimating of tax base was proposed.*

Keywords: taxation, tax fraud, income taxes, the estimation of tax base, tax collection

JEL codes:H26, H25, H24 H83, K42

1 Introduction

The tax evasion is an important problem for public finance in Poland. As the data show the scale of gray economy comparing to GDP is decreasing but still is relevantly high last years (see table 1).

Table 1 The Scale of Gray Economy (2014-2018)

Year	**2014**	**2015**	**2016**	**2017**	**2018**
Bln PLN	361	370	377	396	402
Bln EUR (1EUR= 4PLN)	90,25	90,5	94,25	99	105
Share of gray economy in GDP (%)	19,7	19,5	19,0	18,7	18,0

Source: developed on the Instytutu Prognoz i Analiz Gospodarczych (Institute of Forecasting and the Economic Analysis) (Cieślak-Wróblewska, 2018)

The share of gray economy in gross domestic product in years 2014-2018 decreases smoothly to the rate 18%. However, the nominal value of gray economy increases every year. It means the tax administration should combat the scale of illegal activity of taxpayers. One way to combat tax evasion is estimation of the tax base. The provisions provide the tax authorities with a list of six tax base estimation methods they can use. However, tax authorities may use other methods serving the same purpose, but the law (the Tax Ordinance Act) does not indicate what these methods should be. Some of the tax estimation methods are described in the literature data. The previous partial researches show that tax administration uses mainly the tax estimation methods which were not described in the provision or in the literature data. It is advisable to research if the Polish

tax administration uses the tax estimation method indicated in the provision and if the provisions require to be improved.

The aim of this article is to indicate methods of the tax base estimation used by the tax administration in the light of SAC ruling in 2017.

The research hypothesis is as follows: The tax administration uses different income estimation methods including the methods indicated in the provisions.

2 Estimation of income in Tax Ordinance Act

According to the Tax Ordinance Act tax authorities may estimate the tax base. The tax law allows to estimate tax base in following cases (the Tax Ordinance Act, art. 23 item 1):

- there are no tax books or other data necessary to determine the tax base,
- the taxpayer has breached the conditions entitling him or her to lump-sum taxation taxpayers' taxable incomes,
- the data resulting from the tax records do not allow the taxable base to be determined.

The reason for estimation is involved with the reliability of tax evidences. The law in force stats that tax records should be kept reliably and correctly. Tax registers are considered as reliable if their entries reflect the actual state. The effect of unreliable tax evidences can be estimation of the tax base (Melezeni, 2017).

According to the tax law the tax authorities refrain from determining the taxable base by the use tax estimation. Despite the lack of tax books, the tax authority may determine the tax base if it is possible to obtain evidence during the proceedings or data stemming from tax books and the evidences enable to determine the tax base (Dzwonkowski, 2018).

The Tax Ordinance Act provides tax authorities following tax base estimation (statutory) methods they can use (the Tax Ordinance Act, art. 23 item 3):

- the internal comparative method,
- the external comparative method,
- the inventory method,
- the production method,
- the cost method,
- the type of income as a percentage of turnover.

The legislator has defined the tax base estimating methods included in the provisions in a laconic way (Etel, 2018). One of the tax estimation method is the internal comparative method. The tax base is determined on the base of comparing the amount of turnover with the previous years' turnover figures in the same taxpayer. The next method is external comparative method. It estimates the tax base comparing the amount of turnover in other enterprises that are doing business in similar conditions. The inventory method consists in comparing the value of the assets of the enterprise at the beginning and at the end of the period, taking into account the turnover speed rate. The production method estimates the tax base on basis of the production capacity of the taxpayer. According to its legal definition cost method derives the turnover figure from a company's expenses based on a coefficient indicating their share of turnover. The last method is the type of income as a percentage of turnover. The amount of income is calculated from the sale of particular goods and particular services based on their share of total turnover (Dworniak, 2003; the Tax Ordinance Act, art. 23 item 3). Some authors maintain that those methods are most popular in use in practice (Brzeziński, et al 2002). Tax authorities may use other methods to estimate the tax base than those mentioned above. The law does not indicate what these methods should be. Until the end of 2015 there was priority for the methods specified in the provisions. The non statuary methods could be applied in particularly justified cases if the statuary methods could not be applied. Currently, the importance of non-statuary methods and contained in the statutory catalogue - has been equated (Dzwonkowski, 2018). Following methods as 'non-statutory' methods are presented as in the literature (Schneider, 2007; Brzeziński et al., 2007; Brolik et al., 2013; Etel 2018):

- determination the turnover figure from information sources,
- determination the percentages of particular products in total production
- determination the percentages of some goods in the total turnover of the company,
- analysing the formulas used to make particular products,
- estimation business expenses in relation to turnover,
- examining the consumption of electricity,
- estimation a taxpayer's incomes based on its expenses,
- investigating net profits,
- utilising an econometric model of costs.

One of the income estimation method mentioned above is a taxpayer's incomes based on its expenses method. This method is indicated in fact in the Polish law. This method may be used in case of revenues unmatched by the disclosed sources or derived from undisclosed sources as a part of the Personal Income Tax (Kandut 2017). The provisions on revenues unmatched by the disclosed sources or derived from undisclosed sources (the assessment of not revealed sources of incomes) concern particular issues to be followed by the tax administration (Marciniuk, 2017). There are opinions not accepting the assessment of not revealed sources of incomes as an estimation method determining the tax base (Dzwonkowski, 2009; Pietrasz, 2007). It means the assessment of not revealed sources of incomes is not an estimation itself. So a taxpayer's incomes based on its expenses method can be used by the tax administration while the tax is determined only on the basis of the provision of income tax in case of not revealed sources of incomes. Although, some authors (Schneider, 2007) and the German provisions foresee the calculation of the income based on expenses as one of the income estimation methods (Carlé, 2006).

Tax authorities should calculate a taxpayer's liability as accurate as possible. It means that tax administration should apply such a tax estimation method which allows to determine the tax base as close as possible to its accurate value (the Tax Ordinance Act, art. 23 item 5; Adamiak et al., 2014).

3 The identification of use of income tax base estimation methods– research findings

The empirical part of this article is based on the analysis of case studies derived from the rulings of the Supreme Administrative Court. Taxpayers challenging tax authorities' decisions may lodge a complaint with the Voivodeship Administrative Court (VAC). VAC is competent to assess whether a particular decision is legally sound. A complainant who disagrees with the ruling issued by the Voivodeship Administrative Court may submit a cassation appeal to the Supreme Administrative Court. All rulings that the Supreme Administrative Court made in 2017 from 1. January to 30 April and which were available in the Lex database were analysed. As many as 129 rulings issued in connection with article 23 of the Tax Ordinance Act regulating the use of the tax base estimation rules were examined. By analysing court rulings concerning the article 23 of the Tax Ordinance Act the application of estimation methods may be identified. The rulings of Supreme Administrative Court which were examined involved different types of taxes (see table 2).

Table 2 The Types and Numbers of Taxes to which Estimation Provisions Apply

Tax	Income taxes	Income taxes cases as a percentage of all rulings	VAT	VAT cases as a percentage of all rulings	Excise	Excise cases as a percentage of all rulings	Other taxes	Other tax as a percentage of all rulings
No. of cases	52	40,3%	48	37,2%	14	10,9%	15	11,6%

Source: developed by the author

More than 40% of the analysed rulings (see table No 2) concerned income taxes. However, the majority of this rulings were referring to personal income tax (as many as 49 rulings). Only 3 rulings referred to corporate income tax. Whereas, Value-added tax was dealt with in 48 of the rulings. Excise tax was analysed in almost 11% of cases. Also 11 % of analysed rulings related to other taxes like fuel duties, lump sum turnover-based tax.

A more detailed analysis was applied to rulings made in cases where the provisions concerning tax base estimation in income taxes (both personal income tax and corporate income tax) were used. The income estimation methods were applied by the tax authorities in 18 cases (see Table 3).

Table 3 Numbers of Rulings Concerning Estimation Methods and Other Matters Related to Income Taxes

No. of analysed rulings	No. of rulings in which tax base estimation methods were used	No. of rulings in which tax base estimation methods were used as a percentage of all rulings on income taxes	No. of rulings on matters other than the use of estimation methods	No. of rulings on other matters as a percentage of all rulings on income taxes
52	18	34,6%	34	65,4%

Source: developed by the author.

The data in Table 3 show that tax authorities did not use the tax estimation methods in 65,4% of analysed cases. The reasons why there were no tax base estimation methods in the SAC rulings were varied. One important reason was the problem of dummy invoices used as a source of deductible costs. Taxpayers lodged a complaint with VAC demanding using the estimation of tax base. Other reasons were a withdrawal from an estimation procedure or the non-applicability of estimation methods. In some cases the SAC ruled on other issues than tax base estimation like for example expiration of tax liabilities.

Tax estimation is in fact used in some cases when the tax administration uses the rules allowing to refrain from determining the taxable base by the use tax estimation. It may be a way of avoiding the provisions on using tax estimation methods. The tax administration should have justified the choice of the tax estimation method according to provisions when the tax decision were taken. It should explain the use of the applied estimation method. It is easier to formally abandon the tax base estimation and calculate the income tax on base of other evidences. Moreover, such activity seems to be accepted in the SAC rulings. It is not a purpose of this article to investigate the use of rules of abandoning the tax base estimation by the tax authorities. However, this problem should be research in separate article.

In 18 analysed cases involving income taxes, tax authorities used different methods to estimate taxable income. Tax authorities did not used the statutory methods in analysed cases at all. The use of statutory methods requires to meet special conditions. If the taxpayer does not keep his or her tax records it is impossible or it is very difficult to apply such methods like the internal comparative method, the inventory method, the cost method. The external comparative method requires to find companies doing business in similar conditions as the taxpayer does. It is not always possible to find such companies. In case of the production method the tax administration cannot recognize that the production capacity of the taxpayer equals his or her volume of revenues. In the free market economy is not a problem to produce goods or services, but to sell them. So this method in the free market economy cannot be used as the only estimation method. The production method should be only used to determine the maximum range of estimated income. In my opinion, this is why statuary methods are not applied by the tax administration.

The study also shows that the taxpayer's incomes based on its expenses method was not used at all. Although, this method seems to be helpful for tax administration in case of lack of data. The reason for not applying this method may be the fact that this method refers to revenues unmatched by the disclosed sources. The source of income is known in analysed cases while generally the Tax Ordinance provisions on the tax base estimation are applied. It is usually doing business by the taxpayer. The tax administration estimates tax base on the basis of Tax Ordinance not PIT and provisions on revenues unmatched by the disclosed sources or derived from undisclosed sources. This is why the tax authorities do not use this method. It is advisable to change the law. The based on taxpayer's expenses method should be indicated as one of the methods of income estimation regulated in Tax Ordinance. It could be determined in more detail in the provisions like provisions of not revealed sources of incomes.

Following sources were used to estimate the income by the tax authorities in particular analysed cases (in some rulings there was no particular information on applied tax estimation methods).

- the mixed method,
- testimonies of recipients of services, data from bank account, (three cases of the same taxpayer, but they concerned different tax years),
- average margins based on data from other authorities, statistical office and taxpayer's explanations,
- the value of the goods at the beginning and at the end of the year, average price and the average margin to estimate the costs,
- data obtained from the tax records (the amount of purchased materials), testimonies of recipients of services and data obtained from contractors,
- testimonies of witnesses, tax records of the contractors, data from employment and social insurance records kept by the taxpayer, bank account, taxpayer's explanations on the cost calculation,
- tax records for VAT purposes, the share of costs in revenues obtained from the tax records from other part of the tax year,
- the mix of the internal comparative method and the cost method, taxpayer's explanations but with use of other evidences like taxpayer's tax records,
- testimonies of recipients and external market data.

The mix method was based on the features of the internal comparative method regarding the share of operating expenses in the audited period in the sales volume of products, determined based on data from the accounting system and their comparison with information about transactions obtained from taxpayer's contractors. At the same time, through its application, the income from unauthorized sales was estimated, using data from the list of shipments, taking into account the average prices of products in relation to the documented outflow of products. Formally this method was applied in 8 analysed cases, but the rulings referred to the same taxpayer, but they concerned different tax years or the tax advances.

As the study shows the testimonies of recipients (witnesses), taxpayer's explanations are often used to estimate the income of the taxpayer. In case of taxpayer's explanations it would case the underestimation of the income. There is a risk that the taxpayer who have not fulfilled his or her tax obligation properly also could underestimate the data used for estimation. Due to fact that the non – statuary methods are be applied it is advisable to elaborate the guidelines for use the non – statuary methods.

4 Conclusions

In most of analysed cases the tax administration did not use tax estimation methods at all. If the tax was estimated the tax authorities applied the non – statuary methods. So the hypothesis was verified that the tax administration does not use the income estimation methods indicated in provisions. These findings suggest some changes in the tax system. Due to fact that the methods indicated in Tax ordinance are seldom able to be applied in the case of taxpayers doing business it is advisable to elaborate the guidelines for the use

of non – statuary methods. The tax estimation can be applied in fact by the tax administration by using the rules of abandoning the tax base estimation. In such a case no method is named by the tax authorities due to fact that formally no tax estimation is applied. However, this problem of should be research in more detail. Another change in the law concerns the use of the based on taxpayer's expenses method. This method should be indicated as one of the methods of income estimation regulated in Tax Ordinance. It could be determined in more detail in the provisions like provisions of not revealed sources of incomes.

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Debt Capacity and Capital Structure of the Companies Managed by Overconfident CEO

Elżbieta Wrońska-Bukalska

Maria Curie-Skłodowska University
Faculty of Economics
Pl. M. C. Skłodowskiej 5, 20-031 Lublin
elzbieta.bukalska@umcs.lublin.pl

***Abstract**: Overconfidence is one of the psychological biases that have impact on financial decisions. Still, as for financing decisions there is no consensus on the direction of the impact, and in assessing this - some research show using excessive debt while others debt-conservatism. We, in turn, assume that inconsistency on the capital structure decisions of overconfident managers might be explained by debt capacity of the their companies. We think that companies managed by overconfident managers have lower debt capacity and, at the same time, they use a higher debt ratio than their debt capacity allows. We collected a unique sample composed of 145 non-listed companies and their financial data for the 2010-2015 period. We then divided the sample into two subsamples depending on managerial overconfidence. We found that debt capacity is lower for companies managed by overconfident managers. There are also differences in sources of debt capacity: for companies managed by overconfident managers the main source is size and tangibility. Moreover, companies managed by overconfident managers have lower debt ratio. This might indicate safe financing strategy, but using a low debt ratio means that companies managed by overconfident managers are constrained to use equity because they exhaust their debt capacity.*

Keywords: overconfidence, capital structure, debt capacity

JEL codes: G32, G40, D91

1 Introduction

Overconfidence is one of the biases and fallacies that affects a cognitive process. Overconfidence can have some serious consequences. Researchers have offered overconfidence as an explanation for medical misdiagnosis, mistaken court judgement based on overconfident witnesses' statements, road accidents, as well as the ill-considered decisions made by politicians (Johnson, 2004). The notion of overconfidence has been studied since 60ies of the XX century. Eventually, overconfidence was identified as a complex phenomenon. Moore and Healy (2008) identified three dimensions of overconfidence: (1) overestimation of one's actual performance relative to an objective standard, (2) overplacement of one's performance relative to others, and (3) overoptimism in one's beliefs.

Much research has shown that overconfidence is an important factor affecting financial decision-making and financial performance. Overconfident managers are convinced that they have better knowledge and abilities than do others. This induces them to refrain from obtaining new information, to not listen to advice or expert opinion. If overconfident managers actually go gain pertinent information, they use it to confirm their own beliefs (Paredes, 2004). Reluctance to gain new knowledge makes the overconfident managers miss investment opportunity or miss the signs of failure (Goel and Thakor, 2008). Hence, overconfident managers continue their course of action whatever its prospects are (Baker et al., 2007). Overconfident managers find it difficult to learn from past experience and correct their behavior (Heaton, 2002). They attribute any success to their own efforts and, at the same time, they attribute failure to the actions of others. Overconfident managers are also convinced that their future will be better than that of other people; they overestimate the possibility of success and, at the same time, they underestimate the possibility of failure (Malmendier and Tate, 2005). The afore-mentioned might explain the

overconfidence managers' attitude toward risk – they underestimate risk and engage in more risky activity (not because it is riskier but because the overconfident manager just can not see risk).

Overconfident decision-making has been observed in many financial decisions. Indeed, managerial overconfidence leads to higher probability of failure for newly-established companies (Russo and Schoemaker 1992, Cooper et al. 1988), as well as overinvestment – even in negative NPV projects (Gervais et al. 2003; Malmendier and Tate, 2005).

Some research exists on the capital structure of overconfident managers. This has demonstrated statistically a significant relation between managerial overconfidence and capital structure decisions.

Herein, one group of researchers has tackled static capital structure ratios and revealed that overconfident managers keep higher debt ratios than do managers showing no overconfidence (eg. Barros and Silveira, 2008; Ben-David et al., 2007; Hackbart, 2009; Park and Kim, 2009; Rihab and Lotfi, 2016). The explanation of higher debt ratios is that overconfident managers underestimate the probability of failure and they can not see the risk connected with the use of excessive debt.

A further group of researchers have examined the issue of dynamic decisions with regards to the of capital by overconfident managers. With reference to this, Lin et al. (2005) have confirmed that the importance of debt relative to equity use is more pronounced for the overconfident CEOs. Here, the ratios of net debt issues to total external financing are 53% and 49% for the optimistic and the non-optimistic, respectively. Furthermore, optimistic CEOs tend to issue more debt than non-optimistic CEOs.

Yet another group of research has been centered upon the financing decisions of overconfident managers. Malmendier et al. (2011), for example, found that overconfident managers use lower debt ratios and called it debt conservatism. In addition, Hackbarth (2009) found that overconfident managers with "risk perception bias" tend to believe that their debt is undervalued, while equity is overvalued and, therefore, they prefer equity to debt financing.

The lack of consistency in research findings on capital structure of overconfident managers gives a good rationale for further research attempts to explain the financing decision of companies managed by overconfident managers. With this in mind, we hold that the capital structure decisions of overconfident managers depend on the debt capacity of their companies.

The aim of the paper is to identify the relation between debt capacity and capital structure in companies managed by overconfident managers. We think that companies managed by overconfident managers have lower debt capacity and, at the same time, they use a higher debt ratio than their debt capacity indicate.

In our research, we collected a unique sample of 145 non-listed companies by surveying the CEOs on their overconfidence. We subsequently divided the sample into two subsamples depending on the overconfidence. We collected the financial data of surveyed companies covering the 2010-2015 period. The total number of observations is 870. We compared debt capacity levels, as well as capital structure of the subsamples.

In our study, we employed the nonparametric U Mann Whitney test (for independent subsamples). We also implemented regression analysis. We found partial confirmation of our expectations.

Our results are important for business practice (for the companies owners and cooperating institutions – eg. banks). This is because there is quite a number of overconfident people who are in managing positions, and their decisions affect the financial health of the enterprise. The originality of our research lies in implementing thorough research not only on the capital structure of the companies managed by the overconfident managers but also on the overconfidence identification, on the debt structure

and the factors affecting the capital structure (debt capacity). Such an approach is the first known to us in assessing the relation between managerial overconfidence and financing decisions.

2 Debt capacity

Debt capacity was originally defined by Myers (1977) as the point at which an increase in the use of debt reduces the total market value of the firm's debt. Debt capacity is the maximum amount of debt that keeps the firm's value increasing.

Indeed, investors limit credit supply if they expect that further debt issues are not supported by a firm's liquidity and profitability, and lenders protect their claims through bond covenants and loan agreements if the company wants to exceed debt level. Corporate managers have incentives not to use excessive debt financing to avoid costly renegotiations with creditors and to maintain control over the firm. Hence, it is in their best interest to stay below some critical amount of debt. Hess and Immenkotter (2014) call the critical amount of debt which is determined by these various forces the firm's debt capacity.

Firms that are most financially secure use the public debt market for financing. Such firms have the greatest capacity to borrow, and they hold a very low probability of distress and – and so it is cost effective for them to avoid the intermediation costs incurred with bank debt. Firms that are more of a risk financially have a lower capacity to borrow, hence they use the more flexible but nominally more expensive bank debt. Bank debt provides the cheapest form of flexible financing. Firms that are at the greatest of risk financially are constrained to use equity (or are unable to obtain any outside funding). Once firms exhaust their debt capacity, they will eventually resort to equity.

Lemmon and Zender (2010) define debt capacity as having a credit rating and the possibility to issue bonds in a public market. The presence (or absence) of rated debt provides an indication of the extent to which a firm has access to relatively low cost borrowing and so suggests a relatively large (or small) debt capacity.

According to Lemmon and Zender (2010), a primary indicator of debt capacity is whether the firm has, based on its underlying characteristics, a high likelihood of being able to access the public debt markets. Firms that can access the bond market have cash flows that are sufficiently stable, hold sufficiently large pools of existing collateral, and have sufficient informational transparency to allow access to relatively large amounts of arms-length debt. These firms are bigger, have less volatile cash flows, have more tangible assets, and thus they are likely to demand higher levels of debt financing because these firms have rated debt.

There are some factors, however, affecting the likelihood of having rated debt. Firms with low levels of collateral have relatively low demand for debt financing and seek intermediated or monitored debt while firms with high levels of collateral use direct or public debt. What is more, smaller and younger firms are likely to have a shorter track record and be more opaque from the standpoint of lenders, suggesting that they will be less likely to have bond ratings. Smaller firms also face proportionally higher fixed costs of issuing bonds in the public debt markets. In contrast, large firms with their higher amount of tangible assets and longer credit history usually have higher debt capacity. In addition, companies with low volatility will be more likely to be able to obtain a bond rating. More profitable firms are also better able to make required payments to debtholders and so can support more debt. Moreover, firms with more debt outstanding have proven their ability to borrow (Lemmon and Zender, 2010).

3 Methodology

It is quite challenging to identify and to measure overconfidence. Usually, in cognitive psychology, overconfidence is identified through personal survey. Surveying allows to identify beliefs and track the rationale for a specific behavior. However, when referring to managers, other ways of identifying overconfidence were developed. By far the most

influential proxies for managerial overconfidence have been constructed by Malmendier and Tate (2005). The proxies and dataset of the aforementioned have been used in many other studies of overconfidence: based on options (longholder, holder 67), shares (net buyer), and based on articles appearing in the press. Another method of identifying CEO overconfidence is based on the frequency of upward-biased earnings forecasts (Lin et al., 2005) or the frequency of M&A made by managers (Doukas and Petmezas, 2007). A still further method of identifying overconfidence is built upon higher CEOs' relative compensations (Hayward and Hambrick, 1997). Methods commonly used to identify CEO's overconfidence allow to evaluate the overconfidence by behavior - not by beliefs. While human behavior might sometimes result from the strategy implemented by the company - not from the personal beliefs held by managing personnel (e.g. frequency of M&A). Additionally, the stated measures might be applicable only to listed companies. To identify and measure overconfidence, we followed the methodology of Wrońska-Bukalska (2016) who assumed (after Moore and Healey, 2008) that overconfidence is a complex phenomenon consisting of overestimation, overplacement and overoptimism. She used a survey to identify overconfidence and developed an original method of overconfidence measuring. This methodology allows to identify the managerial overconfidence and separate overconfident (OC) managers from the non-overconfident (nonOC).

To identify debt capacity, we followed the methodology of Lemmon and Zender (2010), who prepared a logit regression model in which the dependent variable is one if a firm has debt rating in a particular year and zero otherwise. The prepared logit regression predicts bond ratings and they used a predictive model of whether a firm has a bond rating in a given year as the primary indication of the extent of a given firm's debt capacity. In their study, they identified several characteristics used in the logit regression: firm size (log of total assets, Log TA), profitability (ROA), the fraction of total assets that are tangible (PPE), the market to book ratio (MB), leverage (Lev), firm age (the natural log of the number of years since the firm first appeared on Compustat, Log Age)), the variability of cash flow (the standard deviation of stock returns, SdR). Their logit regression model for companies with high bond rating is:

$$\Pr = -10.048 + 1.212\ \text{Log TA} + 0.028\ \text{ROA} - 0.136\text{PPE} - 0.077\ \text{MB} + 3.917\ \text{Lev} + 0.363\ \text{Log Age} - 4.944\ \text{SdR} \quad (1)$$

which is based on the likelihood that a firm has access to public debt markets (Pr). If this is so, the rating is 1. This logit regression model reveals the characteristics of a company and the expected signs and all are significant predictors of the likelihood that a firm has a bond rating. The model fit as measured by the pseudo R-squared is 52%.

We applied the regression model estimates that were presented in Lemmon and Zender's (2010) model, but we corrected this model so as to make it applicable for non-listed companies. Ultimately, we implemented the variables as following: size of the company - SIZE – log of Total assets, age of the company - AGE – log of years since company establishing, tangibility - TANG – the relation of fixed assets to total assets, profitability - PROF – the relation of EBITDA to total assets, leverage – LEV – the relation of long-term debt to total assets, variability of the cash flow - sdOCF – standard deviation of OCF, while OCF is the relation of operating cash flow to total assets.

To measure capital structure we followed Rajan and Zingales (1995) and we implemented same ratios describing the capital structure and the structure of debt and equity: Debt ratio – DEBT - the relation of total liabilities to the sum of the equity and total liabilities = 1 – the relation of equity to total assets (the equity ratio), Equity to fixed assets – EQUITY – the relation of equity to fixed assets, Share capital ratio – SHARE - the relation of registered capital gained from owners in the relation to total assets, Reserved capital ratio – RES - the relation of reserved capital (retained earnings) to total assets, Long-term ratio – LONG- the relation of long-term liabilities to total assets, Short-term ratio – SHORT- the relation of short-term liabilities to total assets.

The study sample we utilized comes from Polish companies that are non-listed. The data refer to the companies that were willing to take part in the survey on overconfidence. Our

research covers the specific features of managers (overconfidence) and financial data of 2010-2015 and includes only those companies that meet the following requirements: the business being established before 2010, the business being run for the whole 2010-2015 period, president being the same for the whole period of 2010-2015, complete financial statement being available, insurance and banking companies being excluded. We collected 145 surveys and were able to divide the sample into two samples: non overconfident managers (nonOC – 78 companies and 468 observations) and overconfident managers (OC – 67 companies and 402 observations).

4 Results and Discussion

Table 1 presents the descriptive statistics of factors affecting debt capacity, but also the descriptive statistics of debt capacity for the sample and subsamples.

Table 1 The Descriptive Statistics of Factors Affecting Debt Capacity and Debt Capacity

	sample			nonOC			OC			U Mann Whitney statistics
	mean	median	SD	mean	median	SD	mean	median	SD	
SIZE	8.7	8.5	2.4	8.3	8.5	1.8	9.2	8.7	3.2	-1.630* (0.103)
TANG	34.0	28.8	0.28	21.6	8.7	0.24	43.6	41.4	0.29	-6.699*** (0.000)
PROF	-2.2	2.63	0.43	4.36	3.34	0.16	-15.5	2.2	0.84	-2.621*** (0.009)
LEV	9.48	0.15	0.22	7.18	0.79	0.12	9.84	0.03	0.13	-0.353 (0.724)
AGE	18	17	8.7	17	16.5	5.8	19.5	18	12.2	-0.723 0.470
OCF	5.6	6.2	0.67	6.9	7.1	0.27	-4.8	5.2	0.74	-0.804 0.422
DEBT CAP	0.72	0.83	4.3	1.07	0.87	3.5	0.32	0.83	5.1	-1.583* 0.113

Source: own calculations based on data collected by surveying

Our results indicate that debt capacity is lower for companies managed by overconfident managers. This is consistent with our expectations. The sources of debt capacity for companies managed by non-overconfident and overconfident managers are different. Companies managed by overconfident managers are bigger, older, have higher tangibility and lower profitability. What is the most important, the source of interest coverage – EBITDA – is lower for companies managed by overconfident managers.

Table 2 presents the descriptive statistics of capital structure ratios for the sample and subsamples.

Herein, it is noticeable that debt ratio is lower for companies managed by overconfident managers. This is quite surprising because some research held that such companies demonstrated higher debt ratios (eg. Barros and Silveira, 2008). However, we conjecture that this lower leverage might be explained by lower debt capacity (especially profitability). This is contradictory to our expectations because we assumed that companies managed by overconfident managers have higher debt ratios.

Table 2 The Descriptive Statistics of Capital Structure

	sample			nonOC			OC			U Mann Whitney statistics
	mean	median	SD	mean	median	SD	mean	median	SD	
DEBT	66.1	63.3	0.46	72.4	49.4	2.06	48.0	36.8	0.59	-4.663*** 0.000***
EQUITY	5.61	1.6	17.5	7.8	3.1	17.9	2.6	1.3	3.5	-2.924 0.003
SHARE	20.5	6.1	0.48	12,3	4.7	0.22	34.1	7.8	0.83	-3,435*** 0.001
RES	9.3	32.9	2.20	17,3	22.7	0.52	33.1	36.8	0.50	-2.559**

										0.011
LONG	9.48	0.15	0.22	7.18	0.79	0.12	9.84	0.03	0.13	-0.353 (0.724)
SHORT	62.9	38.0	2.06	68.9	54.0	0.45	38.8	27.3	0.58	-6.078*** (0.000)

Source: own calculations based on data collected by surveying

That the debt ratio is much lower for companies managed by overconfident managers may be support for the results drawn by Malmendier et al. (2011). Yet, as evident in the table, at the same time the ratio of equity to fixed assets is lower. This shows that companies managed by overconfident mangers implement more risky financing strategies. According to the theory proposed by Lemmon and Zender, 2010, the firms at greatest risk are constrained to use equity because they have exhausted their debt capacity. It seems that companies managed by overconfident managers use lower debt ratios because the position of the company is too risky to obtain extra debt and they are forced to use equity, but this equity is not enough to finance fixed assets.

We prepared two regression models that include overconfidence and debt capacity as the independent variables and some controlling variables: tangibility, profitability, size, age, operating cash flow in relation to total assets. The dependent variables are: debt ratio (DEBT) and equity to fixed assets ratio (EQUITY), respectively.

$$DEBT = \beta 0 + \beta 1 OC + \beta 2 DEBT\ CAP + \beta 3 TANG + \beta 4 PROF + \beta 5 AGE + \beta 6 SIZE + \beta 7 OCF \quad (2)$$

$$EQUITY = \beta 0 + \beta 1 OC + \beta 2 DEBT\ CAP + \beta 3 TANG + \beta 4 PROF + \beta 5 AGE + \beta 6 SIZE + \beta 7 OCF \quad (3)$$

Table 3 presents the regression analysis results.

Table 3 Regression Models of Debt Ratio and Equity to Fixed Assets Ratio

Independent\Dependent variable	DEBT	EQUITY
OC	-0.198; 0.001***	-1.080; 0.031**
DEBT CAP	0.393; 0.063*	-5.365; 0.002**
TANG	-0.390; 0.171	-16.105; 0.000***
PROF	-0.505; 0.008**	3.000; 0.056*
AGE	-0.091; 0.632	-0.794; 0.616
SIZE	-0.183; 0.000***	0.800; 0.036**
OCF	0.079; 0.513	-0.462; 0.644
F statistics; p-value	7.495; 0.000	12.450; 0.000
R square	0.068	0.108

Source: own calculations based on data collected by surveying

As seen in the table, the debt ratio is negatively related with overconfidence. This means that higher overconfidence is accompanied by lower debt ratio. Moreover, the debt ratio is positively related with debt capacity - which reveals that the higher debt ratio the higher debt capacity.

Furthermore, as evident, the relation of equity to fixed assets is negatively related with overconfidence. This means that the higher overconfidence the lower the equity ratio (because tangibility is higher). Still, the ratio is negatively related with debt capacity, which implies that the higher the debt capacity, the lower relation of equity to fixed assets (because companies with higher debt capacity are able to get extra debt and do not need equity). Again, companies managed by overconfident managers seems to take on more risk, yet the companies holding the greatest risk are constrained to use equity because they have exhausted their debt capacity (Lemmon and Zender, 2010). Thus, companies managed by overconfident managers use lower debt ratios because they are in too great a position of risk to obtain extra debt and they are forced to use equity - but this equity is not enough to finance fixed assets.

5 Conclusions

We aimed to find the relation between debt capacity and capital structure for companies managed by overconfident managers. We found that such companies have lower debt capacity - which means that they are able to obtain less debt and they have to rely on equity. Our research also shows that companies managed by overconfident managers have lower debt ratios - which demonstrates that they utilize more equity. At the same time, companies managed by overconfident managers while employing more equity, have a lower relation of equity to fixed assets. Thus, the debt capacity of the companies managed by overconfident managers depends more on tangibility than on profitability and other factors. Still, this tangibility is so high that higher equity is not sufficient to finance fixed assets.

We also found support for the notion that companies managed by the overconfident have lower debt ratios (Malmendier et al., 2011), but we would not call this practice "debt conservatism". Herein, lower debt ratios by such companies are justified by having lower debt capacity and holding higher risk. The firms displaying the greatest risk are constrained to use equity because they have exhausted their debt capacity (Lemmon and Zender, 2010). Thus, we are more prone to agree with Hackbarth (2009) who found that overconfident managers demonstrate "risk perception bias" and they believe that their debt is undervalued, while equity is overvalued and, therefore they prefer to utilize equity to debt financing.

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Application of Selected Machine Learning Methods to Companies' Insolvency Prediction

Joanna Wyrobek

The Cracow University of Economics,
Department of Corporate Finance
Rakowicka St. 27, 31-510 Kraków
wyrobekj@uek.krakow.pl

***Abstract**: The purpose of the paper was to test the efficiency of various modern machine learning methods on the representative sample of Polish companies for the time period 2008 – 2017. The novelty factor in the paper is that it uses a representative sample of companies, which seems to improve the efficiency of the models and that the training sample and the validation sample include data from different time periods and different companies (the training sample data covered the period of 2008 – 2013 and the validation sample covered the period 2014 – 217). The hypothesis verified in the paper is [H1] that: the most efficient algorithms in bankruptcy prediction are: Gradient Boosting Decision Trees and Random Decision Forest.*

Keywords: machine learning, bankruptcy prediction, corporate finance

JEL codes: G33, C55, C63

1 Introduction

According to Lewis (Lewis, 2017), 'Machine learning is a collection of algorithms that generate insight from data. That insight might be used by humans or other machines to make a decision'. In other words, machine learning involves machines 'learning from examples, rather than being explicitly programmed for a particular outcome' (Brynjolfsson, Mcafee, 2017, p. 5) which are capable of either forecasting future outcomes or classifying objects into classes (Lewis, 2017).

Currently, machine learning is one of the most popular research areas in banks, various sorts of financial institutions, international corporations, and ministries (judging by the job advertisements). Examples of current research directions include (Brynjolfsson, Mcafee, 2017, p. 5) robo-advisory, i.e., automatic systems that advise on asset management, artificial intelligence trading, risk management, insurance underwriting and claims, i.e., personalized underwriting. Another popular application of machine learning techniques is bankruptcy prediction (Barboza, Kimura, Altman, 2017, p. 406).

Generally speaking, bankruptcy can be defined as a legal term meaning the situation when a physical or legal person cannot repay its obligations. Bankruptcy is a legal status, which can be only imposed by court order and can be initiated either by a debtor or the person itself.

In line with the current regulations of the Polish law (Bankruptcy and Insolvency Act from the 28th of February 2003), bankruptcy (pl. *upadłość, bankructwo*) (Bankruptcy and Insolvency Act from the 28th of February 2003, paragraphs: 10, 20) is defined as the proceedings commenced by way of Bankruptcy Application to the High Court concerning a company that became insolvent in order to commence a joint investigation of all claims by its creditors. Since in the Polish law bankruptcy is the result of insolvency, it is important to define also the term insolvency. According to the Polish Bankruptcy and Insolvency Act from the 28th of February 2003 paragraphs: 11 and 12, a company is considered insolvent in two cases:

Case 1: it is presumed that a company is insolvent if a company is unable to meet its obligations and the delay in payment is longer than three months, or

Case 2: it is presumed that a company is insolvent if the balance sheet value of all its liabilities (without provisions and liabilities towards its subsidiaries) exceeds the value of its assets and this condition persists for a period longer than 24 months.

In any of the above cases, the insolvency situation means that a company is unable to pay back its obligations and if any liabilities are going to be repaid, it is going to take a long time and it is not certain. This is why the financial situation of any business partners and clients is carefully checked by a company to make sure that it is not giving trade credit or any other forms of a loan to a partner with a high risk of bankruptcy.

The purpose of the paper was to test the usefulness of various modern machine learning techniques in the Polish companies' bankruptcy prediction. In particular, the following algorithms were tested: support vector machines (SVM), Random Forest (RF), Gradient Boosting Decision Trees (GB), Neural Network with 1 hidden layer (NN), Convolutional Neural Network (CNN) and Naïve Bayes (NB). The research hypothesis was [H1]: the most efficient algorithms in bankruptcy prediction are Gradient Boosting Decision Trees and Random Decision Forest. Contrary to many publications (compare remarks about the research method in Appendix 1) the paper clearly divides the dataset into a training sample (which is further divided into the train sample and test sample within 10 fold cross-validation procedure) and a validation sample to test the efficiency of the trained models on a separate sample of companies and separate time period.

2 Related Works

Table 1 presents a brief summary of previous results concerning the accuracy of machine learning methods in bankruptcy prediction. The list of papers is presented in the Appendix 1, Table 1 only shows a brief summary of the average accuracy for different algorithms (based on these papers). Only 1 paper in the list used a representative sample of companies – it was the paper written by Min and Jeong (Min, Yeong, 2009).

As it can be seen from Table 1, only naïve Bayes had accuracy above 95% but the average accuracy was based only on 2 papers, so it is not very reliable.

Table 1 Summary of the Previous Research Concerning the Accuracy of Selected Machine Learning Methods in Bankruptcy Prediction

Technique	Base Classifiers	Av. Accuracy	No of papers
Single model	DT	80,05	19
Single model	NN	85,3	7
Single model	Naive Bayes	95,25	2
Single model	SVM	81,13	21
GB	DT	82,93	7
Random Forest	DT	89,37	4

Source: own research

Among the publications listed in Appendix 1, one can find some papers which were based on Polish companies. Pawełek and Grochowina (2017) used a sample of 42 bankrupt companies and 7181 active companies and applied the techniques described in Gatnar (2008, p. 63) to train (among other models) the Random Forest model. The best accuracy the researchers managed to achieve was found for the unbalanced sample of companies and it was equal to 90,3%. Another publication based on Polish companies is the book by Pociecha, Pawełek, Baryła and Augustyn (2014) who (among other methods) used 3-layer neural (input, hidden, output) networks on the sample of 7147 active companies and 182 bankrupt companies. The best accuracy of their models was equal to 78,6%.

Another publication which used Polish data and machine learning algorithms in bankruptcy prediction was the book written by Korol and Prusak (2014). Korol and Prusak's models were trained on 39 bankrupt companies and 39 active companies. Korol and Prusak used

many different neural networks, one of them was a neural network with 1 layer of hidden neurons. Researchers tested different combinations of neurons in the input layer and in the hidden layer. For 10:1 proportions between the training and validation sample the researchers achieved 100% of the accuracy of their model.

A list of analyzed previous publications in Appendix 1 shows a brief description of the validation technique used in each paper As it can be seen, not always the researchers used a separate validation sample and in many cases it was unclear what they meant by the "test sample" – whether it was an internal division for the purpose of the cross-validation or whether the training sample was used for training and the test sample was used only for the validation of the already trained model. Only in 2 papers the authors clearly explained that the validation sample was not used for training and that the validation sample comprised companies different to companies included in the training sample and from the different time period. In many cases, the description of the model validation was unclear and too general.

Another important remark about the previous research is that all analyzed publications used for model training only a selected number of financial ratios and non-financial measures. On one hand, this approach allowed to train different machine learning models on exactly the same variables. On the other hand, however, decision trees based models (specifically: RF, GBDT) and neural network methods deal very well with correlated features (independent variables) and work very well on data (after normalization) taken directly from a financial statement. They create their own ratios as a result of their training. Therefore, it was possible that the approach adopted in the previous papers did not allow to fully test the capabilities of decision trees based models and neural networks.

3 Model Specification

Dataset chosen for the research included years 2008 – 2017 and initially included 147 340 companies (all of the companies in the data sample used double-sided accounting). Data were downloaded from the database Orbis which belongs to Bureau Van Dijk company. Data included the balance sheet (statement of financial position) and the income statement elements. Data were tested whether the sum of assets was equal to the sum of equity and liabilities. Moreover, any suspicious or wrong records or columns were also removed. The final sample included 1415 bankrupt companies and 1450 active companies. Active companies were randomly chosen, but we tried to match the type of the economic activity between each bankrupt company and a similar active 'sister' company. As a company status change date (active→bankrupt or active->insolvent), we assumed the year when the company had a negative equity for the first time (although according to the Polish law it was overzealous, we should take the next year) or the Orbis company status change data, whichever was first (if the latter was available in the database). In relation to the assumed status change date, we assumed that the insolvency petition must have been filed one year earlier and that the model should be able to warn about the insolvency petition yet another year earlier (a similar approach was adopted in Aktan 2011, p. 57).

Therefore, the time difference between the status change date and the moment when the model should signalize upcoming problems was at least 2 years (for the companies where we estimated the status change date based on negative equity, the real moment of insolvency announcement by the court could have been later). What is worth mentioning is that we considered as bankrupt or insolvent only these companies, which had appropriate status in the Orbis database (analysis of the dataset showed that not all companies with negative equity were bankrupt or insolvent, but all bankrupt companies had negative equity).

The data sample was then divided into the training set including the companies data for years 2008-2013 and the validation set which included the companies data for years 2014-2017. Companies in each data set were different (companies in the validation set did not belong to the training set).

After validity checks and preprocessing, the data sample was normalized. We also applied the one-hot encoding to discrete data. For preprocessing, we took advantage of the skleran Python library. Training data sample was divided into 10 parts and for each iteration, we used 9 parts for training and 1 part for testing (cross-validation).

As it was explained earlier, the following models were trained (all with skleran library): support vector machines (SVM), Random Forest (RF, 100 trees), Gradient Boosting Decision Trees (GB), Neural Network with 1 hidden layer (NN, the number of input neurons and in the hidden layer was equal to the number of variables), Convolutional Neural Network (CNN) and Naïve Bayes (NB). The code was written in Jupyter Notebook (Python version 3.6). Application method was based on the following publications: Rashka (2015), Kirk (2017), Mueller and Guido (2016), Tripathi (2017), Lantz (2015), Lesmeister (2015), Julian (2016), Swamynathan (2017), Lewis (2017), Bali and Sarkar (2016), Viswanathan (2016), Chiu (2015).

For the Gradient Boosting Decision Trees model, the number of estimators was assumed to be 100, the function which measured the quality of split was mean squared error with improvement score by Friedman, learning rate was 10%, the improvement of the loss function was calculated as the deviation between the value for the out-of-the-bag samples and the value for the previous iteration. Maximum depth of the individual regression estimators was set to 3.

For the neural network (NN) model we assumed 100 trees and there were 681 features (number of features was the same for all models – it represents the number of variables after one-hot encoding). As the activation function for the Random Forest model, we used Scaled Exponential Linear Unit (but we also tested ReLU). As the initializer, we used the LeCun uninform initializer.

The convolutional neural network (CNN) was also based on SeLU function and LeCun uinformed initializer and sigmoid activation function. The loss function was binary cross-entropy. The Random Forest (RF) model was based on 100 decision trees, nodes were split based on the Gini criteria.

4 Results and Discussion

Table 2 shows the results of the model training. In Table 2 one can find accuracies (its definition can be found in Nagaraj, Sridhar, 2015 p.35) calculated for every training subset, the average training accuracy and finally, the accuracy coefficient calculated for the validation sample. The last coefficient should be considered as the most important measure of the predictive power of the models because it shows the efficiency of the model for the companies and years which were not previously shown to the model.

As it can be seen, the calculated accuracy coefficients for every training subset were quite similar and except for the RF, the validation sample accuracy was always lower than the average training accuracy.

Table 2 Comparison of the Accuracy of SVM, RF, GB, NN, CNN and NB Models

training subset	SVM im acc	RF im acc	GB im acc	NN im acc	CNN im acc	NB im acc
1	70,51	99,52	99,52	83,83	83,95	72,53
2	72,41	99,41	99,52	83,35	83,83	70,75
3	69,56	99,88	99,76	85,97	82,28	74,44
4	68,37	99,76	99,88	83,47	82,05	74,55
5	69,17	99,17	99,64	80,6	80,83	72,98
6	70,95	98,93	98,93	81,55	82,14	71,31
7	69,17	99,17	99,76	84,52	81,55	73,69
8	68,57	99,76	99,76	84,64	83,93	75,36

training subset	SVM im acc	RF im acc	GB im acc	NN im acc	CNN im acc	NB im acc
9	67,5	99,05	99,05	82,26	83,1	71,79
10	72,86	99,76	99,88	87,14	82,5	72,26
average	**69,91**	**99,44**	**99,57**	**83,73**	**82,62**	**72,97**
validation sample	**69,54**	**98,91**	**99,11**	**83,35**	**82,23**	**72,6**

Source: own research

As it can be seen in Table 2, the most accurate model proved to be the gradient boosting decision trees. The validation sample accuracy of the model was 99,11%, which means, that for 1000 companies, on average, the model would wrongly classify (active as bankrupt or bankrupt as active) only 9 companies. The second best validation accuracy could be observed for the random forest model with the accuracy equal to 98,91%. In terms of classifying 1000 companies between bankrupt and non-bankrupt classes, on average, the model would be wrong for 11 companies.

The third best model turned out to be the neural network with 1 hidden layer with the validation sample accuracy equal to 82,23%. According to Table 2, the fourth best model in terms of validation accuracy was the Naïve Bayes model with the accuracy of 72,6%. The least efficient model was the Support Vector Machines model with the accuracy equal to 69,54%. If one assumes a standard confidence level p = 5%, only two models had the confidence level below 5%: it was the Gradient Boosted Decision Trees model and the Random Forest Decision Trees model.

Even though it should not be necessary, we tested whether the calculation of financial ratios based on the available raw data from financial statements would improve the accuracy of the models, but it turned out that algorithms efficiently created all necessary ratios internally, without the intervention of the programmer.

5 Conclusions

Efficient bankruptcy prediction is extremely important for every participant in the market system. Based on the presented model training results, it seems that modern computer science created at least two very efficient tools which work almost out of the box – gradient boosted decision trees and random forest (also based on decision trees) models. Presented research was designed to observe the behavior of various machine learning methods when they were trained with a representative sample of the companies. Despite the fact that the training sample was based on different companies from different years than the validation sample, at least two models – the GBDT and the RFDT proved to be very accurate. The relatively low accuracy of other analyzed machine learning models must be, however, treated with caution, because there are many variants of these models which potentially can significantly change their accuracy.

Decision trees are often considered as the algorithm which is not dealing well with time. In other words, decision trees are considered to be very precise in classifying new companies (companies which were not shown previously to the model) but from the same time period which was used to train the model and not very good with classifying new companies from new time periods (time period which representatives were not used to train the model before).

Presented results seem to contradict this opinion. It was exactly the decision-tree based models which predicted almost perfectly which companies would go bankrupt and which companies would remain active in the validation sample which contained years beyond the time period used for their training.

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Appendix

Table 3 List of publications where the authors used SVM, RF, GB, NN, CNN or NB algorithms for companies' bankruptcy prediction

Studies	Techniques	Base classifiers	Accuracy(%)	Validation method
Ghodselahi, Amirmadhi (2011)	GB	DT	72,77	10 fold cross-validation
Kim Kang (2012)	GB	DT	75,1	10 fold cross-validation
Kim Kang (2012)	GB	DT	76	10 fold cross-validation
Heo and Yang (2014)	GB	DT	78,52	10 fold cross-validation
Kim and Upneja (2014)	GB	DT	98,1	80/20 partition
Marques, Garcia, and Sanchez (2012)	GB	DT	75,42	80/20 partition
Sun, Jia, and Li (2011)	GB	DT	96,46	5 fold cross-validation
Alfaro, Garcia, Games, and Elizondo (2008)	GB	DT	91,1	5 and 4 fold cross-validation

Barboza, Kimura, Altman (2016)	RF	DT	87,06	449 active and bankrupt companies in the training set, 133 bankrupt and 13300 active companies in the test set, different years and companies, no normalization, only selected financial ratios
Liao, Shih, Chen, and Hsu (2014)	RF	DT	94,91	60/20/20 partition
Nagaraj, Sridhar (2015)	RF	DT	97,4	80/20, 70/30 partition
Pawełek, Grochowina (2017)	RF	DT	90,3	5 fold cross-validation
Korol (2010)	RF	DT	*88,88*	5 fold cross-validation
Tsai, Cheng (2012)	Single Model	DT	67,6	5 fold cross-validation
Aktan (2011)	*Single Model*	*DT*	*87,2*	50/50 partition
Alfaro, Garcia, Games, and Elizondo (2008)	*Single Model*	*DT*	*87,29*	17 bankrupt and 17 active banks for training and validation sets
Cho, Kim, and Bae (2009)	*Single Model*	*DT*	*72,38*	5 fold cross-validation
Cho, Hong, Ha(2010)	*Single Model*	*DT*	*66,73*	5 fold cross-validation
Geng, Bose, and Chen (2015)	*Single Model*	DT	74,4	80/20 partition
Ghodselahi, Amirmadhi (2011)	*Single Model*	*DT*	*70,35*	not explained
Heo and Yang (2014)	*Single Model*	*DT*	*73,1*	not explained
Kim Kang (2012)	*Single Model*	*DT*	*70,3*	not explained
Kim and Upneja (2014)	*Single Model*	*DT*	*97*	80/20 partition
Lee (2018)	*Single Model*	*DT*	*73,6*	80/20 partition
Liao, Shih, Chen, and Hsu (2014)	*Single model*	*DT*	*94,68*	80/20 partition
Marques, Garcia, and Sanchez (2012)	*Single Model*	*DT*	*68,75*	80/20, 70/30, 60/40 and 50/50 partition
Min J., Jeong C. (2009)	*Single Model*	*DT*	*76,8*	10 fold cross-validation
Ramakrishnan, Mirzaei, Naveed (2015)	*Single Model*	*DT*	*74,79*	10 fold cross-validation
Sun and Li (2009)	*Single Model*	DT	80,9	10 fold cross-validation, the paper mentions the validation sample
Sun, Jia, and Li (2011)	*Single Model*	*DT*	*96,54*	10 fold cross-validation, the paper mentions the validation sample
Sun, Jia, and Li (2011)	*Single Model*	*DT*	*96,54*	10 fold cross-validation, the paper mentions the validation sample
Tsai (2014)	*Single Model*	DT	83,07	10 fold cross-validation, the paper mentions the validation sample
Aktan (2011)	*Single Model*	*Naive Bayes*	*92,2*	50/50 partition
Nagaraj, Sridhar (2015)	*Single Model*	*Naive Bayes*	*98,3*	50/50 partition
Tsai, Cheng (2012)	Single Model	NN	73,9	test set: 2010-2014, validation set: 2013-2015

Aktan (2011)	*Single Model*	NN	*90*	5 fold cross-validation
Blanco-Oliver et al (2015)	*Single Model*	NN	*82,7*	5 fold cross-validation
Ecer (2013)	Single Model	NN	97,06	5 fold cross-validation
Ghodselahi, Amirmadhi (2011)	*Single Model*	NN	*74*	5 fold cross-validation
Hu, Tseng (2007)	*Single Model*	NN	*81,78*	5 fold cross-validation
Nanni, Lumini (2009)	*Single Model*	NN	*82,95*	60/20/20 partition
Korol and Prusak (2015)	*Single Model*	NN	*100*	60/20/20 partition (5 fold cross-validation)
Pociecha et al (2014)	*Single Model*	NN	*95,83*	66/33 partition (10 fold cross-validation)
Tsai, Cheng (2012)	Single Model	SVM	77	66/33 partition (10 fold cross-validation)
Aktan (2011)	*Single Model*	*SVM*	*92,7*	66/33 partition (10 fold cross-validation)
Altinirmak, Karamasa (2016)	*Single Model*	*SVM*	*91,9*	70/30 partition, 3 different data sets
Arieshanti et at (2013)	Single Model	SVM	70,42	70/30 partition, 3 different data sets
Chaudhuri, De (2011)	*Single Model*	*SVM*	*74,75*	66/33 partition (10 fold cross-validation)
Cho, Kim, and Bae (2009)	*Single Model*	*SVM*	*78,01*	train set: 145, validation set: 89 (10 fold cross-validation)
Geng, Bose, and Chen (2015)	*Single Model*	SVM	71,1	70/30 and 60/40 partition
Ghodselahi, Amirmadhi (2011)	*Single Model*	*SVM*	*71*	not explained
Heo and Yang (2014)	*Single Model*	*SVM*	*73,29*	not explained
Kim Kang (2012)	*Single Model*	*SVM*	*72,45*	66/33 partition (10 fold cross-validation)
Marques, Garcia, and Sanchez (2012)	*Single Model*	*SVM*	*71,25*	66/33 partition (10 fold cross-validation)
Min, Lee (2005)	*Single Model*	*SVM*	*88,01*	66/33 partition (10 fold cross-validation)
Nagaraj, Sridhar (2015)	*Single Model*	*SVM*	*99,6*	66/33 partition (10 fold cross-validation)
Nanni, Lumini (2009)	*Single Model*	*SVM*	*80,74*	66/33 partition (10 fold cross-validation)
Pena, Martinez, Abudu (2009)	*Single model*	*SVM*	*82,3*	66/33 partition (10 fold cross-validation)
Ramakrishnan, Mirzaei, Naveed (2015)	*Single Model*	*SVM*	*84,79*	66/33 partition (10 fold cross-validation)
Sun and Li (2009)	*Single Model*	SVM	82,64	66/33 partition (10 fold cross-validation)
Sun, Jia, and Li (2011)	*Single Model*	*SVM*	*96,06*	5 fold cross-validation
Sun, Jia, and Li (2011)	*Single Model*	*SVM*	*96,06*	10 fold cross-validation
Sun and Li (2012)	*Single Model*	SVM	81,16	10 fold cross-validation
Xiao, Yang, Pang, and Dang (2012)	*Single Model*	SVM	64,4	10 fold cross-validation
Ecer (2013)	Single Model	SVMs	85,29	Train set: 80%, validation set: 20%

Methodical Approaches to Assessing the Budget Potential of the Region Taking into Account the Innovative Development of High-tech Industries

Sergey Yashin[1], Nadezhda Yashina[2], Nataliya Pronchatova-Rubtsova[3], Oksana Kashina[4]

[1, 2, 3, 4] Lobachevsky State University of Nizhny Novgorod
Institute of Economics and Entrepreneurship, [1] Management and Public Administration Department,
[2, 3, 4] Department of Finance and Credit
Bolshaya Pokrovskaya street 37, 603000 Nizhny Novgorod, Russian Federation
E-mail: [1] jashinsn@yandex.ru, [2] sitnicof@mail.ru, [3] pronat89@mail.ru, [4] oksana_kashina@mail.ru

Abstract: *The basis for successful social and economic regional development is a stable and flexible financial system. It is required to conduct state financial policy, taking into account the innovative character of changes in all spheres of life. It is necessary to find a balance between the effective functioning of the budget system in the conditions of economic volatility, limited financial resources, fierce competition and often unavailability of borrowed funds and the inevitable transition to the model of innovative development in the knowledge economy. The study aims at developing a methodology for assessing the region's budget potential, taking into account the innovative development of high-tech industries to increase the population's well-being. The authors developed a methodology for assessing the region's budget potential, taking into account the innovative development of high-tech industries based on a number of principles and a specially developed system of indicators. Indicators should comprehensively characterize the region's budget potential from the standpoint of financial sustainability and the region's economic development through high-tech industries. It is proposed to form two blocks of indicators: "Revenues, Economy, Innovations" and "Expenses, Socio-Economic Indicators". The methods of economic, system analysis and mathematical statistics were used. Approbation of the methodology was carried out on the official open data of the Federal State Statistics Service and the Federal Treasury of Russia for 2016. Practical implementation of the methodology makes it possible to rank the regions on the basis of a consolidated standardized indicator of the region's budget potential including the innovative development of high-tech industries. Monitoring the rank and analysis of the numerical value of the region's consolidated indicator allow: to establish that the problems of the region's budget potential development are related to the lack of a developed innovation environment and a unified productive system for managing budget resources; to develop effective managerial decisions considering innovative character's transformations to increase the population's well-being.*

Keywords: budget potential, innovative development, high-tech industries, consolidated standardized indicator, rating

JEL codes: H2, H5, H6, O3, H7

1 Introduction

According to the Concept of long-term social and economic development of Russia until 2020, the expected new wave of technological changes is to strengthen the role of innovations in the social and economic development and reduce the impact of many common growth factors. The speed and quality of transfer from the exportable raw materials to the innovative path of development to a large extent are determined by the efficiency of scientific and technological activities. In the context of the knowledge economy it is exactly strengthening of comparative advantages in the scientific, educational and high-tech fields that will allow to involve new sources of economic growth, ensure progressive development of the society and transfer to a new technological paradigm, which in the long run will result in growth of the population's welfare and well-being.

The research investment level is commonly considered an indicator of the maturity of an

economy. Expenditures should be understood as financial and human resources required to carry out this activity. The result is new knowledge, technologies, inventions, theories and discoveries. The emergence of the 'expenditures and results' model inevitably results in the need to assess the impact of resource investment. As the social and economic impact it is suggested to consider the influence of innovative development through knowledge-intensive and high-tech industries on the economic development of a state, the country's GDP growth, which will represent a source of additional resources to finance public expenses and increase the population's welfare.

Innovative development of an economy of any country in the world is absolutely impossible without a stable and developed financial system as a basis of not only financing transformations of innovative nature, but also of a reproduction processes regulator. The basis of a country's financial system is its budget system. It becomes important to study the peculiarities and challenges of the budget system efficient functioning taking into account the innovative orientation. The financial stabilization problem in Russia cannot be solved without strengthening the importance of the government regulation of the financial system elements. Reforming the budget system in the context of the economy of knowledge is impossible without innovative development of high-tech industries. In the conditions of the capital market volatility, insufficiency of financial resources, inaccessibility of borrowings it becomes relevant to assess the budget potential of a region taking into account the innovative development of high-tech industries to increase the country's population's welfare. The budget policy that takes into consideration innovative development provides for ensuring the priority of innovation-related expenditures and determination of the parameters and pattern of changing the budget main expenditure items necessary to develop the innovations. The regional policy provides for setting a higher priority of support of those regions that invest in innovative development. In the long term, the share of the Russian high-tech commodities and services in terms of volume on the global markets may reach 5-10 % by 2020, and Russia may take the leading positions in the sector of fundamental and applied R&D and technologies related thereto.

A lot of researchers in their works traditionally pay attention to the economy innovative development issue (De Marchi, 2012; Cappelen et. al. 2012; Hewitt-Dundas, 2006, 2013; Ganotakis, 2012; Ganotakis and Love, 2011). At the same time, in the current conditions of increased economic volatility many countries have significantly reduced their budget expenditures for multiple programs aimed at innovation development support (European Commission, 2010; European Commission, 2011). In doing so, many authors also note that innovative development success is determined not at all by the amount of innovation financing, but by the human capital level. The higher the human capital level, the more significant impact it positively provides on innovations. So, Dakhli and De Clercq (2004) in their work considered the influence of the two forms of capital, human and social ones, on the innovation development level in 59 countries, providing an overall view on the role these forms of capital play in generating material and non-material values. The authors have established that there is a positive correlation between the human capital development level and innovation development. However, Griliches (1979, 1990) notes that the interrelation between human capital and the volume of produced innovative products is rather a complex one, in particular, a topical issue in this regard is understanding how much impact human capital provides on innovations in high-tech sectors. Akhmetshin et. al. (2018), Mustafin and Ignateva (2016), Qi Dong et. al. (2012) also highlight the importance of human capital as a factor of economic growth, as well as of generation and implementation of new concepts and innovations. So, there is a need to create a new concept of innovative human capital as an innovation determinant. McGuirk et al. (2015) note that innovative human capital is the key concept that needs to be taken in consideration when developing state programs of innovation support in a country.

One of the key challenges is financing of high-tech sectors and innovations. Economic researchers are of the opinion that innovative activities are hard to finance using the funds of the open competitive market participants (Hewitt-Dundas, 2006, 2013). In this regard an important role is assigned to public financing of the innovative development of regions taking into account their budget potential (Vertakova and Vlasova (2015) aimed to increase

the country citizens' social and economic welfare. So, the innovations themselves are to contribute to human capital development and well-being of the population. This problem statement makes it necessary to develop a methodology of assessing the budget potential of the country's regions taking into account the innovative development of their high-tech industries to increase the population's welfare and well-being.

Within this study, the **budget potential (BP)** of a region taking into account the innovative development of **high-tech (HT) industries** should be understood as the development level of the regional capacities to increase income and expenditure financing quality that will ensure efficient functioning of the budget system in the conditions of economy volatility, limitedness of financial resources, competition and difficulties related to attraction of borrowings based on innovative development in the conditions of the knowledge economy.

The objective of this work is to study the budget potential of a region taking into account the innovative development of high-tech industries to increase the population's welfare and well-being (using the example of the Russian Federation constituent entities) using the methodology developed by the authors.

Despite the fact that there is a number of in-depth studies on this matter, we think that studying the budget potential of a region taking into account the innovative development of high-tech industries as a system of quantitative indicators is not sufficiently covered. There is no any integral, mutually interconnected quantitative assessment system of the budget potential that would allow to characterize it comprehensively in terms of regional financial stability and economic development through high-tech industries.

2 Methodology and Data

The authors have developed methodological principles of studying the BP of a region taking into account the innovative development of HT industries that include the principles of assessment, system of indicators and procedure for assessing the BP of a region taking into account the innovative development of HT industries. The concept of innovative state of social and economic systems lies at the basis of our developments. Out study is based on the statistical analysis methods, as well as on the systematic approach principles suggesting a holistic approach to a matter under consideration.

We suggest the following principles to assess the budget potential of a region taking into account the innovative development of high-tech industries:

1. The principle of balanced reference values. It means that the input reference values regarding the BP of a region taking into account the innovative development of HT industries are quantitatively interconnected. Any and all accepted reference indicator values are satisfactory for growth of the BP of a region taking into account the innovative development of HT industries.
2. The breadth of coverage principle. The number of indicators must be necessary and sufficient to assess the BP of a region taking into account the innovative development of HT industries.
3. The indicator quality principle. To assess the innovative state, one needs to use the indicators allowing to compare the system state over time and space that can be expressed in relative units.
4. The indicators shall be reliable.
5. Conclusions on the current state of the social and economic system are formed by assessing the uniformity of approximation to the reference level by separate indicators.

The result of assessing the BP of a region taking into account the innovative development of HT industries is identification of problems in development of certain elements and indicators, as well as development of recommendations for the budget potential growth.

We suggest to carry out the development and practical use of the methods of assessing the BP of a region taking into account the innovative development of HT industries according to the following procedure: 'Research object selection' → 'Initial data collection'

→ 'Clarification and adjustment of reference values' → 'Calculation of indicators' → 'Innovative development level analysis' → 'Detailed analysis of the developed indicator units'. To achieve the objective of this study and obtain a comprehensive assessment, we have developed a methodology used to determine a consolidated standardized indicator of a regional BP taking into account the innovative development of HT industries.

Procedure for assessing the budget potential of a region taking into account the innovative development of high-tech industries (stages).

I. Based on the objectives of our study we suggest to form two units of indicators that characterize the budget potential of a region taking into account the innovative development of high-tech industries: the first unit is 'Income, Economy, Innovations', and the second one is 'Expenditures, Social and Economic Indicators' (table 1).

Table 1 The System of Indicators Used to Assess the Budget Potential (BP) of a Region Taking into Account the Innovative Development of High-tech (HT) Industries (fragment)

Indicator / indicator unit name	Impact on the BP
1. 'Income, Economy, Innovations' (IEI) unit	
1.1. Motivation of enterprises to invest their own funds in R&D	+
1.2. Budget and tax return of the regional economy	+
1.3. Regional economy innovativeness indicator	+
1.4. Motivation of enterprises to invest their own funds in technological innovations	+
1.5. Regional scientific and staffing resource level	+
1.6. Consumer price index	-
1.7. Innovative activity (the share of enterprises engaged in innovative activities)	+
1.8. Regional enterprise investment innovativeness indicator	+
1.9. The share of and high-tech and knowledge-intensive industries in GRP	+
1.10. The indicator of efficiency of using public funds to increase regional income in high-tech and knowledge-intensive fields	+
…	
2. 'Expenditures, Social and Economic Indicators' (ESEI) unit	+
2.1. Healthcare public financing indicator	+
2.2. Share of healthcare public financing in GDP	+
2.3. Share of education public financing in GDP	+
2.4. Share of culture public financing in GDP	+
2.5. Average population income per capita	+
2.6. Birth rate	
2.7. Death rate	-
2.8. Life expectancy at birth	+
…	

Source: prepared by the authors

II. Calculated indicators allowing to assess the BP of a region taking into account the innovative development of HT industries may have various dimension, importance or weight. And the need to carry out a comprehensive assessment based on the whole set of indicators requires to bring them to a non-dimensional form, to a unified zero reference point, to a unified variation interval. In this regard the authors use a method based on linear conversion of initial indicators, within which the values of transformed (standardized indicators) will fall within the specified interval from 0 to 1. Upon conversion the indicator dimension disappears, but a fine structure of changes in certain indicators remains. Now one has the possibility to compare them and display in a unified coordinate system, as well as to aggregate the calculated indicators (Kornilov et al., 2017).

Standardization of the developed indicators of the assessment system is carried out taking into account the impact on the regional BP level taking into account the innovative development of HT industries (table 1). If an increase in the value of indicators results in improvement of the comprehensive assessment of the BP (positive impact (+), the bigger the coefficient value, the better), formula (1) is used, and if an increase in the value of indicators results in deterioration of the comprehensive assessment (negative impact (—), the lower the coefficient value, the better), then formula (2) is used.

$$K_{ij}^{*} = \frac{K_{i\,max} - K_{ij}}{K_{i\,max} - K_{i\,min}},\ 0 \le K_{ij}^{*} \le 1 \quad (1)$$

$$K_{ij}^{*} = \frac{K_{ij} - K_{i\,min}}{K_{i\,max} - K_{i\,min}},\ 0 \le K_{ij}^{*} \le 1 \quad (2)$$

where K_{ij} is the calculated value of the i^{th} indicator from the IEI or ESEI units of the system of indicators used to assess the BP in the j^{th} region, K^{*}_{ij} is the i^{th} standardized indicator of the system of indicators used to assess the BP in the j^{th} region, $K_{i\ max}$ is the highest calculated value of the i^{th} indicator, $K_{i\ min}$ is the lowest calculated value of the i^{th} indicator used to assess the BP, $i \in [1; N],\ N = 26$.

III. To determine the BP of a region taking into account the innovative development of HT industries in the conditions of the economy volatility one has to take into account the variability of the values of indicators characterizing the regional social and economic state. To take into account the economy volatility factor we suggest using the formula (3):

$$KV_{ij}^{*} = \frac{K_{ij}^{*}}{\sigma_i} \quad (3)$$

where KV^{*}_{ij} is the standardized indicator of a region taking into account the volatility K^{*}_{ij}, σ_i is the mean square deviation of the regional standardized indicator K^{*}_{ij}.

IV. To obtain a quantitative comprehensive assessment of the BP of a region taking into account the innovative development of HT industries in the conditions of volatility and heterogeneity of social and economic conditions, horizontal and vertical disbalance in the development of the regions one should calculate a consolidated standardized indicator of the budget potential ($CSIV^{*}$). The $CSIV^{*}$ of a region is calculated (4) as the sum of standardized indicators taking into account the volatility in the region that are included in the system of criteria used to assess the BP (IEI or ESEI units) taking into account the innovative development of HT industries in the regions.

$$CSIV_{j}^{*} = \sum_{i=1}^{n} KV_{ij}^{*} \quad (4)$$

where $CSIV^{*}_{j}$ is the consolidated standardized indicator of the BP of the j^{th} region taking into account the innovative development of HT industries in the conditions of volatility.

The lower the value of the $CSIV^{*}_{j}$, the more efficient the state innovation policy, the higher the quality of reforming the budget system in the knowledge-based economy and the more efficient public finance administration to increase the country's population's welfare are.

3 Results and Discussion

Practical implementation of the suggested methodology includes 71 regions of the Russian Federation of the 85 possible. The sampling was conditioned by the public availability of official information for analysis. The methodology approbation resulted in the following rating of the constituent entities by the regional budget potential level taking into account the innovative development of high-tech industries for 2016. Ranking was carried out based on the values of calculated consolidated standardized indicators ($CSIV^{*}$) (table 2).

Table 2 Rating of Constituent Entities of the Russian Federation Based on the Results of the Methodology Approbation, 2016 (a fragment)

Name of the Russian regions	$CSIV^{*}$	Rank
Saint Petersburg	106.39	1
Nizhny Novgorod region	106.58	2

Moscow	107.53	3
Republic of Tatarstan	107.81	4
…		
Tver region	112.17	14
Sakhalin region	112.81	15
Novosibirsk region	112.82	16
Republic of Udmurtia	112.97	17
…		
Sevastopol	115.86	30
Republic of Mari El	115.94	31
Kamchatka Krai	116.32	32
Stavropol Krai	116.84	33
…		
Murmansk region	117.37	38
Zabaikalsky Krai	117.41	39
Kirov region	117.66	40
Samara region	117.69	41
Republic of Crimea	117.81	42
Vladimir region	117.93	43
Russian Federation	117.99	44
…		
Kurgan region	120.83	59
Arkhangelsk region	120.96	60
Pskov region	121.29	61
Primorsky Krai	121.33	62
…		
Amur region	126.25	72

Source: authors' calculations based on the data of the Federal State Statistics Service and the Federal Treasury of the Russian Federation.

The peculiarities of the historical and economic development of different Russian regions explain the ambiguity of the country's current situation. The level of scientific and technological development is both a result of the economic situation and, at the same time, provides impact on economic processes itself.

The leading positions in the 2016 rating are held by the regions (for instance, Saint Petersburg, Moscow, Republic of Tatarstan, Nizhny Novgorod region) with the most efficient state innovation policy. This is confirmed by the values of indicators (budget and tax return of the regional economy, regional economy innovativeness, innovative activity, life expectancy at birth) that are above, while the death rate is below the country average. In these regions the values of the following indicators are also high: motivation of enterprises to invest their own funds in technological innovations, regional scientific and staffing resource level, the share of and high-tech and knowledge-intensive industries in GRP, efficiency of using public funds to increase regional income in high-tech and knowledge-intensive fields, average population income per capita. The rating leaders are characterized by the concentration of R&D institutions, availability of leading universities and broad financial opportunities. So, in the Nizhny Novgorod region not only R&D centers, but knowledge-intensive production facilities in the fields of mechanical engineering, chemistry and defense industry are concentrated as well. This is one of the most important regions in terms of IT development, characterized by a close link between fundamental science and education and applied research and IT-enterprises. In the outsider regions (for instance, Amur and Arkhangelsk regions, Primorsky Krai) the values of the following indicators are below the country average: regional economy innovativeness, motivation of enterprises to invest their own funds in technological innovations, the share of and high-tech and knowledge-intensive industries in GRP, life expectancy at birth. The indicators of public financing of education, culture and healthcare in regions do not have a certain trend in relation to the country average, they can be both above and below it. As a result, the quantitative assessment has clearly shown that the first-class or lacking regions are not

necessarily characterized by only the best or only the worst indicators, respectively. It is quite obvious that successful innovative development of a territory contributes not only to GDP growth, but also ensures qualitative and progressive changes thereof. A number of factors remains restraining the development of science and innovations, the key one of which is still the lack of financing (the level of wage of scientists, material and technical facilities). The return on financing of high-tech and fundamental developments due to its nature is deferred through time, which is a significant disadvantage in comparison with receipt of profit from mineral extraction.

No doubt that a transfer to an innovative path of development is quite a long and laborious process requesting significant financial expenses. To successfully implement it one needs to ensure the demand for innovations within the country, improvement of the innovation related infrastructure, efficient interrelation of the commercial sector and science, using the experience of prosperous regions.

4 Conclusions

The methodology of assessing the budget potential of a region taking into account the innovative development of high-tech industries was used to assess the social and economic policy of the Russian Federation regions. The developed consolidated standardized indicator ($CSIV^*$) allows to quantitatively assess territorial leaders and outsiders. It has been established that the problems of regional budget potential development are connected with the lack of both a developed innovative environment and a single efficient budget resource administration system. Analyzing the values of a consolidated indicator in the context of specific indicators of the assessment system, one can develop efficient managerial decisions taking into account innovative transformations to increase the population's welfare and well-being.

Innovative development taking into account its competitive advantages both in traditional sectors and in new knowledge-intensive fields and the economy of knowledge suggests a breakthrough in increasing the human capital efficiency, development of high-tech sectors and transformation of innovation factors into the main source of territorial economic growth. The social result of public policy will represent the opportunity to ensure the human capital development and improve the population's life quality, that is, an increase in the erudition, longevity, birth rate, rise of morality and spiritual wealth of the population.

It has been found out that a critical value of a specific indicator of the assessment system does not pose a threat to the budget potential taking into account the innovative development of high-tech sectors in a region in whole. However, this is a signal to strengthen the control over spending budgetary funds and implement a responsible social and economic policy in this field. The best possible value of all coefficients in a specific region is just one case among potential specific cases. This means that there are a lot of efficient ways of state innovation policy.

The key areas of analysis and control shall be the following: development of the R&D potential and high-tech sectors taking into account the required financial and organizational resources; structural diversification of the economy based on innovative and technological development; increasing the efficiency of the budget expenditures in whole and innovation-related expenses in particular; permanent monitoring both of each separate indicator of the budget potential assessment system and of the whole system of indicators in their interrelation; timely analysis of the growth drivers and problematic regions to take preventive measures to increase the efficiency of their activities.

The analysis of the results of the suggested methodology approbation confirms its consistency in whole. The methodology can be easily adapted, and the system of indicators can be meaningfully added in accordance with the terms and objectives of an assessment. The formed system of indicators to a large extent characterizes the budget potential of a region taking into account the innovative development of high-tech industries, while truly depicting the state and trends of current state innovation policy.

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Methodical Approaches to the Formation of Model Budgets in order to Improve the Effectiveness of the Budget Process in Russia

Nadezhda Yashina[1], Nataliya Pronchatova-Rubtsova[2], Sergey Petrov[3], Oksana Kashina[4]

[1, 2, 3, 4] Lobachevsky State University of Nizhny Novgorod
Institute of Economics and Entrepreneurship, Department of Finance and Credit
Bolshaya Pokrovskaya street 37, 603000 Nizhny Novgorod, Russian Federation
E-mail: [1] sitnicof@mail.ru, [2] pronat89@mail.ru, [3] petrov_ss@list.ru, [4] oksana_kashina@mail.ru

Abstract: *The purpose of the study is the formation of model budgets based on assessing the effectiveness of budget resources management of the territories for improving inter-budgetary relations. A methodology for assessing the effectiveness of budget resources management of the territories, considering the formed indicators in order to develop the model budgets, is proposed. The integrated indicator of the effectiveness of budget resources management is adopted as a basic criterion for classifying budget stability, which will allow to determine the type of model budget for the purpose of forming inter-budgetary relations in the region. The methodological basis was the methods of economic, system analysis and mathematical statistics. The methodology has been tested on the official data of the Finance Ministry of the Nizhny Novgorod region for 2014-2016. The result of the assessment is the rating of municipalities, and two classes of model budgets are established. The first class is characterized: by high financial stability due to a growth of the distributions' norms of regulatory taxes to municipalities, increasing the share of own revenues to 80-90%, a reduction in subsidies, subventions, increased dotations, the possible growth of municipal borrowing; by norms of social standards per unit of consumers of budget services, established with an increased coefficient. The second class is characterized by sufficient financial stability of municipalities, requires a balanced approach to establishing the structure of income and financing of expenditures. This methodology will help to match the amount of expenditure obligations to the amount of disposable income and balanced budgets. The formation of model budgets will increase the responsibility of the regional state authorities and local governments for ensuring effective spending of funds, for creating a base for expanding their own revenue potential; will contribute to improving the budgetary process management effectiveness and the introduction of budgeting principles based on results.*

Keywords: budget resources, effectiveness, model budget, inter-budgetary relations, integrated indicator

JEL codes: H7, H21, H61, H63, H68

1 Introduction

Stability and firmness of public budget ensuring coherent functioning of all sectors and fields of life with their complex links and close interdependence of specific fields have been called into question by the global financial system turbulence. In the conditions of the market economy volatility it has become quite obvious that a public budget system has high flexibility to changes in the macroeconomic situation. The main efforts of a state are focused on achieving its stable development, increasing the public expenditures efficiency, improvement of the quality and accessibility of public services, elimination of disproportions of territorial social and economic development, growth of the population's welfare and well-being. Reforming of public finances at all levels of the budget system must result in long-term balance and sustainability of territorial budgets. In this regard special attention is required to be paid to organization and implementation of the budget process to increase its efficiency based on the assessment of public finance administration quality. In promoting the efficiency of solving current tasks of territorial budgets an important role is played by inter-budgetary transfers that are necessary for the budgets of most regions and municipalities to fulfill their social obligations: ensuring a minimum of social services guaranteed to each citizen of a country and a decent standard of living.

That's why the issues of improving the model of building inter-budgetary relations remain relevant (Yashina et al., 2013). The system of inter-budgetary transfers is intended to provide an optimal balance between common regional interests and the interests of specific municipalities, to facilitate rational distribution of financial resources in a region.

A large number of studies is dedicated to assessment of budget resources administration efficiency. Special attention is paid to studying territorial budget sustainability as an indicator of the budget resources administration efficiency.

The priority settings of the public financial policy include ensuring long-term sustainability of territorial budgets. An indicator of territorial budget sustainability assessment is a 'budget gap' reflecting long-term conformity of the budget expenditure and revenue with the accumulated public debt amount. A lot of works are dedicated to assessment of the budget gap in relation to some European and American countries (Auerbach et al., 1991; 2003; 2004; Evans et al., 2012; Gokhale, Raffelhuschen, 1999; Gokhale and Smetters, 2003; Kotlikoff, Burns, 2012). In Russia the assessment of this value was for the first time carried out under the guidance of L. Kotlikoff (Goryunov et al., 2013). Budget sustainability allows to clarify whether it is possible to maintain budget expenditures on a planned level and to fulfill one's obligations to creditors to the full extent with the key characteristics of the tax and budget policy remaining unchanged (Goryunov et al., 2015). Budget sustainability describes a specific fiscal regime with a specific structure and budget revenue and expenditure amount.

Methodological aspects of the budget sustainability assessment were elaborated in the works by J. Horne (Horne, 1991) and O. Blanchard et al. (Blanchard, 1990; Blanchard et al., 1990), revealing the overall concept of budget sustainability and suggesting specific indicators to assess it. The 'intertemporal budget constraint' of a state serves as a basis and indicators are needed to determine whether chronical deviations between revenue and expenditure will emerge provided that an economy will develop in accordance with a certain trend.

In the conditions of economic volatility special attention should be paid to studying the factors that are able to lead to the risk of emergence of public budget crisis situations. Such factors may include: currency and time structure of public debt, availability of contingent liabilities, banking sector sustainability, access to international capital markets (Reinhart and Rogoff, 2009). In such situations to assess public budget sustainability methods are required that mainly represent a comprehensive stress testing of finance. In the context of crisis phenomena transformation of a budget mechanism into an efficient tool of macroeconomic stabilization and using all budget expenditure reserves to finance the economy and human capital development become the key aspect of the budget policy. (Bogolib, 2015).

There is no a single methodological approach to determine and assess budget sustainability in the Russian practice. There is no systematic legal regulation of this issue, and this concept is not explained in regulatory instruments. However, compliance with the requirements of the Budget Code of the Russian Federation to the state of regional and local budgets (restrictions by the level of debt and budget deficiency, standards of expenditures for maintenance of public authorities, etc.) are often interpreted as the basis of ensuring budget sustainability (Yashina et al., 2013). The methodologies are widespread of assessing the budget financial sustainability based on an analysis of characteristics of the revenue and expenditure budget items, accounts payables on the basis of: integral indicators (see, for example, Kolesov, 2000; Yashina et al., 2013), arched logarithmic elasticity indicators (Lapushinskaya, 2001), based on a correlation analysis (Yashin and Yashina, 2003).

Currently the issue of lack of transparent and unified methodologies to determine budget sustainability for the purpose of increasing budget resources administration efficiency requires to study and develop new methodological approaches to carrying out a comprehensive qualitative and quantitative assessment of territorial budget sustainability.

The objective of this study is to form model budgets based on the assessment of the

territorial budget resources administration efficiency to improve inter-budgetary relations.

2 Methodology and Data

The authors have offered a methodology of assessing the territorial budget resources administration efficiency to form model budgets. A comprehensive indicator of the territorial budget sustainability may be used as a criterion to assess the budget resources administration efficiency. Depending on the assigned category of budget sustainability, the model budget type is determined and a corresponding inter-budgetary relations policy in a region is formed.

The high rate of current changes and the need of an immediate response lead to development of new approaches, models and methods even in conservative areas of activity, including public administration. In this regard the authors have developed a methodology of the budget sustainability express analysis based on the system consisting of 8 reference indicators.

For the purposes of analysis, it is necessary to:

- Determine the scope of required financial information;
- Form the groups of revenue based on the commonly accepted budget revenue classification by tax, non-tax revenue and non-refundable transfers, and of expenditures taking into account the expenditure functional classification;
- Develop coefficients.

Information from official reports on implementation of municipal and regional budgets will be used as initial data.

The system of coefficients shall meet the following requirements: maximal informativeness; reliability and accessibility — determination on the basis of official budget implementation reports; comparability — an opportunity to carry out assessment of municipalities and constituent entities of the Russian Federation in space (in comparison with other territories) and in time (frequency); availability of numerical reference standards of minimum satisfactory level or variation range.

The system of indicators represents relative indicators/coefficients of the budget state (IBS) and includes:

1. Financial independence coefficient (IBS_1) is calculated as the ratio of budget own revenue (OR) to the total revenue amount (R) and shows to what extent the budget depends on financial support of a higher-level budget or what is the share of the budget own revenue (1):

$$\mathrm{IBS}_1 = \frac{\mathrm{OR}}{\mathrm{R}} = \frac{\mathrm{TR+NTR}}{\mathrm{R}} \quad (1)$$

where TR is tax revenue, NTR is non-tax revenue.

2. Financial sustainability coefficient (IBS_2) is calculated as the ratio of tax revenue (TR) to the total revenue amount (R) and shows how much taxes go into the budget (2):

$$\mathrm{IBS}_2 = \frac{\mathrm{TR}}{\mathrm{R}} \quad (2)$$

3. Coefficient of own revenue and non-refundable transfers ratio (IBS_3) is calculated as the ratio of tax revenue (TR) and non-tax revenue (NTR) to non-refundable transfers (NRT), which allows to compare the amount of one's own funds and financial support (3):

$$\mathrm{IBS}_3 = \frac{\mathrm{OR}}{\mathrm{NRT}} = \frac{\mathrm{TR+NTR}}{\mathrm{NRT}} \quad (3)$$

4. Coefficient of sufficiency of one's own revenue to finance social expenditures (IBS_4) is calculated as the ratio of one's own revenue (OR) to social sector expenditures (E_s): healthcare, education, social policy, physical training, culture and cinema; shows the level

of budget own funds sufficiency (the degree of self-sufficiency) to finance the social sector (4):

$$IBS_4 = \frac{OR}{E_s} = \frac{TR+NTR}{E_s} \quad (4)$$

5. Coefficient of sufficiency of one's own revenue to finance production industries (IBS_5) is calculated as the ratio of one's own revenue (OR) to expenditures for national economy (E_{ne}) and housing and utility sector (E_{hus}), shows the level of budget own funds sufficiency (the degree of self-sufficiency) to finance the production industries (5):

$$IBS_5 = \frac{OR}{E_{ne}+E_{hus}} = \frac{TR+NTR}{E_{ne}+E_{hus}} \quad (5)$$

6. Administration expenditures financing coefficient (IBS_6) is calculated as the ratio of expenditures for nationwide issues (E_{NI}) to the total budget expenditure amount (E), shows how much budgetary funds is used to finance the administrative apparatus (6):

$$IBS_6 = \frac{E_{NI}}{E} \quad (6)$$

7. Human capital investment coefficient (IBS_7) is calculated as the ratio of expenditures for the social sector (E_s) to the total budget expenditure amount (E), shows how much budgetary funds is used to finance the human capital development (7):

$$IBS_7 = \frac{E_S}{E} \quad (7)$$

8. Interest expenditures coefficient (IBS_8) is calculated as the ratio of expenditures for servicing state and municipal indebtedness (E_i) to tax revenue (TR) and shows to what extent the expenditures for servicing state and municipal indebtedness are covered by tax revenue (8):

$$IBS_8 = \frac{E_i}{TR} \quad (8)$$

Upon carrying out the coefficient express analysis the municipal budget sustainability level is determined by determining the coefficient reference values for the three sustainability categories. The threshold coefficient reference values determining budget sustainability categories are formed by an expert method based on an analysis of the array of the calculated values of indicators taking into account the peculiarities of territorial social and economic state and development, analysis of the most successfully developing and efficiently functioning municipalities, as well as the coefficient variation range ($IBS_{i\ max}$, $IBS_{i\ min}$) within the aggregate of the territorial budgets under consideration.

The coefficient analysis does not allow to assess the budget sustainability in an unequivocal, quantitative and summarized manner. In this regard, we offer a methodology of assessing the territorial budget resources administration efficiency taking into account the formed reference indicators by determining an integrated standardized budget sustainability indicator (indicator of the budget state), IBS^*_{integ}. The calculation of the integrated standardized indicator includes the following three stages:

1. Dividing the coefficients used for analysis into two groups according to the impact they provide on the territorial budget resources administration efficiency (table 1);
2. Bringing the indicators to a comparable form according to formulas (9) and (10) (table 1). Separate budget state indicators may have various dimension, importance or weight, which requires to bring them to a unified form, to a unified zero reference point, to a unified variation interval when carrying out a comprehensive assessment of territorial budgets based on an aggregate of indicators. The authors use a method based on linear conversion of initial indicators, within which the indicators values fall within the specified interval from 0 to 1 (Kornilov et al., 2017).

Table 1 Grouping Indicators by the Territorial Budget Resources Administration Efficiency

Group 1. 'Improvement of the budget sustainability with an increase in the indicator values'	**Group 2. 'Deterioration of the budget sustainability with an increase in the indicator values'**
$IBS^*_{ij} = \frac{IBS_{i\,max} - IBS_{ij}}{IBS_{i\,max} - IBS_{i\,min}}$ (9)	$IBS^*_{ij} = \frac{IBS_{ij} - IBS_{i\,min}}{IBS_{i\,max} - IBS_{i\,min}}$ (10)
where IBS^*_{ij} is the value of the i^{th} standardized indicator in the assessment coefficient system in the j^{th} municipality; $IBS_{i\,max}$ is the maximum value of the i^{th} indicator within the whole sampling of municipalities; IBS_{ij} is a separate calculated value of the i^{th} indicator; $IBS_{i\,min}$ is the minimum value of the i^{th} indicator within the whole sampling of municipalities; $0 \le IBS^*_{ij} \le 1$.	
Financial independence coefficient (IBS_1)	Administration expenditures financing coefficient (IBS_6)
Financial sustainability coefficient (IBS_2)	Interest expenditures coefficient (IBS_8)
Coefficient of own revenue and non-refundable transfers ratio (IBS_3)	
Coefficient of sufficiency of one's own revenue to finance social expenditures (IBS_4)	
Coefficient of sufficiency of one's own revenue to finance production industries (IBS_5)	
Human capital investment coefficient (IBS_7)	

Source: prepared by the authors.

3. Calculation of $IBS^*_{integ\ j}$ is carried out by aggregating the converted indicators of a specific municipal budget (11):

$$IBS^*_{integ\,j} = \sum IBS^*_{ij} \quad (11)$$

Ranking of municipalities is carried out in accordance with the value of an integrated standardized budget sustainability indicator. The lower the value of the integrated standardized budget sustainability indicator $IBS^*_{integ\ j}$ the more efficient the territorial budget resources administration is.

Simultaneously with making a rating one has an opportunity to form the budget sustainability categories by 'cutting them off' by the threshold reference values of IBS^*_{integ} for budget sustainability categories.

The following categories are formed by the efficiency of budget resources administration based on budget sustainability:

4. 'Best budgets' have the lowest IBS^*_{integ} values in a sampling not exceeding the threshold reference values to be assigned to this category;
5. 'Satisfactory budgets' have the IBS^*_{integ} values exceeding the I category values, but which are lower than the II category threshold reference values;
6. 'Worst budgets' have the highest IBS^*_{integ} values, the worst ones in a sampling.

The final stage of assessing the budget resources administration efficiency is forming model budgets of the following two categories:

- 1 category of model budgets: municipalities considered to be the best ones based on the budget sustainability criterion and, accordingly, with the most efficient administration of the budget resources;
- 2 category of model budgets: municipalities with satisfactory and worst budget sustainability values and, consequently, with a poor quality of budget resources administration.

3 Results and Discussion

Practical implementation of this methodology was carried out based on the sampling of data of 52 municipalities of the Nizhny Novgorod region, regional and consolidated budget

of the region for 2014-2016. A comparative rating of municipalities of the Nizhny Novgorod region by assessment of the budget resources administration efficiency is shown in Table 2.

Table 2 Rating of Municipalities Based on the Results of the Methodology Approbation, 2014-2016 (a fragment)

Municipality name	Position in 2014	Position in 2015	Position in 2016
Regional budget	1	1	1
Consolidated budget	2	2	2
1 category 'Best budgets'	3	3	3
Dzerzhinsk city	4	5	4
Bor city	5	7	10
Vyksa city	6	12	14
Nizhny Novgorod city	7	37	46
...			
2 category 'Satisfactory budgets'	26	26	26
...			
Vachsky district	36	39	36
Bolsheboldinsky district	37	43	40
Dalnekonstantinovsky district	38	48	41
Urensky district	39	33	34
...			
Sokolsky district	51	51	45
Bolshemurashkinsky district	52	56	56
Vadsky district	53	57	54
Spassky district	54	52	52
Sharangsky district	55	53	55
Krasnooktyabrsky district	56	55	57
Tonkinsky district	57	54	50
3 category 'Worst budgets'	58	58	58

Source: authors' calculations based on the data of the Finance Ministry of the Nizhny Novgorod region.

The analysis of the results of the suggested methodology approbation confirms its consistency. The rating of the Nizhny Novgorod regional municipalities during these three years is headed by the regional and consolidated budget forming the 'best category' of sustainability. Such situation is expectedly reflected in the following development indicators: GRP grows in average by 6%, the most profitable sources remain personal income tax that accounts for nearly 40%, then comes the corporate profit tax and property tax. These indicators grow, which shows an increase in corporate profits, investments in fixed assets and regional average wage. Even the availability of significant expenditures for servicing state and municipal indebtedness in these budgets rather shows a positive trend. Not the amount of indebtedness is of importance, but how efficiently it is administered (Yashina et al., 2015), whether these funds are used to increase the population's standard of living and welfare and human capital development or not. When analyzing the expenditure item it is worth noting that primarily these are investments in human development, that is, healthcare, education and social policy development programs. The positive aspect in this regard is that the budgetary funds are not just wasted but rationally used, including for capital expenditures: investments in building schools, kindergartens or underground development. The majority of the territorial budgets have preserved their development orientation in the course of this study, which has reflected in a comparatively stable composition of the budget sustainability categories (table 2). The drastic change in the Nizhny Novgorod city position is mainly due to a poor quality of human capital financing, indebtedness administration and insufficient self-sufficiency in supporting production industries.

For territories with the 'best budgets' according to the sustainability criterion (regional and consolidated budget of the Nizhny Novgorod region) it is recommended to develop the '1 category model budgets', for territories with the 'satisfactory and worst budgets' — '2 category model budgets' (Nizhny Novgorod city, Bor city, Dzerzhinsk city, etc.).

4 Conclusions

The integral assessment of the budget resources administration efficiency is the basis of budget administration, since it allows to analyze the quality of planning, implementation of local and regional budgets, as well as the level of regulating and controlling thereof. The developed methodology of budget sustainability express analysis based on 8 indicators allows to: analyze the rationality of using budget resources and a model of inter-budgetary relations in a region; reveal the main problems related to shortfalls in receipt of revenue, expenditures 'scatteration' and peculiarities in financing a specific sector; determine the reference points to increase the quality of budget process administration; develop a policy to implement set objectives and tasks of territorial social and economic development.

Forming 'model budgets' will provide an opportunity to:

- Ensure the balance between common regional interests and the interests of specific municipalities;
- Rationally distribute financial resources in a region;
- Ensure conformity of expenditures with the amount of available revenue, as well as budget balance;
- Increase the responsibility of public authorities for the efficiency of spending funds and growth of one's own revenue potential;
- Increase the efficiency of budget process administration;
- Implement into the budget process result-oriented budgeting principles.

For territories with the first category model budgets it is recommended to: increase the standards of regulating taxes distribution and the share of one's own revenue up to 80-90 %; lower subsidies, subventions, increase grants; use borrowed resources; establishe increased social standards per budget service consumer unit. For territories classified within the second category of model budgets it is suggested to gradually increase the standards of regulating taxes distribution and ensure the share of one's own revenue not lower than at 50%, decrease grants, not to resort to borrowings.

The optimal differentiation of expenditure obligations between different levels of authority will ensure efficient provision of budgetary services, reduce the number of subventions and subsidies not related to implementation of national priorities, reduce doubling and scaterring of budgetary funds. Transfer on the municipal level of an additional standard of deductions from profit tax, personal income tax and excises will solve the problem of the budget revenue item replenishment, provide local self-government bodies with an opportunity to influence the receipt of such taxes, eliminate the problem of a low specific weight of local budget own revenue.

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