

**TRENDS IN THE CZECH REGIONAL MANUFACTURING****Trendy v české regionální výrobě****HELMUTH YESID ARIAS GOMEZ <sup>1</sup>****GABRIELA ANTOŠOVÁ <sup>2</sup>**

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**Annotation**

This article aims to recognize the recent trends in the regional specialization according to changes in sectoral employment. The three New Economic Geography's (NEG) agglomerative forces, namely: low transport cost, economies of scale and relevance of footloose productive factors, have been powerful determinants guiding the location of firms, in spite of policy intervention blatantly activist intended to reverberate artificially the geography of production (such as interventionist measures during the communist regime). Although, the most recent models of geography and trade recognize a bijective interaction between NEG forces and comparative advantages, to fully explain productive specialization. This contribution interprets the trends in the Czech Manufacturing inspired by the tenets of the NEG and the analysis of regional specialization of the Czech Republic in a context of inter-territorial inequalities regarding the distribution of manufacturing activity. Methods are used by application the Kim's Divergence Index to detect the degree of similarity or not throughout the manufacturing structure, while observing the sectoral specialization of labor. The results of the Index suggest the specific role of each individual region (NUTS2) in a national hierarchy of manufacturing tasks that also shook up the Czech integration into the international production system.

**Key words**

New Economic Geography, comparative advantage, industrial agglomeration, productive specialization

**Anotace**

Tento článek si klade za cíl rozpoznat nedávné trendy v regionální specializaci podle změn v odvětvové zaměstnanosti. Tři aglomerační síly nové ekonomické geografie (NEG), konkrétně: nízké náklady na dopravu, úspory z rozsahu a relevantnost mobilních výrobních faktorů, byly silnými determinanty umístění firem. A to i navzdory politickým zásahům, které zjevně aktivně zamýšlely uměle odrážet geografii výroby (například intervenční opatření během komunistického režimu). Ačkoli nejnovější modely geografie a obchodu uznávají bijekci mezi silami NEG a komparativními výhodami konkrétně pro úplné vysvětlení produktivní specializace, v tomto příspěvku se interpretují trendy v české výrobě inspirované principy NEG. Pro analýzu regionální specializace České republiky v kontextu meziteritoriálních disparit týkajících se rozdělování výrobní činnosti je použito Krugmanovo řešení. Kim Index je použit pro detekci míry podobnosti neboli napříč výrobní strukturou, konkrétně při sledování odvětvové specializace práce. Výsledky sledovaného indexu naznačují specifickou roli každého jednotlivého regionu (NUTS2) na administrativní úrovni výrobních aktivit, které otřásly také českým zapojením do mezinárodního obchodního systému.

**Klíčová slova**

Nová ekonomická geografie, komparativní výhody, průmyslová aglomerace, výrobní specializace

**JEL classification:** R12, L60

## 1. Introduction

The manufacturing landscape of the actual Czech Republic was the result of an accumulative process of localized undertakings on a relatively small extension of land that has been startlingly affected by political turnovers and disruptive economic transformations. In spite of the rather disruptive manufacturing process, the Czech Republic could presume being on a more industrialized level amid the central European neighbours (Ženka et al., 2015). Perhaps more than in another process occurred elsewhere, the manufacturing in the Czech Republic has been outrightly affected by historic events and by political turmoil and crises. The relatively reduced size of the country eased the regional integration and spurred the consolidation of a national market. Along with the territorial extension, the internal transport connections expedited travels and communications. Recently, the full incorporation into the European sphere has propelled, mostly in a positive way, the national economic development. This article aims to recognize the recent trends in the regional specialization according to changes in sectoral employment.

## 2. Background

Since the Bertil Ohlin times, some economists have pleaded for integration in the determinants of regional and international specialization, and occasionally, Krugman assumed this joint research approach to be a crucial point of departure for the research path (Krugman, 1993 and 1999). In contrast, classical tradition focused on diverting the regional analysis from the international specialization, a disruption which relied on strong theoretical reasons. In fact, under the assumption of international immobility of capital, a different theory must be developed in the realm of regional specialization, the realm where the factorial mobility is the rule (Blaug, 1990). In the Ricardian world, international exchanges make sense only if partners exploit their comparative advantages based on costs and productivity; then trade is the appropriate scenario to demonstrate the differences in terms of productive conditions. Therefore, exchanges between similarly endowed countries never occur, and to the extent that each country took advantages of the differences in costs and technologies, a full specialization landscape emerges that renders an array of countries producing commodities that arise from the more cost-efficient process and with exchanges based on inter-industry trade (Ricci, 1997 and 1999). In a similar vein, the standard Heckscher – Ohlin Model was based on factor endowments and the intensive exploitation, assuming some mobility restrictions in the factors but conferring unrestricted free movements to commodities exchanged. Nonetheless, an imperceptible implicit trade of factors when the trade of commodities is clearly eased (Ottaviano and Puga, 2003). This paradigm can be better understood in light of the interaction between factor abundance and factor intensity (Krugman, 1999). On the other hand, the NTT (New Trade Theory) and NEG models (Krugman, 2008) skipped the Ricardian world in which the comparative advantage emerged as the ultimate tenet explaining the trade and the specialization, for embrace a new paradigm based on a different view of trade. As Krugman (1999) points out, countries have the ability to concentrate industries by exploiting of increasing returns and the “Home Market Effect”, as defined by Davis and Weinstein (1996), provides the sufficiently large scales for defining the specialization pattern of trade. Therefore, the models based on scale economies under monopolistic competition conditions can clearly predict an economic integration without relevant harmful consequences in terms of employment because each partner can specialize in a manufacturing variety, enlarging the markets along with the economic integration (Krugman, 1993 and 2008). In terms of international trade, these basic forces can be identified with the boost of intra-industry trade after WWII (Grubel, 1967). The transition to a market economy brought drastic changes to regional manufacturing after 1989. The awakening of the Czech Republic to a market global economy experienced the emergence of cheaper labor countries in Asia (Dvořáčková, 2016). The newly market-oriented economy and the exposure to international competition induced a strong process of modernization and adjustment. For instance, the metallurgic sector faced strong competition coming from plants located in Poland, Russia and Ukraine, and also from producers located as far away as China (Sadílek, 2017). Ženka et al. (2015) emphasized the particular vulnerability revealed in the Czech microregions overspecialized in manufacturing production never having forged a diversified economic structure.

## 3. Some Stylized Facts on the Regional Manufacturing

The regional manufacturing process can be propelled toward a specialized structure or a diversified one and the implication of these alternatives were discussed in the Czech context by Ženka et al. (2015). The regional set up of manufacturing can rely on natural advantages thanks to the readiness to receive a certain sort of activities, or some branches exploiting economies of scale. The appropriateness of some areas to operate on specific industries can reveal a type of agglomeration on a more reduced scale than the global manufacturing agglomeration (Ottaviano and Puga, 2003).

**Tab. 1: The Czech Republic. Manufacturing Employment 2018. (Number of employees)**

	1	2	3	4	5	6	7	8
Total Employment	93,123	158,518	167,799	116,780	231,876	222,202	181,655	155,261
Food	9,661	12,185	12,307	6,334	13,100	20,251	15,735	10,587
Beverages	2,782	1,444	3,055	971	1,656	3,432	1,938	1,707
Textiles	1,263	724	1,861	3,671	9,805	4,686	1,424	1,793
Wearing apparel	2,763	1,995	3,441	1,632	3,407	6,321	4,300	2,304
Leather and related products	253	211	257	298	534	1,790	1,526	298
Wood and products of wood and cork.	6,103	5,904	8,728	2,939	6,999	11,091	7,073	4,407
Paper	1,330	2,312	2,116	2,892	4,800	2,870	2,669	2,430
Printing and reproduction of recorded media	6,850	4,242	1,742	1,551	2,089	3,497	2,014	2,225
Chemicals	2,382	5,086	2,151	7,247	4,761	2,403	5,969	2,232
Basic pharmaceutical products	1,860	1,289	92	159	857	3,296	309	2,888
Rubber and Plastic	3,716	8,394	10,925	6,810	18,539	16,445	23,342	7,021
Other non-metallic mineral products	4,434	7,358	6,288	11,807	12,634	8,402	4,655	2,785
Basic metals	1,518	3,247	2,582	3,871	4,758	5,410	4,007	19,465
Metal products.	11,153	16,606	25,964	19,381	29,324	36,240	36,217	21,847
Computer, electronic and optical products	3,738	6,449	4,774	1,427	13,343	6,056	7,451	4,772
Electrical equipment	7,429	5,715	15,966	9,821	18,387	20,524	19,153	11,246
Machinery and equipment	6,165	11,876	19,184	8,896	25,676	29,492	16,687	14,516
Motor vehicles, trailers and semi-trailers	2,784	46,906	28,012	14,186	42,261	14,254	7,599	25,483
Other transport equipment	2,695	2,624	3,144	777	2,486	2,612	5,201	4,828
Furniture	1,570	1,997	3,309	1,747	3,073	6,291	4,134	2,810
Other manufacturing	4,137	6,320	7,026	3,290	7,762	8,772	3,857	1,864
Repair and installation of machinery and equipment	8,303	4,555	4,817	7,041	5,321	8,040	6,366	7,184

Regions: 1. Praha. 2. Střední Čechy (Central Bohemia). 3. Jihozápad (Southwest). 4. Severozápad (Northwest). 5. Severovýchod (Northeast). 6. Jihovýchod (Southeast). 7. Střední Morava (Central Moravia). 8. Moravskoslezsko

Note: Due to the statistical confidentiality, there are no published data for tobacco products and coke and refined petroleum products. Summing up all sector participations doesn't equal total.

Source: Own research results based on EUROSTAT information.

In some cases, the location can respond to purely Marshallian externalities in branches requiring the connection with natural inputs or can respond to exploitation of economies of scale and enhanced volumes of production, theoretically the degree of factor mobility directly affects the location of regional manufacturing. In a nutshell the location matters concern to a continuous tension between mobile and immobile factors (Krugman, 1993). The table 1 illustrates regional trends in manufacturing specialization. Some flagship branches stand out there. The automobile industry has a long history in the Czech lands, going back as far as the Austro-Hungarian empire. Casting the memory back to 1895, the Laurin and Klement plant was originally intended to manufacture bicycles. Already in 1905, the plant was converted into the production of vehicles and during the Austro-Hungarian empire, it was the largest car maker. The location decision was originally made in the town of Mladá Boleslav when overtaking the company; later, the company's centerpiece remained there. Other two plants are now operating near the Polish border: in Kvasiny producing the most upmarket cars as Škoda, and in Vrchlabí producing transmissions not only internally for the group's brands the local for the local brands but also for international brands.

The new economic situation in the Czech Republic after the Velvet Revolution turned the attention of Škoda abroad and strengthened the three plants as a productive segment amid a real global trade business. The role of Vrchlabí producing kinds of specific inputs for the car industry unveils the inclusion of this location into a huge international chain of production, reinvigorating the local specialization and the local production pattern. The consolidation of this plan on the German frontier can be understood amid the gravitational forces pushing the regional Czech industry, thanks to the proximity to the focus German market. But Škoda is not the only player in the sector; Toyota, Peugeot and Citroën have presence in Kolín with a plant producing different models (Ministry of Industry and Trade, 2018). In other transport equipment industries, plants in Děčín-Křešice, Kutná Hora and Hradec Králové stand-out.

As an empirical fact, the heritage of planned and forced industrialization during the totalitarian regime was the territorial deployment of large enterprises dominating the local economy. The result of this strategy was a local

overspecialization of the territories, rather than a diversification of manufacturing activity. It increased the local dependence on particular branches and exposed the local economy to high risks of instability during the restructuring cycles of the manufacturing sector (Ženka et al., 2015). In fact, from an empirical point of view, the comparative advantages are actually embedded in general conditions representing idiosyncratic traits of the regions or countries, which can reflect technological advantages, natural conditions or institutional factors propitiating the production of certain commodities (Pflüger and Tabuchi, 2016). The regional distribution must be understood in the light of mobility or immobility of factors, because location decisions ultimately concern where to set up the factors and where to put them to produce. Exploiting economies of scale, the final result leads to a diverse degree of spatial concentration (Krugman, 1993). Likewise, loosely speaking, the spatialization based on natural advantages is assumed to be a spreading force, to the extent that the resources are dispersed across the space. Some regions succeeded in forging a diversified manufacturing structure, more prone to facing ulterior crises hitting individual sectors. These diversified territories are enabled to cope with potential disturbances and external shocks provided their capacity is able to absorb the exceeding labor thanks to the operation of the so-called portfolio effect (Ženka et al., 2015). Other branches open up one clear regional rooting. The manufacturing of fashion jewelry has been located in the region of Liberec, surrounding the city of Jablonec nad Nisou, requiring expertise of craftsmen. Traditional firms producing this kind of products are mostly of a reduced scale, small and medium size firms prevailing. There is a clear reliance on natural resources in the production of wood and wooden products considering that in the country there is an area of 2.7 million ha covered by forests owned by the state and municipalities but some parts are also in private hands. The privileged production areas are located in Vysočina, South Moravia and South Bohemia (Ministry of Industry and Trade 2018). The Czech manufacturing industry has evolved to an intermediate level and then further to complex production, such as airplanes, turboprop engines, and small turbine aviation and light sport aircrafts. Besides, other industries have developed, such as computers and peripheral equipment, communication equipment and measuring instruments. The latest branch (means communication equipment and measuring instruments) sees a remarkable role of the Brno's Cluster of companies (Ministry of Industry and Trade, 2018). Other recent developments in the field of biotechnology came about in the jurisdiction of Prague and Ostrava (Blažek et al., 2011).

#### 4. Specialization and Regional Divergence

In Krugman (1991) and Kim (1995 and 1998) is proposed an Index of Regional Specialization based on the manufacturing employment data. The measurement is relatively simple because relies on the comparison in the sectoral structures of employment between pairs of regions. The particular comparison at each sectoral level is defined as:

$$\sum_i |S_{ij} - S_i^*|,$$

being  $S_i$  the weight of the branch in the employment of region  $j$ , and the symbol  $*$  pertains to the information of the homologous regional partner.

While applying the absolute value, the methodology takes into account the numerical distance between the data pertaining to each region. According to Krugman (1991) and Kim (1995 and 1998) this index is applied to analyzing the degree of similarity in the manufacturing structure in the comparison between two regions. At the extent that the index is near to zero, the two regions are prone to produce an alike set of manufacturing baskets, and loosely speaking, the joint manufacturing landscape is less specialized. In contrast, if the indicator tends to 2 or the value is relatively high, the mutual comparison across regions reveals a fairly different sectoral distribution of employment. Each region is intended to produce a relatively different basket of manufacturing commodities and the composition of the manufacturing absorption of labor indicates a divergent productive intensity. Kim (1995) asserts that the index is quite meaningful for describing simultaneous evolutions, observing the sectoral and territorial breakdown. The use of NACE classification at any specific level of aggregation, theoretically, can include within each sector, a set of activities with a similar factorial intensity, according to Heckscher-Ohlin tradition. On the other hand, the regional units can take up either functional or common features in terms of territorial homogeneity. The general principle of interpretation of the index is that sector tends to be more localized as the territories achieve a higher specialization. In this article, the index is purposely calculated, using as a source of data the employment data at the regional and sectoral level furnished by EUROSTAT for the Czech Republic. The purpose is to make a static comparison between 2008 (a harsh period in terms of economic performance) and the year 2018. This exercise consults by statistical availability, the information arranged in a more general breakdown at a NUTS2 level. A more detailed overhaul at a NUTS3 level should be more accurate, but for more detailed information the statistical confidentiality makes disappear some data regarding particular sectors and the exercise could entail important drawbacks. The results of the index for 2008 and 2018 are set forth in tables 2 and 3 respectively.

**Tab. 2: Index of Regional Divergence in Manufacturing Employment. NUTS2 (2008)**

Cohesion Region NUTS2	Prague	Central Bohemia	Southwest	Northwest	Northeast	Southeast	Central Moravia
Central Bohemia	0.538						
Southwest	0.478	0.399					
Northwest	0.532	0.491	0.4005				
Northeast	0.572	0.406	0.241	0.368			
Southeast	0.410	0.464	0.277	0.406	0.405		
Central Moravia	0.440	0.521	0.323	0.464	0.452	0.262	
Moravian Silesian	0.542	0.516	0.482	0.518	0.541	0.486	0.575
Average: 0.447							

Source: authors' own research, based on EUROSTAT information. See Kim (1995), Kim (1998) and Krugman (1991).

The findings of Krugman (1991) reveal that such exercise applied at an intra-national level concludes that the degree of specialization is more intensive because, without borders and tariffs, the regions can take advantage of local assets and differentiated natural resources, aiming to distribute the goods towards the remaining national regions. In contrast, the international comparison across regions of several countries must indicate an alike structure because due to political separation and tariffs, each country tries to develop a sectorial structure intended to meet the national necessities, and therefore, the compared countries can configure simultaneously a similar bundle of manufacturing stuff distributed across regions.

The comparison between a pair of regions casts interesting conclusions. The first conclusion is that Prague has stood out in the service sector but not in manufacturing activities. The secondary sector is dispersed across different regions and each region (NUTS2) harbored some typical manufacturing branches. Observing the spatial distribution of sectors, each region received specific branches that predominate other sectors. For instance, spatial concentration of some sectors is clearly identified in the following regions: metallurgy in Moravia-Silesia, textile in the Northeast, apparel in the Southeast, chemicals in the Northwest, the wood industry in the Southeast, the computer and electronic industry in the Northeast, the beverage branch and so on. Regarding the spatial distribution of motor vehicles and transport equipment, it is relatively dispersed provided there is diversity of plants in diverse regions. This degree of specialization is evident in the outcomes showed by table 2. Prague as a predominant city of services is relatively diverse in manufacturing terms regarding the other regions. Simultaneously, the manufacturing endowments in central Bohemia are clearly different regarding the remaining homogenous regions. Finally, the regions of Central East and Central Moravia demonstrated the most similar manufacturing structure.

The static comparison can be performed by interpreting the average of the values of all cells for each period. The average jumped from 0,447 to 0,473 is indicative of a higher level of regional specialization from 2008 to 2018, explained by important sectoral and regional rearrangement of manufacturing production. For the analysed period some important stylized facts can be identified, based on the comparison of the years 2008 and 2018.

**Tab. 3: Index of Regional Divergence in Manufacturing Employment. NUTS2 (2018)**

Cohesion Region NUTS2	Prague	Central Bohemia	Southwest	Northwest	Northeast	Southeast	Central Moravia
Central Bohemia	0.603						
Southwest	0.525	0.414					
Northwest	0.609	0.567	0.421				
Northeast	0.613	0.395	0.266	0.387			
Southeast	0.444	0.593	0.246	0.460	0.421		
Central Moravia	0.512	0.638	0.408	0.527	0.520	0.317	
Moravian Silesian	0.604	0.510	0.343	0.478	0.409	0.491	0.536
Average: 0.473							

Source: authors' own processing of data, based on EUROSTAT information. See Kim (1995), Kim (1998) and Krugman (1991).

The setback of traditional sectors with a strong spatial tradition occurred in Basic Metals, Textiles, Wood, Printed and Recorded Media, inter alia. In contrast, one remarkable role is performed in Prague, a flourishing city lodging some sectors in net expansion as Electrical Equipment and Other Transport Equipment. In this vein, a protuberant fact is an apparent set of compensating moves between Prague and Central Bohemia, with an expansion in employment in the first case and a recoil in the second one in specific sectors namely: Food Products, Beverages, Textiles, Wood, Rubber and Plastic Products, Other non-metallic Mineral Products, Manufacture of Computer, Electronic and Optical products and Electrical Equipment. Finally, the Czech Republic restated its advantage in

the production of Motor Vehicles with important expansion of employment in the localized spots, lodging this branch: Mladá Boleslav, Vrchlabí, Kvasiny, Kolín, Nošovice, Děčín-Křešice and Kutná Hora.

Blažek and Csank (2005) highlight the economic position of Czech regions as a combination of an internal productive arrangement and an insertion in the international flows of capital and resources. In such vein, the Index of Regional Divergence suggests that there is a clear individual role of each Czech region (Staničková, 2019) responding directly to a national hierarchy, performing a specific specialization thrown to the natural resources and local assets, but recently, a strong influence coming from the Czech position in the gradient west-east can disrupt or reinforce the original specialization. In conclusion, the regional arrangement of Czech industry demonstrated to be clearly focused on specific branches pertaining to the local vocation and economic tradition. It involves a relatively clear specialization of each region in identified production lines. There are fairly extended and ubiquitous branches as food products that, due to the quality of this line, tend to blossom at a more general spatial level. The Czech car industry itself is distributed with relative uniformity across some specific regions.

## 5. Conclusions

The recent direction followed by the studies dealing with trade and specialization patterns, proposed a joint influence of comparative advantages and NEG forces. Analysts are less prone to offer an explanation based exclusively on any of the two theories and ended up accepting the validity of a joint influence as a source of trade. The presence of transport cost and segmented markets can reverse the divergent tendencies of the core periphery model. This argument, together with the assumption of minimal natural endowments in the peripheral regions, can conduce to the creation of a theoretical possibility of industrializing the peripheries. The NEG arguments defending the role of historical accidents as the trigger for unleashing the industrial process were prefigured already by Bertil Ohlin, who identified the optimal conditions present in advanced regions in terms of quality of labor and capital investment (Krugman 1999).

In the Czech Republic, the take-off of traditional manufacturing locations was strongly associated with the access to natural resources as coal, water resources and ore mines. Many firms located their activities in the neighborhoods of important Czech cities as Ostrava and Brno, inter alia, and this accidental location subsequently prompted a dynamic process of cumulative causation. The initial localized advantages tilted to physical and natural advantages, subsequently unleashing a pervasive process of industrialization, yet operating actually.

The initial process of exploitation of common resources for the production in metallurgic and related industries can be understood by the Marshallian categories of natural shared inputs, as the basis for the subsequent manufacturing development. But gradually, in those very territories, were developed more evolved regional structures, able to underpin productive process with a higher complexity. The clustering of metallurgy, automotive and transport equipment branches in the area of Silesian-Moravia is demonstrative of this phenomenon. Recently based on the promotion of ad-hoc systems of innovation, Prague has received more technological oriented branches (Blažek et al., 2011). Alongside, the growth of other urban activities and technological-intensive branches can explain a recent blossom of specific manufacturing projects in the capital city. The analysis of the Index of Regional Divergence in manufacturing reveals a rather specialized regional manufacturing, with particular regions performing specific roles in the regional division of labor. In such cases the connection of the local production with typical natural resources and endowed productive traditions is more evident. In temporal terms, a static comparison in the Index of Regional Divergence reveals an increase in the degree of regional specialization in the Czech Republic. Some sectors tend to be more spatially distributed because there is a clear link between them and the provision of inputs, particularly in the case of motor vehicles and the metallurgical production. Other plants producing cars and transport equipment respond to a traditional location that persistently reinforced the local advantage for this kind of production.

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