REGIONAL DISTRIBUTION OF THE METALLURGICAL INDUSTRY IN THE CZECH REPUBLIC

The aim of the article is to present the regional distribution of the metallurgical industry in the Czech Republic and to describe the specific factors which determine the localization of the industry in Czech regions. In order to achieve that goal, traditional tools of regional analysis are used, such as concentration analysis, used in business-to-business marketing, which does not describe the absolute size of the industry, but its relative size, focusing on the relation between the employees in the metallurgical industry and the total number of employees in a certain region. The sample consists of all the working ironworks and steelworks, foundries, and rolling mills operating in all the regions in the Czech Republic. Nowadays, the metallurgical industry still plays an important role in the Czech economy; the highest coefficient of its concentration is in the Moravia-Silesia Region.

Key words: metallurgy, industry, distribution, concentration analysis, Czech Republic

INTRODUCTION

Since the Industrial Revolution, the metallurgical industry has held a very stable position in the Czech Republic as a sector of the economy. A significant upswing in the metallurgical industry happened between 1945 and 1989; at that time it belonged among the dominant sectors of the social economy. After 1989, Czech metallurgy faced a recession, large companies were restructured, and many workplaces were shut down. The worldwide crisis on the metallurgical market in 1999 and the financial and economic crisis in 2007 had a particular influence on the industry. Nevertheless, metallurgical companies still have almost 48,000 employees. The leading companies are situated in northeast Moravia, in the districts of Ostrava (ArcelorMittal Ostrava a.s., Vítkovice Heavy Machinery a.s., or Evraz Vítkovice Steel, a.s.) and Frýdek-Místek (Třinecké železárny, a.s.). Apart from these, 134 ironworks and steelworks, foundries, and rolling mills operate in the Czech Republic, making products from cast iron, steel, and non-ferrous metals (specifically aluminium, copper, and brass). The most frequent plant types are foundries producing casts weighing from 0.5 grams to 330 tons.

MATERIAL AND METHODS

This article describes the localization of the metallurgical industry in the Czech Republic with the utilization of concentration analysis methods. The spatial concentration of the industry (the opposite is spatial dispersion) is one of the most typical attributes of the

industry. The easiest way to express the concentration of an industry is according to [1] counts of the density and intensity of the industry. Furthermore, it is possible to use a concentration index, a Lorenz curve expressing the values of the Gini coefficient, and a coefficient of localization. Čadil [2] also presents an index of specialization.

Industry localization may be explained by several theories of localization. The first theory of localization is von Thünen's Theory (in [3]), based on the neoclassical theory of perfect competition. Launhardt (in [4]) is the author of a localization triangle model which takes into consideration the factors of transport availability of materials, transport accessibility of plant, and the place of consumption. Weber (in [5]) and Launhardt share the opinion that the ideal location of a company minimizes costs, and, in addition, provides workforce and agglomerative advantages. Weber is also the author of the term "factor of localization".

Damborský [6] states that in modern theories of localization attention is paid to the behaviour of multinational corporations, which are represented by, for example, ArcelorMittal. The localization of an industry is also affected by foreign trade relations between states.

According to [1], the localization factor presents the advantage of cost savings, which are accessible when we realize economic activity at a certain location compared to another location. We can split localization factors into natural and socioeconomic ones. The factors which influence the metallurgical industry the most are water, natural raw materials, energy sources, transportation, the workforce, and the natural environment. In the past, only certain raw materials, energy sources (black coal), and water were the factors which influenced the establishment of metallurgical plants.

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For their survival and development, businesses have to deal not only with relationships with customers and suppliers in the distributive resource exchange channel, but also with other counterparts in the 'environment' [7]. Business-to-business markets in general are characterized by a higher concentration of demand than consumer markets. However, the degree of demand concentration varies from market to market, and it is important to have certain means of comparing the concentrations of markets to establish just how highly concentrated they are [8]. Geographic concentration (also including localization analysis) can be understood as one of the methods for the analysis of market potential on the business-to-business market for metallurgical plant suppliers, who can plan their business models, distribution policy, and logistics strategy on the basis of such information in order to reduce costs and attract new customers [9]. This is an alternative indicator to sales volume or production volume. The concentration rate can be presented by means of a concentration (Lorenz) curve.

CONCENTRATION ANALYSIS

The data source for the analysis was a collection of companies doing business under the Czech Commercial Code, in particular producing, processing, casting, and rolling metals. There is a total of 134 enterprises. Unfortunately, there is no single comprehensive database containing all of the aforementioned companies, but there are partial databases of steel producers (The Steel Federation, Inc) or foundries. The data about these enterprises served as a basic source and was supplemented with other companies registered in the Czech Commercial Register. From each company's data the number of employees as of 1st January 2016 was derived. The total numbers of employees in regions were obtained from the Czech Statistical Office. If a company deals not only with metallurgical production but also engineering, this may cause issues. It slightly distorts the outcomes of the analysis.

A certain advantage of concentration analysis compared to the normal distribution of industry in absolute counts is operating with the relative ratios between employees in the industry and the total figure for the economically active population.

According to [2], a standardized coefficient of localization and the Gini coefficient are used for spatial concentration analysis. The coefficient of localization represents the rate of concentration of the given activity in the region in relation to a higher unit. It has the formula below, where:

$$K_{ki} = \frac{\dfrac{P_{ip}}{P_{io}}}{\dfrac{P_{jp}}{P_{jo}}} \qquad (1)$$

K_{ki} – coefficient of localization

P_{ip} – number of employees in given industry in region

P_{io} – total number of economically active citizens in region

P_{jp} – number of employees in higher unit

P_{jo} – total number of economically active citizens in higher unit.

If the value of the coefficient is lower than 1, the sector concerned in the region is relatively weaker.

If the coefficient value is higher than 1, it means a higher concentration of the given activity and that the region is almost an exporter within the higher unit.

Thus, the coefficient of localization does not describe the absolute size of the industry in the region, but acts as a relative expression of the total number of employees in relation to the higher unit (state). Therefore, unimportant regions can achieve a coefficient of localization with a high value if they do not have a high population density.

According to [10], before 1989, the metallurgical industry was the third biggest sector in the Czechoslovak national economy, providing 145,000 employees with jobs. The traditional locations were centralized in five important regions: North Moravia (Ostrava, Bohumín, Frýdek-Místek, Karviná, Třinec), South Moravia (Brno, Blansko), Vysočina (Žďár nad Sázavou), Central Bohemia (Kladno, Kutná Hora), and Western Bohemia (Plzeň).

RESULTS AND DISCUSSION

The field part will focus on the regional distribution of the metallurgical industry in the Czech Republic using the coefficient of localization by regions.

Table 1 **Regions according to value of coefficient of localization (1st January 2016)**

Region	Coefficient of localization	Number of employees in metallurgical industry
Moravia-Silesia	4,21	22 140
Vysočina	1,88	4 102
Olomouc	1,16	2 724
South Moravia	0,9	4 584
Karlovy Vary	0,74	904
Zlín	1,64	1,59
Central Bohemia	0,45	2 727
Plzeň	0,61	1 613
South Bohemia	0,73	2 134
Ústí nad Labem	0,41	1 376
Liberec	0,39	744
Pardubice	0,33	771
Hradec Králové	0,15	371
Prague	0,01	58

Author's own elaboration

The Moravia-Silesia region achieved the highest values of the coefficient of localization and it is also much higher than the values of other Czech regions.

The region has a very long tradition of metallurgical production, an abundance of raw materials, especially coking black coal, industrial water, and, in the past, also iron ore, which is the most common material processed in the region.

Other regions which achieved above-average values for the coefficient of localization were Vysočina, Zlín, and Olomouc, despite the fact that there are no important sources of raw materials. In the Vysočina region, iron and steel have been produced since the 15th century in the Žďár nad Sázavou and Havlíčkův Brod districts; the most important producer is the metallurgical and engineering company ŽĎAS. The largest companies in the Zlín region are Česká zbrojovka a.s. and Slovácké strojírny, a.s., but they deal only partly with metallurgical production. In the Olomouc region, there are more enterprises employing above 500 employees. The strongest company is UNEX a.s. In the value of the coefficient of localization it is very close to the South Moravia region, where all the metallurgical plants (especially the foundries that are typical in this region) employ 4,500 employees in total. Other regions reach below-average values of the coefficient of localization, but there are significant differences between districts within regions, e.g. in the South Bohemia region there are two districts with above-average values – Strakonice (4.05) and Tábor (2.18), even though the average value in the region is 0.73. The nine districts listed in Table 2 reached the highest coefficients of localization.

Table 2 **Districts by value of coefficient of localization (1ˢᵗ January 2016); first 9 districts**

District	Coefficient of localization	Number of employees in metallurgical industry
Frýdek-Místek	9,84	8 665
Žďár n/S	7,66	3 858
Ostrava	6,74	9 150
Bruntál	3,07	1 101
Kutná Hora	2,9	912
Prostějov	2,35	1 040
Tábor	2,29	599
Mladá Boleslav	1,92	1 095
Beroun	1,72	683
Rokycany	9,84	8 665

Author's own elaboration

Frýdek-Místek is the region with the highest value for the coefficient of localization (9.84), which is affected by the metallurgically combined company Třinecké železárny a.s., where 5,943 employees were working in 2016. This enterprise is focused on rail, profiles, and building steel production. In the same holding there are also companies such as Sochorová válcovna TŽ, a.s., Slévárny Třinec a.s., and VÚHŽ a.s., which used to be one of the centres of metallurgical research in socialist Czechoslovakia. Another large metallurgical company in the region is ArcelorMittal Frýdek-Místek a.s., a producer of sheet steel. Smaller companies are GILAR SLÉVÁRNA s.r.o., GIFF a.s., and Beskyd s.r.o. Localization was affected by the availability of black coal, particularly in the Karviná region, and a good location on the railway from Ukraine, where extensive sources of iron ore are located.

Žďár nad Sázavou is also one of the important centres of the metallurgical industry, with its long history reaching back to the 15th century, when iron ore was found there and more steelworks and blacksmiths started to operate in the area. The largest company is ŽĎAS, which developed greatly after 1945; in 2016 it had 2,492 employees. ŽĎAS produces various steels and casts which are further machined. Moreover, smaller enterprises operate in the region which deal with the production of cast iron and steel. There are První brněnská strojírna Velká Bíteš, a.s. and Železárny Štěpánov spol. s.r.o. Tokoz a.s. is a non-ferrous metal foundry.

In the past, the traditional centre of the metallurgical industry was Ostrava, which continues to maintain its position nowadays. Twenty-five years ago, its coefficient of localization would have been much higher than today, but since 1989 there has been a massive restructuring of the metallurgical industry, as well as of heavy machinery. More important enterprises are located in the area; the strongest companies are ArcelorMittal Ostrava a.s., with 4,777 employees, focusing on the production of steel and various rolled products, such as profiles, steel crash barriers, sheet steel, or steel mine supports, ArcelorMittal Tubular Products Ostrava a.s., producing pipes and other rolled products. EVRAZ VÍTKOVICE STEEL, a.s., which produces steel and heavy sheet steel, and Vítkovice Heavy Machinery a.s., a producer of steel and gigantic steel casts up to 330 tonnes.

Furthermore, a non-ferrous foundry called Vítkovické slévárny spol. s.r.o. is also situated in Ostrava. The main localization factors were the availability of high-quality black coking coal, enough industrial water, and the location of the city on the railway from Vienna to Kraków. As a consequence of these factors, plants such as Vítkovické železárny were established in Vítkovice in the 19th and 20th centuries and were greatly developed. Other companies are derivatives of this fac-
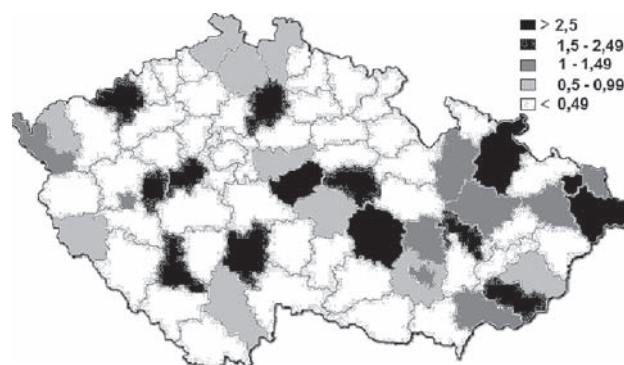

Figure 1 Districts according to the value of their coefficient of localization (1st January 2016); in per cent, author's own elaboration

tory, which significantly affected the development of Ostrava in the last two centuries.

In the Bruntál region, the metallurgical industry is concentrated in two towns, Břidličná, where the largest company in the region, called AL INVEST Břidličná, a.s., operates, producing aluminium and aluminium sheets. The second town, Krnov, is the cradle of two non-ferrous foundries, Uneko spol. s.r.o. and Spojené slévárny Krnov spol. s.r.o.

The dominant enterprise in the Kutná Hora region is ČKD Kutná Hora, a.s., producing iron casts for the petrochemical industry and engineering. Two non-ferrous foundries, Slévárna Losenický and Ljunghall s.r.o., also operate in the area.

CONCLUSION

The metallurgical industry is still one of the most important sectors in the Czech economy, employing 45,000 employees directly and thousands more in supplying companies. The largest representation of the metallurgical industry is in the Moravia-Silesia region. It is possible to identify above-average values of the co-efficient of localization in regions such as Vysočina, Olomouc, and South Moravia. The highest concentration of the industry appears in the districts of Frýdek-Místek, Žďár nad Sázavou, Ostrava, Bruntál, Kutná Hora, Prostějov, Tábor, Mladá Boleslav, Beroun, and Rokycany. The availability of natural resources is an important localization factor, as are metal ores, coal and energies, industrial water, and, last but not least, good railway accessibility. The requirements for university-educated workers are not essential; especially in the smaller plants secondary education is adequate. University-educated employees working as process engineers or plant managers are mostly employed in larger companies. In the Czech Republic, there are no newly established metallurgical plants; on the contrary, several companies have ceased to exist. The reason is the high level of competition among Central and Eastern European companies (in Poland, Ukraine, and Russia), but also China. High entry costs, the high prices of electrical energy in the Czech Republic caused by subsidies for renewable sources of energy, and the prices of emission permits influence the decrease in the numbers of companies in the metallurgical sector.

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