THE SIMILARITY OF COMPETITIVENESS INDICATORS AND THEIR DYNAMIZATION IN SELECTED CENTRAL EUROPEAN COUNTRIES

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Abstract

The level of (inter)national competitiveness is expressed through measurable and non-measurable indicators, using different approaches. For the purpose of this paper, four output measurable indicators have been selected – the openness of the economy, export performance, transformation performance, and relative strength of specialization, namely in four economies (Austria, the Czech Republic, Germany and Poland). The aim of the paper was to find out the similarity between these indicators according to the size of the economies and their dynamization. Based on this, two research questions were defined and were investigated using the cluster analysis method between 1995 and 2017. It was found that the size of the economy did not affect the similarity of competitiveness indicators, but on the other hand, they developed positively in the monitored period.

Keywords

Competitiveness, Dynamization, The Openness of the Economy, Export Performance, Transformation Performance, The Relative Strength of Specialization

I. Introduction

There are many studies that try to capture the phenomenon of competitiveness as widely as possible, but there always some space for new factors that affect it. This points to the dimension of competitiveness, its interdependence, widespread and deep roots, and its constant dynamism. This idea was the main motivation for writing this article, which deals with the dynamization of measurable indicators of competitiveness and their similarity in relation to the size of Central European economies.

The choice of these countries was not random, it was set a priori according to the project's sustainability requirements and it corresponds to a sample of selected countries to meet the aim of the paper. Therefore, both small (the Czech Republic and Austria) and (medium) large economies – Germany and Poland - have been selected to form a relevant group of countries suitable for the given research. For the purpose of this paper, four output measurable indicators have been selected – the openness of the economy, export performance, transformation performance, and relative strength of specialization.

The aim of the paper is to find out the similarity of the indicators of competitiveness and the development of these indicators. Based on this, research questions were defined; the first one investigating whether the economies show similarity in competitiveness indicators according to their size, the second one researching whether there is a positive trend (dynamization) of competitiveness indicators in the selected economies. The above research questions were investigated using the cluster analysis method between 1995 and 2017.

This paper is structured as follows: The second section describes the approaches to the issue of competitiveness using the cluster analysis. The third section explains the usage of indicators of international competitiveness and its methodology; the fourth section discusses the research methodology with the used method. The fifth section summarizes results with the obtained data

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of the comparison of monitored countries and discusses the results of the analysis. In the last section, the obtained facts of this paper are concluded.

II. Literature Review

The definition of national competitiveness is much more problematic than the definition at the company level (Krugman, 1994 or Siggel, 2007). The basic problem is the scope of this concept: Should it be understood as the ability to improve the competitiveness of the domestic business environment and thus the macro-environment and the state of the country in the global economy? Or is it defined by the openness of the economy and its ability to continuously improve its production balance? Could we explain this competitiveness as an innovative effort to increase productivity? It can be stated that the definition of macroeconomic competitiveness gives a positive response to each of the above issues.

Scott and Lodge (1985) argue that national competitiveness is the country's ability to create, produce, distribute, or deliver services in international trade while earning revenues from its resources. Other authors are convinced that a country that can succeed in international trade through high technology and productivity with high income and wages, is competitive (Hastopulos, Krugman and Summers, 1988; Markusen, 1992; Dollar and Wolff, 1993). Reinert (1994) focuses on competitiveness as a reflection of the important features of the world economy. Cooke and Morgan (1998) define national competitiveness as a sub-level economy capacity to attract and sustain businesses with stable or growing market activities while maintaining or improving the living standards of all citizens. Armstrong and Taylor (2000) believe that the country's economic performance and development depend on the relative size and success of the export industry orientation. According to Martin, Kitson and Tayler (2006), competitiveness is a function of dynamic progress, innovation and ability to change and improve. Garelli (2008) defined national competitiveness as an area of economic theory that analyzes the facts and policies that shape the nation's ability to create and maintain an environment that creates greater value for its businesses and creates more prosperity for its citizens. Halásková and Halásková (2015) add that research and development spending in each country is a very important determinant of competitiveness. According to Nečadová (2017), productivity is a key concept for competitiveness (both microeconomic and macroeconomic ones). Kačírková (2017) argues that competitiveness is a continuous process of growth and development, which is long-term and sustainable.

The measurement of competitiveness can be approached in different ways. For purposes of our analysis, the cluster method was used, which has become one of the qualification methods and has had a direct impact on all areas of science in the 20th century. The first comprehensive work focusing on a detailed cluster analysis was created by Tryon (1939). Nowadays, this analysis is widely used by all scientific disciplines, among which the most interesting use is, of course, the economic field.

Peneder (1995) analysed the industrial competitiveness of Austria according to cluster techniques and founded out that there are relationships between market shares and trade specialization, as well as between comparative price advantage and relative export unit values. Kronthaler (2003) used the cluster analysis for comparison of the competitiveness of the east and west part of Germany. He identified ten clusters and found out that the economic capability in the East German regions was still different from the economic capability of the West German regions. MacGillivray et al. (2007) focused on competitiveness of countries and identified four clusters: Starters (eg China) with low-value and often low-quality exports, Compliers (e.g. Poland) with progress on meeting international quality, labour and environmental standards, Asserters (e.g. the Czech Republic) that are actively engaged in developing and promoting of international standards that will provide them with a competitive advantage. The

fourth group are Innovators (e.g. Austria and Germany) with well-designed corporate responsibility strategies, reinforced in most instances by strong NGOs, media watchdogs and consumers demanding responsible new products. Cho, Moon and Kim (2008) categorized a total of 66 countries into nine country groups according to their size and the results of the cluster analysis, (3 groups – small, medium and large, in every 3 levels – strong, intermediary and weak). Önsel (2008) used hierarchical clustering analysis to assign countries to appropriate clusters with 178 criteria. Finally, a new composite index is proposed, using the calculated weights and the results are compared with those of the Global Competitiveness Index of the WEF.

Yunis et al. (2012) used cluster analysis to categorize countries in terms of ICT usage, readiness, and environment and it was found that ICT plays an important role in driving a country's global competitiveness forward. Similarly, Zoroja and Pejic Bach (2016) confirmed that the impact of using ICT for the competitiveness of a country is different for particular groups of countries with regard to the level of economic and social progress. The research showed that the most developed countries of Western, Northern and Central Europe are also among the most competitive countries in the world and they lead in investments and also in the development and the usage of ICT. Kharlamova and Vertelieva (2013) define five clusters of countries according to the level of their relative national competitiveness (with variables as GDP, FDI, export or saldo). The most competitive countries are Switzerland, the Netherlands, Hong Kong and China. Montalbano and Nenci (2014) investigated the trade competitiveness of the new emerging economies – China, India, Brazil and South Africa (CIBS) – with respect to their main global partners. Unlike previous studies, their results do not support the hypothesis of the presence of a competitiveness threat from emerging countries towards the main industrialised economies. Stanickova (2015) defined the main factors of socioeconomic development that determine competitiveness level of EU countries. Gavurova et al. (2017) claimed that the application of cluster analysis confirms its significance in the process of creation of regional policies that are common to several regions, which allows the competitiveness of given regions to increase alongside with a simultaneous increase of the whole country's competitiveness. The research results confirm the significant potential of examining the application aspects of cluster analysis for further development of methodologies intended to measure competitiveness and its benefits for several types of policies.

III. Indicators of competitiveness

In this section, attention will be paid to macroeconomic competitiveness, namely to its measurement, using the hard (measurable) data. As the competitiveness is in its nature a relative concept, the achieved results must be compared with other economies (Balkyté and Tvaronavičiené, 2010; Margan, 2012), so the following indicators will be compared in the context of the selected economies of Central Europe:

- the degree of openness of the economy
- export performance of the economy
- the intensity and structure of specialization through the relative strength specialization
- the added value of the export through the transformation effect.

The data needed to calculate the above indicators was obtained from UNCTAD (2018). Eurostat and OECD database was used for the population (Eurostat, 2019) and GDP variables (OECD, 2018).

The degree of openness of the economy is a basic indicator that characterizes the intensity of foreign trade and points to the degree of linking the national economy to the world economy.

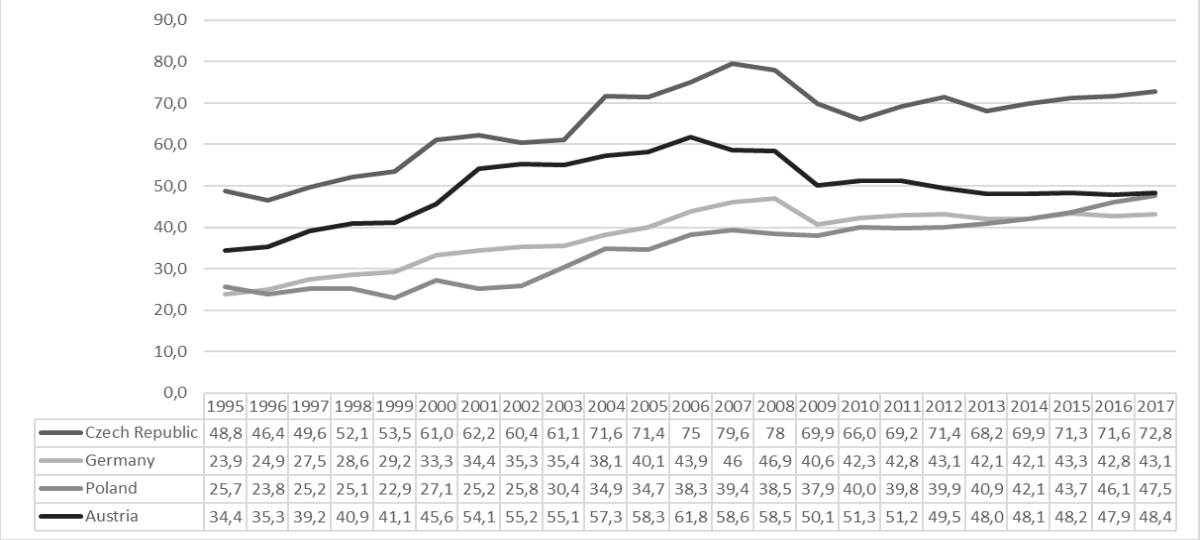
The indicator of the created product, i.e. GDP, which is compared to export, always serves as the basis (Guitierrez, 2006), see the relation (1).

$$OE = \frac{VEX}{GDP} * 100, \quad (1)$$

where OE is the degree of openness of the economy, VEX is the value of the export of goods and services, and GDP is the gross domestic product.

The development of the indicator of openness is shown in Figure 1. Here, it is possible to trace an interesting trend of distancing the Czech economy from other compared economies and the mutual convergence of the economies of Germany, Poland and Austria.

Figure 1 Openness of economy



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Czech Republic	48,8	46,4	49,6	52,1	53,5	61,0	62,2	60,4	61,1	71,6	71,4	75	79,6	78	69,9	66,0	69,2	71,4	68,2	69,9	71,3	71,6	72,8
Germany	23,9	24,9	27,5	28,6	29,2	33,3	34,4	35,3	35,4	38,1	40,1	43,9	46	46,9	40,6	42,3	42,8	43,1	42,1	42,1	43,3	42,8	43,1
Poland	25,7	23,8	25,2	25,1	22,9	27,1	25,2	25,8	30,4	34,9	34,7	38,3	39,4	38,5	37,9	40,0	39,8	39,9	40,9	42,1	43,7	46,1	47,5
Austria	34,4	35,3	39,2	40,9	41,1	45,6	54,1	55,2	55,1	57,3	58,3	61,8	58,6	58,5	50,1	51,3	51,2	49,5	48,0	48,1	48,2	47,9	48,4

Source: authors´ own

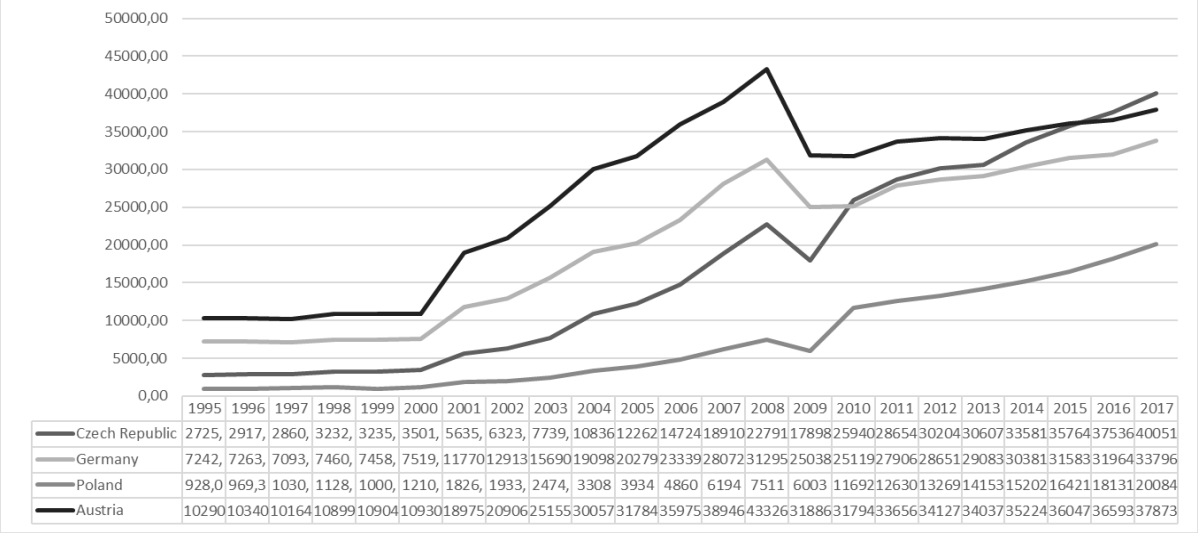
Productivity in foreign trade is a more visible indicator of competitiveness measurement than the degree of openness of the economy. It is expressed through the indicator of export performance of the economy. As Fagerberg (2002) claims, export performance expresses the country's ability to adapt its export structure to changes in world trade patterns. It is measured through various indicators, from the export share on export worldwide (Priede and Pereira, 2015), the balance of trade (Llatja, 2015), to the share of exports on imports (Zhelev and Tzanov, 2012) or the share of exports per capita (Majerová, 2014). For this contribution, export performance will be calculated by the volume of exports per capita, and as it is a productivity indicator, the population is expressed by its productive part, i.e. the economically active population, see relation (2).

$$EP = \frac{VEX}{NPC}\ , \quad (2)$$

where NPC is a number of productive citizens.

In the case of export performance, we can observe a similar trend in the comparison of economies as in the case of openness – three economies converge in the results, one economy is "separated", in this case, it is Poland, as shown in Figure 2.

Figure 2 Export performance



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Czech Republic	2725,	2917,	2860,	3232,	3235,	3501,	5635,	6323,	7739,	10836	12262	14724	18910	22791	17898	25940	28654	30204	30607	33581	35764	37536	40051
Germany	7242,	7263,	7093,	7460,	7458,	7519,	11770	12913	15690	19098	20279	23339	28072	31295	25038	25119	27906	28651	29083	30381	31583	31964	33796
Poland	928,0	969,3	1030,	1128,	1000,	1210,	1826,	1933,	2474,	3308	3934	4860	6194	7511	6003	11692	12630	13269	14153	15202	16421	18131	20084
Austria	10290	10340	10164	10899	10904	10930	18975	20906	25155	30057	31784	35975	38946	43326	31886	31794	33656	34127	34037	35224	36047	36593	37873

Source: authors own

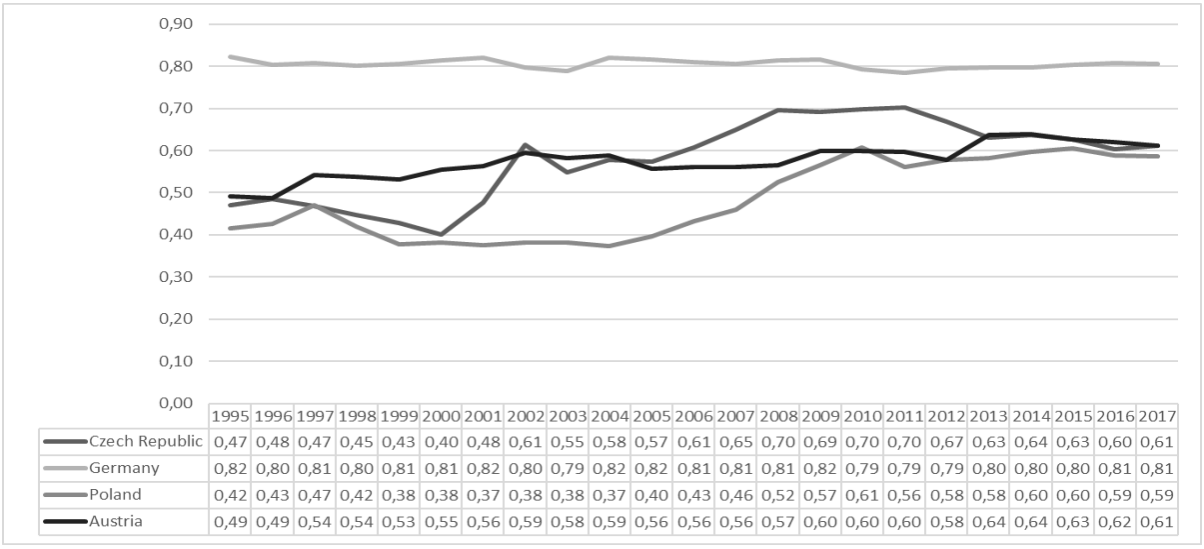
In terms of measurement of international competitiveness, it is not only the amount of export, albeit relatively per capita, but also its structure that is important. In order to be as competitive as possible, the export must include mostly high-tech products, which are compared with normal export production. As Chaudhuri and Ray (1997) argue, technological innovation and dissemination are key factors contributing to national competitiveness. The strength specialisation indicator characterizes the relative advantage or disadvantage in trade for a particular product (or group of products) of the selected economies (Kadeřábková and Žďárek, 2006) and can be expressed by the following relation (3).

$$SS = \frac{\frac{x_{ij}}{\sum x_{ij}}}{\frac{x_i}{\sum_i \sum_j x_{ij}}}, \qquad (3)$$

where SS is an indicator of relative strength specialisation, Xij is the export j-commodity or group of commodities from i-economy, $\Sigma_i X_{ij}$ is the sum of world export j-commodity or group of commodities, X_i is the export of group of commodities of manufacturing industry i-economy and $\Sigma_i \Sigma_j X_{ij}$ is the whole world export of manufacturing industry.

The strength values of the specialization were transferred to the graphic form, see Figure 3, which shows the same trend as in the previous two indicators – one economy is being excluded, the others are getting closer to their values. In this case, it is Germany which shows significantly higher values than other economies.

Figure 3 Strength of specialization



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Czech Republic	0,47	0,48	0,47	0,45	0,43	0,40	0,48	0,61	0,55	0,58	0,57	0,61	0,65	0,70	0,69	0,70	0,70	0,67	0,63	0,64	0,63	0,60	0,61
Germany	0,82	0,80	0,81	0,80	0,81	0,81	0,82	0,80	0,79	0,82	0,82	0,81	0,81	0,81	0,82	0,79	0,79	0,79	0,80	0,80	0,80	0,81	0,81
Poland	0,42	0,43	0,47	0,42	0,38	0,38	0,37	0,38	0,38	0,37	0,40	0,43	0,46	0,52	0,57	0,61	0,56	0,58	0,58	0,60	0,60	0,59	0,59
Austria	0,49	0,49	0,54	0,54	0,53	0,55	0,56	0,59	0,58	0,59	0,56	0,56	0,56	0,57	0,60	0,60	0,60	0,58	0,64	0,64	0,63	0,62	0,61

Source: authors own

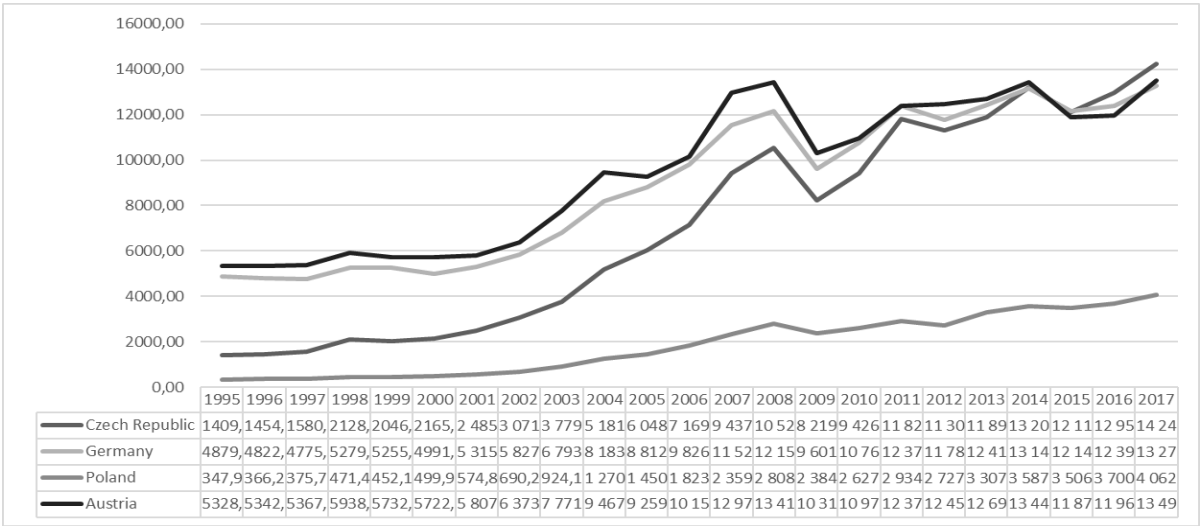
Although the intensity, or productivity, and export structure are important for analyzing the position of the economy in the comparison of economies, it is also good to mention the analysis of its effectiveness. This efficiency is expressed through the indicator of transformation performance, which is expressed by the added value of processing imports and reflects the ability and rate of their appreciation. This indicator is expressed by the difference in exports of manufacturing products and primary production per capita, see (4).

$$TP = \frac{MEX - PIM}{NC}, \tag{4}$$

where TP is the transformation performance of i-economy, MEX is the export of manufacturing industry goods (SITC 5-8), PIM is the import of primary production (SITC 2 a 3) and NC is the number of citizens of i-economy.

As shown in Figure 4, the transformation performance has been the highest in the Czech Republic in the last two years, Germany and Austria being more or less at the same level in close proximity to the Czech Republic, while Poland has the lowest level of added value.

Figure 4 Transformation performance



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Czech Republic	1409,	1454,	1580,	2128,	2046,	2165,	2 485	3 071	3 779	5 181	6 048	7 169	9 437	10 528	9 199	11 426	11 821	11 301	11 893	13 201	12 111	12 951	14 24
Germany	4879,	4822,	4775,	5279,	5255,	4991,	5 315	5 827	6 793	8 183	8 129	8 261	1 521	2 159	601	10 761	12 371	11 781	12 411	13 141	12 141	12 391	13 27
Poland	347,9	366,2	375,7	471,4	452,1	499,9	574,8	690,2	924,1	1 270	1 450	1 823	2 359	2 808	2 384	2 627	2 934	2 727	3 307	3 587	3 506	3 700	4 062
Austria	5328,	5342,	5367,	5938,	5732,	5722,	5 807	6 373	7 719	9 467	9 259	10 15	12 97	13 41	10 310	10 97	12 371	12 451	12 691	13 441	11 871	11 961	13 49

Source: authors own

IV. The methodology of cluster analysis

Cluster analysis is primarily aimed at finding similarities or differences between the objects and provides an empirical tool for explicit object classification (Punj and Stewart, 1983). According to Everitt and Hothorn (2011), cluster analysis is concerned with examining data sets so that they can be meaningfully summarized in terms of a relatively small number of groups or clusters of objects that resemble each other, and which in some respects differ from objects in different clusters.

The main essence of cluster analysis is the classification of individual objects and uncovering their spatial structures. It is about minimizing differences between objects within the same cluster and maximizing these differences between objects of different ones. It is based on two basic approaches – hierarchical and non-hierarchical ones. The first is based on the use of created clusters and these are then used to create other clusters from the rest of the data file. This procedure is repeated until all elements of the data file are part of a cluster. A non-hierarchical cluster approach is based on cluster searches, based on the least difference in diameter. The procedure is advantageous only if the number of clusters is predetermined.

If we want to formulate the principle of cluster analysis mathematically, it is a decomposition of the set S of objects (k) of a certain group of clusters C, see equation (5)

$$S^k = \{C_1, C_2, C_3, \ldots, C_k\}, \tag{5}$$

where $C_i \neq 0$.

In the clustering process, there are seven methods – linkages between the groups, linkages within the groups, nearest neighbour, furthest neighbour, centroid clustering, median clustering and Ward´s method. A method that will be used in this paper is Ward's one. Ward (1963) claimed that grouping in this way facilitates the establishment and understanding of relationships in large files. The principle of the method is not optimization but minimization of heterogeneity and the aim is to find the closest similarity.

Metrics is one of the most common ways of expressing relationships among objects. For Ward's method, the metric of quadratic Euclidean distance d^2 is used, given in the following relation (6).

$$d_e^2(x_i, x_j) = \sum_{k=1}^{n} (x_{ik} - x_{jk})^2, \tag{6}$$

where x_{ik} is the value of k symbol for i observations, x_{jk} is a minimum value of x_{ik} and n is the total numbers of objects.

However, if the selected variables (objects) are listed in different units (coefficients, number of pieces, monetary units, etc.), the data must be first modified to be measurable with each other; it is, therefore, necessary to standardize them. First, the mean value of z_k and the standard deviation of s_k are calculated, see equations (7) and (8) and then standardized by normalizing each object (z-score), see equation (9).

$$\bar{z}_k = \frac{1}{n}\sum_{k=1}^{n} z_{jk}, \tag{7}$$

$$s_k = \left[\frac{1}{n}\sum_{k=1}^{n}\left(z_{jk} - \bar{z}_k\right)^2\right]^{1/2}, \tag{8}$$

$$x_{ik} = \frac{z_{jk} - \bar{z}_k}{s_k}, \quad (9)$$

where z_{jk} is the value of object. The standardized values after this standardization/adjustment have a mean value of 0 and a variance of 1.

III. Results and discussion

Regarding the focus of the research, which in addition to the classification of the competition itself should address the research questions, the clustering method, namely the hierarchical approach by Ward's method, will be used. As mentioned above, this method is not based on optimizing the distance between clusters, but on optimizing the homogeneity of clusters by a certain criterion, which is to minimize the increase in error sums of squared deviations from the clusters centroid points. The advantage of using this method is the tendency to remove small clusters and create clusters of approximately the same size. Since Ward's method leads to minimization of variances within clusters, its choice was thus optimal for the purposes of this paper. As already mentioned, the chosen variables had to be standardized because of their different units (monetary units and coefficients).

All calculations were made using SPSS software; the results of descriptive statistics are presented in Table 1. In total, 92 observations were made on four measurable competitiveness indicators of four selected economies of Central Europe (the Czech Republic, Germany, Poland and Austria) over a period of 23 years (1995-2017). Some of the indicators vary considerably, the largest deviation between the indicators of a given group of countries corresponds to the export performance indicator (EP); the second largest deviation is shown by the transformation performance indicator (TP). These two components are the most heterogeneous ones; the sample is being more homogeneous for the indicators of the strength of specialization (SS) and the degree of openness (OE).

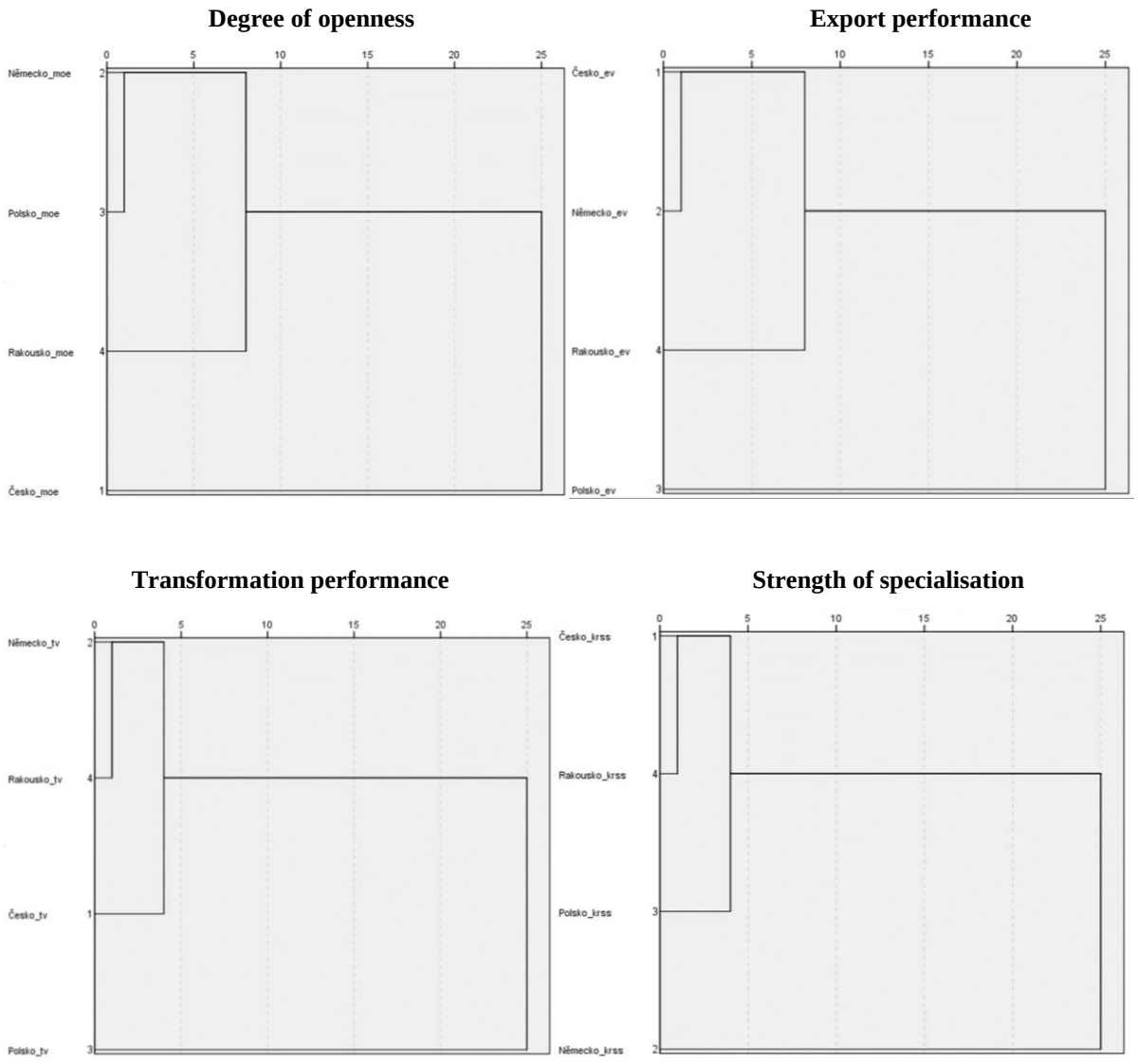
Table 1 Descriptive statistics of competitiveness indicators

	N	Minimum	Maximum	Median	SD	variance
OE	92	22,90	79,60	46,78	14,46	209,07
EP	92	928,05	43326,37	17975,35	12520,77	156769695,80
TP	92	347,97	14242,89	6864,14	4424,14	19573030,62
SS	92	0,37	0,82	0,61	0,14	0,019033

Source: authors´ own in SPSS

To answer the first research question on the similarity of the degree of competitiveness in the individual indicators according to their size, the dendrograms were created (see Figure 5). These dendrograms do not determine the number of clusters but serve as a summary of similarity matrices, where clusters are unified by the shortest distance – measured by Euclidean distance. The first dendrogram shows the similarity of economies in the degree of openness, the second one the export performance, the third dendrogram shows the similarity in transformation performance and the last fourth part of the picture shows the similarity in the relative strength of specialization.

Figure 5 Dendrogram of indicators of competitiveness



Source: authors´ own in SPSS

At first glance, the graphical similarity between the first two and the other two dendrograms can be traced – the distance between the degree of openness and the export performance of individual economies is somewhat greater than that of transformation performance and relative specialization; the similarity of economies is thus smaller. While the similarity of economies in different indicators is different, there is always one common feature – two economies are close, one is more distant, and the fourth economy is always in a remote position. This is, however, all as far as the common features are concerned, and the economies exhibit considerable differences in clustering from the point of view of individual indicators:

1. The degree of openness (OE) is largely influenced by their size – Germany and Poland show considerable proximity, Austria is closer to these economies and the Czech Republic is the furthest and at least similar compared to the other three economies.
2. Export performance (EP) brings two different economies together – Czech and German, the Austrian economy, like in the previous indicator, shows a considerable distance from the first cluster, and Poland being in the last cluster.
3. The efficiency of foreign trade in the form of transformation performance (TP) again draws near two countries completely different in their size – Germany and Austria. The third economy is the Czech Republic, Poland forms the ultimate cluster.

However, the distance between the first and second clusters is much smaller than in the first two cases.

4. The indicator of the export of the most technologically advanced products, i.e. the relative strength of specialization (SS), links the Czech and Austrian economies, the next cluster is Poland and the most different is Germany.

The above-mentioned dendrographic representation does not show which economies achieve better levels of competitiveness in each of the competitiveness indicators, but whether they are similar to measurable competitiveness due to their economic size or not. As can be seen, the similarity of economies in competitiveness indicators is not conditioned by their size.

Although economies do not have a similarity in competitiveness indicators on the basis of their size, is it possible that they will show their positive development, dynamization, in the monitored period of time? Based on the second research question, cluster analysis objects – all monitored competitiveness indicators in the selected economies of Central Europe – were evaluated using metrics created in the SPSS program. The following four clusters were identified according to Ward's method:

- Cluster 1 identifies a group of indicators with very low development potential in terms of international competitiveness.
- Cluster 2 identifies a group of indicators with below-average development potential in terms of international competitiveness.
- Cluster 3 includes a group of indicators with average development potential in terms of international competitiveness.
- Cluster 4 is a group of indicators with above-average development potential in terms of international competitiveness.

The difference between below-average and very low development potential was determined within the range of ≤10 and ≥10 per cent from the average – that is, if the indicators showed a deviation of 10 per cent from the average potential, they were included in cluster 2 (below-average development potential), if the deviation is higher than 10%, countries have already had very low development potential and have been included in the first cluster.

Based on the results, the competitiveness indicators were ranked according to their development potential into four clusters over time, as shown in Table 2. There we can see whether the development process has led to dynamization – better international competitiveness outcomes. The cluster level is listed for each year and indicator, and the individual dynamic phases are separated by lines in the middle of the table. The periods in which the development potential stagnated or eventually moved back are marked in italics and grey.

Table 2 Dynamization of indicators of international competitiveness (1995-2017)

Year	OE	TP	EP	SS
1995	Cluster 1	Cluster 1	Cluster 1	Cluster 1
1996	Cluster 1	Cluster 1	Cluster 1	Cluster 1
1997	Cluster 1	Cluster 1	Cluster 1	Cluster 1
1998	Cluster 1	Cluster 1	Cluster 1	Cluster 1
1999	Cluster 1	Cluster 1	Cluster 1	Cluster 1
2000	Cluster 2	Cluster 1	Cluster 1	Cluster 1
2001	Cluster 2	Cluster 1	Cluster 1	Cluster 1
2002	Cluster 2	Cluster 1	Cluster 1	Cluster 2
2003	Cluster 3	Cluster 2	Cluster 1	Cluster 2
2004	Cluster 3	Cluster 2	Cluster 2	Cluster 2
2005	Cluster 3	Cluster 2	Cluster 2	Cluster 2
2006	Cluster 3	Cluster 3	Cluster 2	Cluster 2
2007	Cluster 3	Cluster 4	Cluster 3	Cluster 2
2008	Cluster 3	Cluster 4	Cluster 3	Cluster 3
2009	Cluster 4	*Cluster 3*	*Cluster 2*	Cluster 3
2010	Cluster 4	*Cluster 3*	Cluster 4	Cluster 3
2011	Cluster 4	Cluster 4	Cluster 4	Cluster 3
2012	Cluster 4	Cluster 4	Cluster 4	Cluster 3
2013	Cluster 4	Cluster 4	Cluster 4	Cluster 4
2014	Cluster 4	Cluster 4	Cluster 4	Cluster 4
2015	Cluster 4	Cluster 4	Cluster 4	Cluster 4
2016	Cluster 4	Cluster 4	Cluster 4	Cluster 4
2017	Cluster 4	Cluster 4	Cluster 4	Cluster 4

Source: authors´ own in SPSS

The fastest dynamization occurred in the case of the degree of openness, when the monitored countries reached the above-average level of competitiveness already in 2009, without moving to a lower level. Similar dynamization, although not so rapid, showed also the relative strength of specialization, which reached the highest level of development potential in 2013. The other two indicators – export performance and transformation performance – were "affected" by economic development in the monitored period, although the process of dynamization was faster than the relative strength of specialization. The export performance was characterized by the lowest dynamization at the beginning of the period – it remained at low development potential (cluster 1) from all monitored indicators for the longest time. This indicator then showed a very short period of increasing potential to below-average levels (cluster 2) and average levels (cluster 3). In 2009, this indicator decreased the degree of dynamization to below-average development potential (expressed by cluster 2), which corresponds to the economic crisis in the monitored economies (except Poland). Since the following year, there has been a sharp improvement in development potential (moving from cluster 2 to cluster 4). In the case of transformation efficiency – the efficiency of foreign trade – there was the fastest potential development – unlike other indicators of competitiveness, this indicator shifted to above-average development potential (cluster 4) as the first one out of the monitored group, already in the pre-crisis years 2007-2008. However, the impact of the crisis was also visible in 2009-2010, there was a fall into the cluster with average development potential (cluster 3). The

shift to the above-average level (in 2011) remained, as with other indicators, until the end of the monitored period.

IV. Conclusion

Competitiveness is a concept which is discussed in almost all human activities. The high level of competitiveness is an objective to be achieved not only on the company level but also at regional, national and international levels. There still remains a question on how to measure this competitiveness. When we take into account the competitiveness at the macro level, there are two approaches – measurable and non-measurable ones. The paper dealt with the analysis of the first-mentioned competitiveness based on the selected measurable output indicators – the degree of openness, export performance, transformation performance and relative strength of specialization. These four indicators were examined in the selected economies of Central Europe (the Czech Republic, Germany, Poland and Austria) between 1995 and 2017.

The aim of the paper was to find out the similarity of the indicators of competitiveness and the development of these indicators. Based on this, research questions were defined – the first one whether the economies show similarity in competitiveness indicators according to their size, the second one whether there is a positive trend (dynamization) of competitiveness indicators in the selected economies. The above research questions were investigated using the method of cluster analysis.

Although the results of cluster analysis (dendrograms) do not show which economies achieve better levels in individual competitiveness indicators, they indicate whether or not they are similar according to their economy size. The received results show that no similarity occurs and thus the answer to the first question is negative. By dividing the competitiveness indicators into four clusters, the result is that, although the export and transformation performance indicator stagnated in 2009-2010, other indicators did not show this tendency. In general, it was possible to dynamize all competitiveness indicators within the monitored period, therefore, the second research question can be confirmed.

The limitations of the results may be based on the use of the types of indicators or a small number of monitored economies. However, this issue can serve as a basis for further research, which can be extended to both the number of indicators and the number of countries. The results can serve as the case study for implication of European cohesion policy as well.

Acknowledgements

This paper was created within the framework of sustainability of the project "Targeted research in the field of small and medium-sized enterprises to achieve a competitive economy", registration number of the project CZ.1.07/2.3.00/20.0016 and is financially supported by the Ministry of Education, Youth and Sports within the Institutional support for the long-term conceptual development of the research organization in 2019.

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