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Multidimensional comparative analysis of the competitive capacity of the European Union countries and geographical regions

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Abstract
Research background: The basic question we ask is whether is it possible to talk in today's globalizing world about the uniform of the competitiveness of the economies? Posing such questions is particularly important in the case of political and economic structures such as the European Union. The competitiveness of the economies is now one of the most frequently discussed topics. In this work, due to the context of the conducted research (international comparisons of the EU countries' economies) the competitiveness of international economies will be considered in terms of international competitive capacity. In addition to the problems associated with defining this concept, there are also important dilemmas concerned with the measurement of the competitiveness. In the performed comparative analyses of European economies the research results presented within reports of „Global Competitiveness Index" will be used.
Purpose of the article: The main purpose of the paper is to conduct a multidimensional comparative analysis of the competitive capacity of the European Union countries and geographical regions of Europe.

Methods: In the paper, to study the spatial differentiation of the EU countries and geographical regions of Europe in the context of their competitive capacity, the taxonomic measure of development based on median vector Weber was used.
Findings & Value added: As a result, the classification and the typological groups of EU countries and geographical regions of Europe calculated on the basis of the features describing their competitive capacity arises. The value added of these research is the analysis of competitive capacity conducted not only for EU countries, but also for geographical regions of Europe. In the paper, the verification of criteria using by World Economic Forum to assess the competitive capacity of EU economies was also conducted. In this area of the research, because of high level of correlation, many features from initial database were deleted.

Introduction

A stable development of the European Union in various socio-economic areas is one of the EU's strategic development goals. This is a difficult task to implement, mainly due to the significant differences in the rate of development of individual member states, internal differences and historical developmental conditions of these countries. The EU economy, in many sources, is referred to as the second world economy (after the USA economy), (Stefanescu & On, 2012, pp. 889–898). The competition from the high-tech economy of the United States, as well as from developing economies in Asia is, however, significant, and the pursuit of increased competitiveness of the European Union economy is included in all strategic EU documents. In recent years, in the face of many changes and crises in the European Union such as 2007–2008 economic crisis, the Great Britain's decision to leave the EU structures (so-called Brexit) or the ongoing migration crisis, analyses addressing the possibility of further EU development are particularly important. One of the most important directions of research in this area is the analysis of the competitive capacity of the economies of individual EU Member States and the uniformity of European Union development in this area.

In the literature (see: Porter, 1988; Krugmann, 1994, 1996; Feinberg, 2000, pp. 155–167; Thompson, 2004, pp. 62–97; Bossak & Bieńkowski, 2004; Pearce, 2006, pp. 39–74; Pearce & Zhang, 2010, pp. 481–498; Castro-Gonzales *et.al*., 2016, pp. 373–386) a lot of attention was paid to analyzing the level of development of the European Union, including e.g.: sustainable development, technological development, innovation, quality of life and many others. These are mainly comparative analyses showing the differences and similarities in the development of individual EU Member States, while in the paper the attention was also paid to geographical regions of Europe.

The main purpose of the study is therefore to conduct a multidimensional comparative analysis of the competitive capacity of the European Union countries' economies and geographical regions of Europe.

The paper is organized as follows: the second paragraph contains a brief review of the literature in the area of competitiveness of national economies; the next part presents the method of the research including: statistical materials with indicators description, which were utilized in the analysis and the description of the applied methods. The next section focuses on study results in the field of competitive capacity of European Union countries and geographical regions of Europe. In the last section, the authors discuss the results of their analysis with other results in this field and finally formulate conclusions.

The international competitiveness of economies — problems of definitions

The pursuit of competitiveness of national economies has been at the top of the priorities of all political forces for years at all latitudes. The very concept of competitiveness of the economy is very popular today, and is often abused. Krugmann (1996) described it even in his work as "dangerous obsession". It must be mentioned that in the past not all authors agreed with the opinion that competitiveness might be considered with regard to national economy. Such doubts were expressed mainly by Porter (1988) and Krugman (1994). According to these authors, competitiveness should not be considered with regard to countries, and this term would be used with regard to enterprises. In the next years that view was slightly verified by Porter in his later works (Porter, 1998).

In view of those concerns, there is nothing surprising in the fact that it is very difficult to define precisely the concept of competitiveness, particularly in the context of international competitiveness of economies.

One of the first definitions of international competitiveness was the notion developed by the Presidential Council on Competitiveness founded by Ronald Regan in 1983, according to which: „competitiveness is the degree to which a nation can, under free and fair market conditions, produce goods and services that meet the test of international markets while simultaneously maintaining or expending the real incomes of its citizens" (OECD, 1992). Similarly, as the references to competitive capacity found in definitions developed by: European Commission, Office Analysis of the New York Stock Exchange and Competitiveness Policy Council.

IMD's World Competitiveness Yearbook defines competitiveness as an (IMD, 2012) „economy which manages the totality of its resources and competencies to increase the prosperity of its population". And according to the World Economic Forum (Schwab, 2012), the competitiveness of national economy may be defined similarly as: „the set of institutions, policies and factors that determine the level of productivity of a country".

Misala (2011) also proposes that the concept of national competitiveness should be explained differently than the concept of national competitive capacity. According to this author, the national competitive capacity which can be defined: „as a power (the capacity) of a given country in the rivalry for the benefits gained from the participation in the international division of work (see: Durand, 1986; Bossak & Bieńkowski, 2004; Misala, 2011) it is the broadest concept.

The literature (see: Bossak, 1984; Durand, 1986; Porter, 1988; Krugman, 1994; Porter *et al*., 2000; Bossak & Bieńkowski, 2004; Misala, 2011) also contains different definition similar to this proposal e.g.:

- international current competitiveness of national economy (Misala, 2011), reflects the present condition and the directions of changes in inherent ability to compete up to now;
- international competitive standing of national economy (Bossak, 1984), refers to owned shares in the widely understood international business.

In this work, due to the context of the conducted analysis (international comparisons), it was decided to consider the competitiveness of the European Union economies in terms of competitive capacity.

Competitive capacity of the economies of individual EU Member States was assessed on the basis of the results of the study entitled „ Global Competitiveness Index" (GCI) published annually by the World Economic Forum (WEF). In the paper, the verification of criteria using by World Economic Forum to assess the competitive capacity of the world economies was conducted. It should be noted that the value added of the research presented in the paper is not only the verification of WEF database and construction of own ranking lists, but also the analysis conducted for geographical regions of Europe. The authors decided to focus their research also on geographical regions of Europe because in the literature (see: Bartłomowicz & Cheba, 2017, pp. 118–126) the region is very often the subject of many different research conducted in context of e.g. innovations, sustainable development or labor market. It is also the first step of selecting the markets in which to invest. So the research concerning this level of aggregation of competitive capacity indicators may be very useful for the EU Member States governments. In the paper, for comparison purposes, the results from

2006 (the first edition of the WEF research) and 2016 (the last edition), were used.

Research methodology

A comparative analyzes of the competitiveness of economies of individual Member States of the European Union are based on the following assumptions:

1. Due to the context of the conducted analysis (international comparisons) the competitiveness of EU economies is considered in terms of competitive capacity defined as a "power (the capacity) of a given country in the rivalry for the benefits gained from the participation in the international division of work" (see: Durand, 1986; Bossak & Bieńkowski, 2004, Misala, 2011).
2. The study was based on the data from 2006 (first published report), (Lopez-Claros, 2006) and 2016 (last edition), (Schwab, 2017) gathered by World Economic Forum and published in the reports: „Global Competitiveness Index".
3. The original data base included 114 diagnostic features describing 12 area of the GCI index. Hellwig's parametric method was used for the purpose of the selection of the representatives of respective sets (see: Nowak, 1990; Balcerzak, 2016, pp. 7–17).
4. In the work, the analysis for geographical regions of Europe was also conducted wherein both the results obtained by individual EU Member States and the results obtained for the geographic regions of Europe were analyzed and considered from the perspective of the EU Member States.

The study was implemented trough five tasks:

1. Building a database on the basis of WEF indicators of competitiveness of the EU Member States economies.
2. A selection of diagnostic features using the Hellwig's parametric method.
3. A construction of the taxonomic measure of development based on median vector Weber.
4. An analysis of spatial uniformity of development of the European Union countries regarding the results of the GCI Index at the EU level.
5. An analysis of spatial uniformity of development of the geographical regions of Europe.

At the beginning of the study a database was set up. In the paper, the indicators presented by World Economic Forum to study the international competitive capacity of national economies were used. The GCI score is calculated based on data covering 12 categories gathered in the so-called pillars of competitiveness, which together describe the competitiveness of the economies. The main data set contained a total of 114 diagnostic features that describe the three considered areas of competitiveness:

1. basic requirements subindex (key for factor-driven economies), which includes area of: institutions, infrastructure, macroeconomic environment and health and primary education. Its weight is the biggest in economies in the first stage of development, so as it is in the case of economies based mainly on the resources of the factors of production.
2. efficiency enhancers sub-index (key for efficiency-driven economies), which includes area of: higher educations and training, goods market efficiency, labor market efficiency, financial market development, technological readiness and market size. Its importance increases with the transition to the second stage in the development of competitiveness to strive to improve production efficiency and its quality.
3. innovations and business sophistications factors subindex (key for innovation-driven economies), which includes area (pillar) of: business sophistication and innovation. It is most important for countries whose development is based mainly on its capacity for innovation.

In the study, the third considered area was analyzed. In the first step, diagnostic characteristics were selected for the study. The selection criteria were divided into two groups: the content related and formal/statistical ones. After defining and gathering data concerning the initial set of features, proper verification actions are usually performed against two most important criteria (see: Pietrzak & Balcerzak, 2016, pp. 120–129; Bąk, 2015, pp. 43–61):

a) variability, to assess the variability, a diversity coefficient, calculated from the formula, is used:

$$V_j = \frac{S_j}{\bar{x}_j} \tag{1}$$

where: $\bar{x}_j$ — arithmetic mean of X_j, S_j value — standard deviation of j^{th} feature, $j = 1, 2, \ldots m$, m — feature count.

b) correlation — two strongly correlated features carry similar information; therefore one of them is redundant.

It turned out that the analyzed indicators are very strongly correlated and it was necessary to eliminate 30 features in the first stage of the Hellwig's parametric method. To select a final set of diagnostic features the formal approach, a parametric method proposed by Hellwig (Nowak, 1990) was used[1]. It is the most commonly used method of diagnostic characteristics selection. However, this method is not perfect: it is sensitive to outliers (or asymmetric distribution of variables), and it takes into account only direct relationships of a given characteristic with other ones, ignoring indirect relationships. Improved resistance of the method to outliers can be achieved by replacing in the first step the sum of elements in a column (or a row) of the correlation coefficient matrix by their median. The second fault can be eliminated by means of the matrix inverse method (Nowak, 1990).

To the final set of features which are characterized by high spatial variability with low correlation within the selected features and asymmetric distribution, 17 diagnostic features were selected:

- x_1 – intellectual property protection (in the scale: 1–7, where 7 is the best),
- x_2 – burden of government regulation (1–7, where 7 is the best),
- x_3 – available airline seat km/week, millions,
- x_4 – fixed telephone lines/ 100 pop.,
- x_5 – mobile telephone subscriptions/100 population,
- x_6 – gross national savings, % GDP,
- x_7 – general government debt., % GDP,
- x_8 – tuberculosis cases/100 000 population,
- x_9 – tertiary education enrollment, gross %,
- x_{10} – quality of math and science education (1–7, where 7 is the best),
- x_{11} – effectiveness of anti-monopoly policy (1–7, where 7 is the best),
- x_{12} – hiring and firing practices (1–7, where 7 is the best),
- x_{13} – flexibility of wage determination (1–7, where 7 is the best),
- x_{14} – FDI and technology transfer (1–7, where 7 is the best),
- x_{15} – exports as a percentage of GDP,
- x_{16} – domestic market size index (1–7, where 7 is the best),
- x_{17} – local supplier quantity (1–7, where 7 is the best).

The set of diagnostic characteristics chosen for the description of the compared objects can contain the features whose influence on the phenomenon under study has different direction, i.e. stimulants and destimulants.

[1] The classification criterion is the parameter r^* also called a critical value of the correlation coefficient so that $0<r^*<1$. The value of r^* can be chosen at the researcher's discretion or determined in a formal way. In the paper it was assumed: $r = 0.5$.

The classification of diagnostic characteristics selected for the study into stimulants and destimulants[2] is shown in Table 1.

The stimulants are numbers whose bigger values indicate a higher level of progress of a given phenomenon, while the destimulants are diagnostic characteristics whose smaller values signify a higher level of development[3] (Bąk, 2014, pp. 134–145).

In the next step, in order to study the spatial differentiation of the EU countries' economies in the context of their competitive capacity, the taxonomic measure of development based on median vector Weber (1971) was used.

The Weber median is a multi-dimensional generalization of the classical notion of the median. It is about vector that minimizes the sum of Euclidean distance (Euclidean distance) of the data points representing the considered objects, and therefore is somehow "in the middle" of them, but it is also immune to the presence of outliers (Weber, 1971). The positional option of the linear object assignment takes a different normalization formula, in comparison with the classical approach, based on a quotient of the feature value deviation from the proper coordinate of the Weber median and a weighed absolute median deviation, using the Weber median (Młodak, 2014, pp. 895–929):

$$z_{ij} = \frac{x_{ij} - \theta_{0j}}{1{,}4826 \cdot m\tilde{a}d(X_j)} \tag{2}$$

where: $\theta_0 = (\theta_{01}, \theta_{02}, ..., \theta_{0m})$ is the Weber median, $\tilde{\mathrm{mad}}(\mathrm{X_j})$ is the absolute median deviation, in which the distance from the features to the Weber vector is measured[4], i.e.: $\tilde{\mathrm{mad}}(\mathrm{X_j}) = \underset{\mathrm{i=1,2,...,n}}{\mathrm{med}} \left|\mathrm{x_{ij}} - \theta_{0\mathrm{j}}\right|$ $(j = 1,2,...,m)$. The synthetic measure μ_i is calculated on the basis of maximum values of normalized features, similarly to the Hellwig (1968, pp. 307–327) method:

$$\varphi_j = \max_{i=1,2,...,n} z_{ij}, \tag{3}$$

[2] To transforming destimulants into stimulants the following formula was used: $x'_{ij} = \frac{1}{x_{ij}}, i = 1, 2, \ldots, n, j = 1, 2, \ldots, n.$

[3] Sometimes the category of *nominants* is used. In their case the most favourable situation is when they reach a fixed value or number interval.

[4] The Weber median was calculated in *R program: l1median* of package: *pcaPP*.

according to the following formula: $\mu_i = 1 - \frac{d_i}{d_-}$

where: d_- = med(**d**)+2.5mad(**d**), where **d** = (d_1, d_2,…,d_n) is a distance vector calculated using the formula: $d_i = \underset{j=1,2,...,m}{\text{med}} \left| z_{ij} - \varphi_j \right| \quad i = 1,2,...,n$, φ_j — the *i*-th coordinate of the development pattern vector, which is constituted of the maximum values of the normalized features. The assignment of objects with a positioning measure is the basis for a division of objects into four classes. The most commonly used grouping method in the positioning scope is called the *three medians method*. It involves indicating a median of vector coordinates $\mu = (\mu_1, \mu_2, ..., \mu_n)$, which is denoted $med(\mu)$, then dividing the population of objects into two groups Ω_k: those, for which the measure values exceed the median (are higher than it — Ω_1) and those, for which the measure values do not exceed the median (are equal or lower than it — Ω_2). Next the indirect medians are defined as: $\text{med}_k(\mu) = \underset{i:\Gamma_i \in \Omega_k}{\text{med}}(\mu_i)$, where $k = 1,2$. This way the following groups of objects are created[5]:

- Group I: $\mu_i > \text{med}_1(\mu)$,
- Group II: $\text{med}(\mu) < \mu_i \leq \text{med}_1(\mu)$,
- Group III: $\text{med}_2(\mu) < \mu_i \leq \text{med}(\mu)$,
- Group IV: $\mu_i \leq \text{med}_2(\mu)$.

The first (the best) and the second group comprise objects for which results at level higher than the group's median. Thus, these are objects demonstrating a higher development level than object classified as group three and four (the worst).

Results

Table 2 shows the results of the classification of the EU countries obtained by taxonomic measure of development based on median vector Weber. In this table, the results obtained by the individual EU Member States located in the geographic regions of Europe are also analyzed. The division of Europe into geographic regions is commonly used to assess the level of devel-

[5] Equinumerous groups are formed when the number of objects in the community is divisible by four.

opment in the various areas of the European Union. A region is, for example, the first direction in choosing a location for foreign investment (Dunning, 2010, pp. 148–188). Geographical regions are also described in the context of e.g. the resilience to a crisis (Glonti *et al*., 2015), economic development (Porter, 2000, pp. 15–34) and many others. The results presented in this table refer to 2 analyzed periods: 2006 and 2016 in the following structure:

- Western Europe (Austria, Belgium, France, Germany, Luxembourg, the Netherlands),
- Northern Europe (Denmark, Estonia, Finland, Ireland, Latvia, Lithuania, Sweden, the United Kingdom),
- Southern Europe (Cyprus, Croatia, Greece, Italy, Malta, Portugal, Slovenia, Spain),
- Eastern Europe (Bulgaria, the Czech Republic, Poland, Romania, Slovakia, Hungary).

It is clear that the positions of individual countries in the obtained rankings were usually different, with only one exception of Romania (26^{th} position in the rank). Thirteen EU countries improved their situation in 2016 in comparison to 2006 (the United Kingdom, Malta, Sweden, the Netherlands, the Czech Republic, Germany, Portugal, Belgium, Slovenia, Lithuania, Greece, Croatia and Bulgaria). The greatest leaps were observed in the case of Malta which was on the 24 position in the 2006 ranking and then in 2016 jumped 21 positions higher to the 3^{rd} positions. This country improved its results almost in all analyzed areas, especially the improvement of the results calculated on the basis of the following indicators was observed: x_3 — available airline seat (km/ week, millions) — 36.58 in 2006 and 82.09 in 2016, x_5 — mobile telephone subscriptions/ 100 population — 76.52 in 2006 and 126.98 in 2016, x_9 — tertiary education enrollment, (gross %) — 26% in 2006 and 41.21% in 2016, x_{15} — exports as a percentage of GDP — 76.5% in 2006 and 139.04% in 2016.

The situation in the field of competitive capacity in 2016 compared to 2006 deteriorated in the case of 14 EU countries — the most affected were Italy (down from the 13^{th} to the 28^{th} position), Spain (the fall from the 6^{th} to the 19^{th} position) and the Slovak Republic (down from 10^{th} to the 18^{th} position). Both rankings are characterized by low positions occupied by both Southern and Eastern European countries. In both rankings in the last two groups, which include countries with the lowest scores, almost all countries from these geographical regions of Europe are classified. In Southern Europe the most unfavorable changes are in Italy and Spain. Similar changes are also described in the papers presenting the situation of the European Union countries in areas such as sustainable development (Szopik-

Depczyńska *et al*., 2017, pp. 481–491), investment attractiveness (Cheba, 2015, pp. 73–88) and socioeconomic development in general.

On the other hand, in the case of Eastern European countries, despite the traditionally low position occupied by such countries as Romania or Bulgaria, attention should be paid to the significant improvement in the position occupied by the Czech Republic, which for several years has been perceived by investors as an attractive location for investment. Among the countries of Eastern Europe, it is the Czech Republic that was the best in 2016 ranking.

The countries located in Northern and Western Europe were primarily classified into the first two groups. The first place in 2016 was the United Kingdom, which in 2006 was also classified in the first group, but only in position 5. Despite the events of last year and the decision to leave the European Union by this country, the United Kingdom was ranked first in the 2016 ranking. Comparing the results of both rankings, one should also pay attention to the wider range of taxonomic measure results achieved in 2016, which should be interpreted as a greater variation in the countries studied during that period.

Because the standing of individual EU countries in the years of study is not the same (in some cases the movements in the ranking are considerable), Kendall's tau coefficients were determined in order to assess the conformity of ordering the objects under study (Table 3). Kendall's tau coefficients adopt values from the interval [–1, 1]. The closer their value is to 1, the greater the conformity of ordering (Mandal & Mukhophyay, 2017, pp. 55–75). The obtained value of the coefficients confirm that the position taken by EU countries is not the same, and there are differences between these position in the ranking from 2006 and 2016. The results are confirmed by previous observations on major changes in some countries' positions in the rankings.

Sometimes, even one diagnostic feature was decisive for belonging to a particular group, the level of which clearly distinguished countries themselves. Due to this, it was decided to determine the measures ω_j that can be interpreted as the scales defining the relative importance of individual diagnostic features[6]. These measures were calculated according to the formula (Nowak, 1990, pp. 34–35):

[6] The higher the value of the measure, the greater the importance of the *j*-th diagnostic feature.

$$\omega_j = \frac{V_j}{\sum_{j=1}^{m} V_j} \cdot 100\ \% \tag{4}$$

where: V_j — classic coefficient of variation calculated for the *j*-th diagnostic feature.

It turned out that in the study of the competitive capacity of EU countries based on data from the two analyzed period (2006 and 2016) the most important are: x_3 — available airline seat (24.99%) and x_8 — tuberculosis cases/ 100 000 population (18.11%). These two diagnostic features were characterized by the highest variability in the set of attributes accepted for testing, their share exceeded 43% of the total value of the sum of variability coefficients and therefore they significantly influenced the classification of objects (EU Member States).

At the next step of the research, the results of the analysis presented in the paper with the WEF results were compared. The ranking lists elaborated on the basis of this two different proposal in the next table (Table 4) were presented[7].

The results presented in Table 4 confirm the differences in the rankings elaborated on the basis of diagnostic features selected to the study according the Hellwig's method and the results proposed by WEF. The differences are significant e.g. on the first place in the ranking list elaborated in 2006 on the basis of diagnostic features proposed to assess the competitive capacity by authors, Luxemburg located in Western Europe is classified. While in the WEF ranking this country takes only 11th rank. The positions of other countries located in this geographical region of Europe classified according WEF ranking are worse than in the ranking proposed by the authors. The same situation for the results from 2016 is observed.

On the other hand, completely different situation in case of countries located in Western Europe is noticed. Every countries located in this region of Europe improved their position in 2006 in comparison to WEF ranking list. In the case of results from 2016, the improvement of the positions only for 3 out of 6 countries located in this region is observed. The following countries were classified on the same positions in these two rankings:

- in 2006: Denmark (2end position), Finland (3), Latvia (21), Malta (24), Poland (19) and Bulgaria (28);
- in 2016: Denmark (6) and Ireland (11).

[7] The results of WEF ranking was calculated on the basis of results of EU countries from this ranking.

Conclusions

The results published annually by the World Economic Forum were used to examine the competitive capacity of the economies of the European Union. The original database contained 114 variables describing different areas of competitiveness, or rather the competitive capacity of the world economy.

It should be noted that the assumptions adopted for the construction of this ranking, whereby a significant proportion of the variables is determined on the basis of the subjective opinions of companies' representatives causes that these features are strongly correlated. As a result, a significant part of them has to be eliminated during the statistical methods of selection of features. In the paper the Hellwig's parametric method was used for this purpose. As a result of application of this method, finally, 17 features describing different areas of competitiveness (competitive capacity) of economies of European Union countries were selected for the study. This way of construction of ranking can be considered as a complement to the proposal used by WEF. The selection of diagnostic features can be realized within all features collected for this purpose or can be focused in particular groups (pillars) of Global Competitiveness Index. In this case, the selection within 12 pillars of this index has to be considered.

The results obtained confirm the observations of other authors (see: Nic & Świeboda, 2014; Lopez, 2005, pp. 623–648). Most of them indicate that the division of Europe into a more developed West and less developed East, or a division into so called "old" and "new" EU Member States are not supported by the WEF rankings proposed by WEF. It is confirmed by the significant reduction (compared to 2006 and 2016) of a position occupied by countries such as Spain or Italy, and the improvement of a position occupied by some Eastern European countries such as the Czech Republic.

The results of the analyses presented in this paper are particularly important in the light of recent developments in the European Union, which face a number of crises and in the context of the proposed changes and divisions of the European Union into so called Europe of two speeds.

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Annex

Table 1. Division of diagnostic features into stimulants and destimulants

Stimulants	Destimulants
x_1, x_2, x_3, x_4, x_5, x_6, x_9, x_{10}, x_{11}, x_{12}, x_{13}, x_{14}, x_{15}, x_{16}, x_{17}	x_7, x_8

Source: own elaboration on WEF data.

Table 2. The EU countries located in geographical in Europe sorted by their competitive capacity in: 2006 and 2016

Geographical region	2006		2016	
	Value of synthetic measure (μ_i)	Rank/ group	Value of synthetic measure (μ_i)	Rank/ group
Western Europe				
Austria	0.365	16/ III	0.297	20/ III
Belgium	0.375	14/ II	0.372	13/ II
France	0.377	12/ II	0.333	15/ III
Germany	0.309	17/ III	0.422	8/ II
Luxembourg	0.680	1/ I	0.529	2/ I
Netherlands	0.432	9/ II	0.466	5/ I
Northern Europe				
Denmark	0.626	2/ I	0.448	6/ I
Estonia	0.505	7/ I	0.417	9/ II
Finland	0.568	3/ I	0.408	10/ II
Ireland	0.556	4/ I	0.378	11/ II
Latvia	0.256	21/ III	0.082	27/ IV
Lithuania	0.186	25/ IV	0.305	17/ III
Sweden	0.440	8/ II	0.492	4/ I
United Kingdom	0.552	5/ I	0.789	1/ I
Southern Europe				
Cyprus	0.239	22/ IV	0.250	23/ IV
Croatia	0.124	27/ IV	0.204	24/ IV
Greece	0.233	23/ IV	0.271	21/ IV
Italy	0.376	13/ II	0.080	28/ IV
Malta	0.228	24/ IV	0.523	3/ I
Portugal	0.305	18/ III	0.374	12/ II
Slovenia	0.291	20/ III	0.333	14/ II
Spain	0.542	6/ I	0.301	19/ III
Eastern Europe				
Czech Republic	0.387	11/ II	0.426	7/ I
Bulgaria	0.103	28/ IV	0.156	25/ IV
Hungary	0.371	15/ III	0.307	16/ III
Poland	0.293	19/ III	0.261	22/ IV
Romania	0.158	26/ IV	0.140	26/ IV
Slovak Republic	0.404	10/ II	0.302	18/ III

Source: own calculations based on WEF data.

Table 3. Kendall's τ coefficients calculated for the ranks of voivodships according to taxonomic measures of development

Year	2006	2016
2006	1.0000	**0.4603**
2016	**0.4603**	1.0000

Table 4. The EU countries located in geographical regions of Europe sorted by their competitive capacity in: 2006 and 2016 according the authors proposition and WEF ranking list

Geographical region	2006		2016	
	authors ranking	WEF ranking	authors ranking	WEF ranking
Western Europe				
Austria	16	8	20	10
Belgium	14	10	13	7
France	12	7	15	9
Germany	17	4	8	1
Luxembourg	1	11	2	8
Netherlands	9	6	5	2
Northern Europe				
Denmark	2	2	6	6
Estonia	7	12	9	12
Finland	3	3	10	3
Ireland	4	9	11	11
Latvia	21	21	27	18
Lithuania	25	18	17	15
Sweden	8	5	4	4
United ingdom	5	1	1	5
Southern Europe				
Cyprus	22	23	23	25
Croatia	27	25	24	27
Greece	23	26	21	28
Italy	13	22	28	17
Malta	24	24	3	20
Portugal	18	20	12	16
Slovenia	20	15	14	23
Spain	6	13	19	14
Eastern Europe				
Czech Republic	11	14	7	13
Bulgaria	28	28	25	22
Hungary	15	17	16	24
Poland	19	19	22	19
Romania	26	27	26	21
Slovak epublic	10	16	18	26

Source: own calculations based on WEF data.