

PRODUCTIVE AND EXPORT POTENTIAL OF THE EU COUNTRIES: CLUSTERS' ANALYZE

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International trade, as a major factor of openness, has an increasingly significant contribution to economic growth and thus for competitiveness. The aim of paper is to analyze level of productive potential achieved by the EU Member States. The results confirm the heterogeneity that exists among the EU Member States as well as in the trade area. While the calculations show that productivity growth of foreign trade was significant in the case of the entire EU, but the significance of productivity in foreign trade was not the same in the case of individual countries.

Keywords: competitiveness, economic openness, European Union, revealed comparative advantage, trade balance, trade concentration, trade diversification

Introduction

In this paper, external competitiveness is considered as a synonym of the trade competitiveness or export competitiveness of a country.

The research in this area was focused on the pursuance of the external competitiveness of the whole EU or selected EU countries from the aspect of export growth, diversification and sophistication until now. Cheptea, Fontagné and Zignago (2012) recorded the changes in the market share of the EU27 and selected non-EU member states that occurred in 1995–2009 under the influence of structural changes and the efficiency effect. Cheptea et al.

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(2013) explored the external competitiveness of the EU27 from the point of view of goods as well as commercial services in 2002–2010.

Besides the traditional decomposition of the export efficiency in the area of merchandise trade, they analysed the exports of the EU27 and other countries from the point of view of the technological level and the specialisation of export with respect to the current fragmentation of the production process.

Priede and Pereira (2015) stated that the EU competitiveness and export efficiency was negatively influenced by the political situation in the world, which was connected with the adoption of economic sanctions against Russia.

Orszagova, Savelin and Schudel (2013) focused their attention on the analysis of the external competitiveness of the candidate states of the EU, such as Montenegro, Iceland, Croatia, the Former Republic of Macedonia, Serbia and Turkey. They found out, among other things, that most candidate states increased their exports from the point of view of the number of trade partners and products and that all candidate states recorded a growth of export to the EU. In addition, the intra-industry trade with the EU member states became more important for countries with a bigger economy.

While the present research of trade or the export competitiveness of the EU was focused on the decomposition of export growth from the aspect of an intensive and extensive margin, our methodological approach is based on the evaluation of the trade competitiveness of the EU member states via the measurements of national productivity. It results from the presumption that productivity is generally considered to be one of the most important sources of competitiveness. We especially explore factors that contributed to the growth of productivity and in this way also to the trade competitiveness of the individual countries.

Unlike the previous studies, this paper explores especially the export competitiveness of the EU individual member states that includes data about the total EU trade, i.e. intra-EU as well as extra-EU trade.

Theoretical Background and Literature review

According to the Organisation for Economic Co-operation and Development (2014), competitiveness in international trade is a measure of a country's advantage or disadvantage in selling its products in international markets. Reis & Farole (2012) emphasise that it is not enough to be productive in the static form, but it is necessary to adapt to the structural changes. To remain competitive and adapted to changes, according to Reis & Farole (2012), means to carry the redistribution of resources (capital, labour, institutions) into activities that bring a higher value added. External competitiveness is often explored in literature from the point of view of export efficiency or export growth.

Orszagova, Savelin & Schudel (2013) state that successful export efficiency is a long-term attribute of the country competitiveness. These authors evaluate export efficiency according to the export gains achieved from the market share. Besides price and production

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costs, they also consider the external competitiveness of the candidate states of the EU from the point of view of productivity, institutional framework and the structure of exports.

The individual countries achieve export growth, according to many authors, via intensive or extensive growth (Felbermayr & Kohler, 2004; Besedes & Prusa, 2007, and Eaton et al., 2007). Farole et al. (2010) described the intensive growth of export as a situation in which a higher amount of the same product is sold to the same markets. This deepening of the present trade relations is accompanied by growing specialisation and the development of intra-industry trade. Contrary to this, the extensive growth of export is accompanied by new trade flows, which are connected with new products or new destinations. Besedes & Prusa (2007) describe three possible versions of extensive growth in which: (1) the same product is sold to new markets or (2) a new product is sold to the present markets or (3) a combination of both cases occurs, i.e. a new product is exported to new markets. These different concepts of the extensive growth of export are often the reason for different claims about the level and the form of export growth.

Conclusions about whether the intensive form of export growth has a higher importance than the extensive form of export growth vary in literature and can also be influenced by the methodology with which the trade analysis is carried out (the static & dynamic approach). However, some results of analyses show the fact that the predominant part of export is based on the intensive form of growth. Cheptea, Fontagné & Zignago (2012) found out that the exports of new products or former unexploited markets took a significant share in the total number of trade flows in 1995 and 2009, but in the value terms they contributed to the growth of world trade only by 17 % at the same time. Eaton et al. (2007) also explored the possibilities of the entrance of companies to the export markets on the case of the merchandise exports of Columbia, and the authors of this study found out that a small number of big and steady export companies have the highest share in the total export incomes of a country, although new exporters shared in the total export expansion by almost a half. Reis & Farole (2012) carried out a decomposition of export growth in three parts, i.e. in addition to intensive and extensive growth, they introduced the term of sustainable growth that is also inherently connected with the qualitative growth of export.

From this decomposition of export growth it is possible to deduce the main factors by which export growth is determined. It is the level, growth and market share of the current exports (intensive growth), the diversification of products and markets (extensive growth); the quality and the sophistication of exports (qualitative growth) and the entrance into the market and sustainable trade (sustainable growth). Farole et al. (2010) see the forces that contributed to the qualitative growth and productivity in human capital, innovations and the spreading of knowledge.

The decomposition of export growth into intensive, extensive, sophisticated and sustainable growth enables us to evaluate the competitive advantages of the exporting country, i.e. to identify the internal factors of the growth of the export efficiency of a country. Contrary to this, Ahmadi-Esfahani (2006) explored via the Constant Market Shares Analysis

(CMSA) whether the growth of the export efficiency of a country is not caused by the fact that export is focused on the growing dynamic markets or that it is carried out in such a commodity structure in which the demand in a given market has significantly increased. However, according to some authors, getting a share in markets in which exporters are already anchored is considered to be a bigger success than the participation in the growth of markets that are able to import more thanks to the growth of income (Rojí ek, 2010).

A complex view of export growth enables the authors of the economic policy concepts to uncover the revealed comparative advantages that countries achieve in their exports of goods and services and to determine the precise diagnosis of external competitiveness. As Slaný states, for the correct understanding of competitiveness it is important to know its sources (Slaný, 2006, p. 11) that are denoted as competitive advantages.

Background of Empirical Analysis

Based on current knowledge is determined the main hypothesis of empirical analysis: area with higher level of productivity has better prerequisites for achieving trade competitiveness. This means that it has a significant competitive advantage over other territories, resp. it is able to more effectively utilize these advantages in foreign trade. The issues of competitiveness and performance are significantly connected with economic globalization that transcends national boundaries, with the aim of achieving efficiency through optimal allocation of resources internationally. Economic growth and exploitation differences in competitiveness are the tools to achieve this goal.

In terms of territory, the analysis is focused on the 28 EU Member States. The reference period consists of years of 2000-2015. The reference period covers the period of growth dynamics and the EU enlargements, including also the period of economic decline, a milestone reflected the effects of economic crisis and the subsequent stagnation. In DEA analysis annual changes of productivity within the reference period are examined. Data sources are the Eurostat, the World Bank and the OECD. Database is compiled of 20 indicators (see Tab. 1), 10 of which corresponds to the character of inputs and 10 outputs corresponds to the character of outputs. Indicators of inputs and outputs are separately used in FA. Indicators are available at national level for all EU Member States in the reference period 2000-2015.

With respect to the fact that the weights of various indicators would be incommensurate, it was necessary to proceed the standardization during data pre-processing, therefore, to unify their standards. In this chapter most commonly used method of standardization – data transformation into a Zscore is used. In a subsequent step, the matrices of inputs and outputs for the reference period 2000-2015 in a standardized form were verified to criteria suitability for FA. FA is meaningful if original variables are correlated with each other.

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Table 1 - Indicators of inputs and outputs
(authors elaboration, 2017)

Inputs		Outputs	
Revealed Comparative Advantage	RCA	Exports of Goods of the EU in World Exports of Goods	ExG-Share
Index of export Diversification	IED	Pace of Growth in Exports of Goods	ExG-Growth
Index of Import Diversification	IID	Normalized Trade Balance	NTB
Index of Export Concentration	IEC	Exports of Goods to GDP	ExG-GDP
Index of Import Concentration	IIC	Exports of Services to GDP	ExS-GDP
Trade in ICT – Imports	ICTI	Pace of Growth in Exports of Services	ExS-Growth
Trade in ICT – Exports	ICTE	Pace of Growth in Exports of Goods and Services	ExGS-Growth
Harmonized Index of Consumer Prices	HICP	Exports of Services of the EU in World Exports of Services	ExS-Share
Labour Costs	LC	Balance of Services	BS
Real Effective Exchange Rate	REER	Labour Productivity	LP

Based on the used method of data standardization, Pearson correlation coefficient was elected as the degree of correlation Pearson correlation coefficient. As the ideal is considered a state when degree of correlation indicator does not drop below 0.3 and exceed 0.9 (Field, 2005). FA is conclusive only if the set of parameters for the inputs and outputs is tied sufficiently strong mutual correlations. To assess their level, Kaiser-Myer-Olkin (KMO) criterion is often used and measures the suitability of items for FA, as confirmed also territorial analysis (Melecký, 2015). KMO values are in the range from 0 to 1, in the case of indicators whose KMO value is significantly lower than 0.5 are generally regarded as inappropriate, and their inclusion in the final selection is generally not recommended. Values between 0.5 and 0.7 are considered as acceptable, values from 0.7 to 0.9 are considered as very good and values above 0.9 as excellent. The absolute majority of indicators move above the threshold of 0.8, only four variables (ExG-Growth, ExG-GDP, ExS-GDP, BS) reach KMO values less than 0.5. Given the fact that these variables occurred just under the threshold, they are included in the FA. Besides the values for each variable, KMO can be calculated for the dataset as a whole. In this case, KMO value reaches satisfactory 0.653 for inputs and 0.591 for outputs.

This means that although not all correlations reach required level of tightness, databases for inputs and outputs are suitable for FA. This is confirmed by the Bartlett's test of sphericity, the null hypothesis states that the various variables file depend on each other. Due to the resulting level of significance test, which is much lower than the limit value (0.05), this hypothesis may be dismissed and data declared as usable.

Correlation matrix, anti-image matrix, KMO measure and Bartlett's test of sphericity indicate that among variables are some relationships and FA could be a useful tool for their discovery. The next step in the analysis is to determine the number of factors. To determine the number of factors has been used a Principal Component Analysis (PCA), which is most commonly used in similar analyses. PCA consists in the fact that "main component" are

searched, and the number of factors (k) is determined based on the criterion of eigenvalue, the criterion percentage of variance and the criterion Cattell index, i.e. graph of eigenvalues (Meloun & Militký, 2006).

Table 2 - Case of Input and Output Factors – Rotated Component Matrix
(authors calculation, 2017)

Indicators of Inputs	Factors of Inputs			Indicators of Outputs	Factors of Outputs				
	1	2	3		1	2	3	4	5
Zscore (RCA)		-.567		Zscore (ExG-Share)	.898				
Zscore (IDE)	.767	-.425		Zscore (ExG-Growth)		.908			
Zscore (IDI)	.829			Zscore (NTB)			.807		
Zscore (ICE)	.924			Zscore (ExG-GDP)			.901		
Zscore (ICI)	.777			Zscore (ExS-GDP)					.866
Zscore (ICTE)		.863		Zscore (ExS-Growth)		.910			
Zscore (ICTI)		.863		Zscore (ExGS-Growth)	-.460			.526	-.411
Zscore (HICP)			.922	Zscore (ExS-Share)	.938				
Zscore (LC)			.881	Zscore (BS)				.579	
Zscore (REER)		-.414		Zscore (LP)				.783	

In terms of factors for inputs and outputs generated by PCA, within the results is evident that the fulfilment of the first and second criterion is (in the case of inputs) for $k = 3$. Three factors of inputs thus explain 71.673 % of total variability in reference period. For outputs, it was clear that the fulfilment of the first and second criterion is valid for $k = 5$. Five factors of outputs thus explain 79.541 % of total variability in reference period. Factors of inputs and outputs are further discussed in following part of the chapter. The following step was the establishment of factors and determination the factor loadings. By the application of PCA and the rotation method of normalized Varimax was provided an estimate, i.e. factorial matrix (also called matrix load factor). Tab. 2 shows the factor loadings for each original indicator of inputs and outputs.

Optimal is when each original indicator is strongly positively or negatively correlated with one factor and the other minimum, what is met. Based on these facts, new factors may be identified and named. For the interpretation, the relevant indicators are those with the factor loadings exceeded the value of 0.4 (Stevens, 2002). For elaboration of FA, the software IBM SPSS Statistics 24 is used in this chapter.

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In assessing, the overall productivity of the unit is necessary to take into account a greater number of inputs, but also outputs. If a performance measure (input/output) is added or deleted from consideration, it will influence the relative efficiencies. Empirically, when the number of performance measures is high in comparison with the number of DMUs, then most of DMUs are evaluated efficient. Hence, the obtained results are not reliable. The number of evaluated DMUs must be sufficiently large. There is a rough rule of thumb (Cooper, Seiford & Tone, 2007), which expresses the relation between the number of DMUs and the number of performance measures as follows (1), and suppose there are n DMUs which consume m inputs to produce s outputs:

$$n \geq \max \{3(m + s), m \cdot s\}. \quad (1)$$

Nevertheless, in some applications the number of performance measures and DMUs do not meet the mentioned formula (1). To tackle this issue, it should select some performance measures in a manner, which comply (1) and impose progressive effect on the efficiency scores. These selected inputs and outputs calls selective measures. But formula (1) needs more considerations and simple calculation shows that when $m = 6$ and $s = 6$, then $3(m + s) = m \times s$. As a result, in this chapter instead of using (1), following formula (8) is applied:

$$n \geq 3(m + s), \quad (2)$$

In the case of this chapter, the rule of thumb is met, because number of DMUs is three times higher than sum of input and outputs, i.e., $28 \geq 3(3 + 5)$, $28 \geq 3(8)$, $28 \geq 24$. For solution of DEA method software tool based on solving linear programming problems is used in the paper – Solver in MS Excel 2016, such as the DEA Frontier.

Results of Factor Analysis

The results of the Factor Analysis include these factors and entrance indicators: Factor 1 – Diversification and Concentration of Trade that is created by the four following indicators: IED, IID, IEC, IIC. Factor 2 – Sectorial Structure of Export of Goods that is created by these indicators: RCA, ICTE, ICTI, REER. Factor 3 – Costs and Prices consists of two indicators: HICP, LC.

Diversification and Concentration of Trade (Factor 1) is expressed through the product structure of the export and import of goods of the EU member states. The calculations of the indexes of the diversification of the export and import of goods express how the product structure of the export or import of a given country is different from the world structure.

The calculations of the index are in the range of 0–1, where the value near 1 indicates a higher difference in the product structure of the export or import between a given country and the world, i.e. a higher bias than the standard formula of behaviour, which is typical of the world as the whole. Trade concentration expresses the portfolio of export or import or, in

other words, on which amount of products the export (or import) of a given country is concentrated.

The index of product concentration is also called the Herfindahl-Hirschman index (HHI) and it takes the value from 0–1, where the value near 1 indicates a higher level of concentration of the exports and imports of goods, i.e. trade is concentrated on a small number of products. Contrary to this, the values close to zero express the homogenous disposition of export and import to groups of products (UNCTAD, 2016).

Data about trade diversification and concentration were obtained from the UNCTAD database and the calculations were based on the methodology of Standard International Trade Classification (SITC), rev. 3, on the third product level that includes 261 products. Sectorial Structure of the Export of Goods (Factor 2) expresses in which commodity groups a given country really achieves a revealed comparative advantage and in which scale the export and import of ICT products contributes to the total trade of a given country. The export and import of ICT products also confirms a higher level of sophistication of foreign trade. Factor 2 also includes the level of the Real Effective Exchange Rate (REER) that influences the value of the entrance materials, which consecutively has a significant impact on the total sectorial structure of export (some products are more, some less dependent on imports). Revealed Comparative Advantages were determined by the calculation of the Balassa index of RCA. The results of the RCA index express the level of the export specialisation of a given country and its competitiveness in given commodity groups of SITC. Cost and Prices (Factor 3) are expressed through Harmonised Index of Consumer Prices (HICP) and unit Labour Costs (LC). These indicators also influence the total efficiency and the export competitiveness of a given country.

The factors of outputs include, according to the results of the Factor Analysis, these indicators: Factor 1 - Market Share that is created by these indicators: ExZ-shares, ExS-shares. Factor 2 - Dynamic of Export includes these indicators: ExZ-growth, ExS-growth. Factor 3 – Economic Openness and Trade Balance consists of two indicators: NTB, ExZ-GDP. Factor 4 - Productivity, Trade Growth and Balance in Services consists of these indicators: ExZS-growth, BS, LP. Factor 5 - Economic Openness in the Area of Commercial Services is created by only one indicator, i.e. ExS-GDP.

Market Share (Factor 1) expresses in which way the individual countries share in the world exports of goods and commercial services in a given time period. Dynamic of Export (Factor 2) expresses by how many percent the export changed every year compared to the previous year, where the monitored period includes the years 2000–2015.

The pace of the export growth is followed individually for the area of goods and commercial services. Economic Openness and Trade Balance (Factor 3) expresses to which scale a given economy is integrated with the external environment through the export of goods and whether there is balance in these trade flows. Factor 3 includes two indicators. The first indicator shows the share of the export of goods in the GDP of a country in a given year (economic openness). The second indicator shows trade balance that is expressed via the

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Normalized Trade Balance. This indicator is calculated as the proportion of trade balance to the total trade (export plus import). A country that solely exports has the value of Normalized Trade Balance -1, a country that solely imports records +1 as the value of this indicator (Rojí ek, 2010).

Productivity, Trade Growth and Balance in Services (Factor 4) expresses the development of labour productivity and the growth of the export of goods and commercial services in the EU individual member states in 2000–2015. The growth of labour productivity contributes to the growth of the exports and trade balance of a country. The increase of the export of goods and services indicates by how many percent the value of the export of goods and services changed in the current period compared to the value of the indicator in the primary period, i.e. in 2000, under the influence of the achieved level of labour productivity. Trade in commercial services currently represents the most dynamic part of global trade that grows in its significance in achieving the growth of world trade. The trade balance in the service sector is expressed as the difference between the export and import of commercial services. A positive balance in services indicates a dominance of exports over imports. Economic Openness in the Area of Commercial Services (Factor 5) records the level of integration of a given economy with the external environment, in this case via the export of commercial services and its share in GDP.

The last step of the Factor Analysis includes the calculation of factor scores that express the level of the influence of the individual factors in the EU member states. The values of the factor scores for the inputs and outputs for the individual countries represent the most important output of the Factor Analysis in this chapter, because they are the entrance variables for the measurement of productivity using the DEA method.

Conclusion

With the development of globalization in the world economy, to the focus of interest has shifted the question of the individual, microeconomic and macroeconomic competitiveness. Although the country's competitiveness could be affected by a variety of factors that are intertwined and complement, international trade has increasing importance for the whole (aggregate) competitiveness. The chapter does not cover the EU total (aggregate) competitiveness, but focuses only on the EU export competitiveness. The main motivation is the fact that number of the EU Member States kept increasing trend, however, the share of the EU as a whole in world exports is gradually declining, especially under the influence of increasing competition in the global market. In doing so, the EU dependence and its Member States on international trade increases. The EU needs not only to export goods and services, but also import especially the various parts of product and raw materials. In order to maintain the EU's leading position in the world trade and to achieve the trade balance, it is necessary to monitor basic resources and factors affecting the EU's external competitiveness. The aim of this chapter is evaluation of the productivity as a source of the

EU Member States export competitiveness in the reference period 2000-2015. In this period, the EU went through many changes such as the development of integration, but also the progress of globalization, which affects all parts of the world and the spheres of social life.

The analysis is performed at level of the individual EU Member States, using the data on foreign trade obtained from the official sources. The authors are aware that the data capturing value added have greater explanatory importance and gives a more realistic picture of the current trade flows, but the time series is too short to allow research focused on business matters. In this chapter, for the evaluation of national productivity as a source of competitiveness the following methods are exploring: Factor Analysis, Data Envelopment Analysis and Cluster Analysis. Selected business indexes were analysed by these methods. The results of this analysis are the determination of the extracted factors of competitiveness, which were used as variables for the evaluation of national productivity. Based on these results, the EU Member States were divided into groups (clusters) corresponding to the achieved level of productivity, which is considered one of the main sources of competitiveness.

The results of empirical analysis confirm the heterogeneity that exists among the EU Member States as well as in the commercial area. While the calculations for the entire EU show the productivity growth of foreign trade in the reference, this is not the case of individual countries. The highest productivity growth was recorded in Slovakia, Greece and Romania. Productivity growth has been achieved in Slovakia under the influence of price and non-price factors. In the case of Greece, there has been a positive change in productivity due to a favourable growth rate of goods exports, which was sufficiently diversified. Other reason for growth was due to the positive development of trade in commercial services, where Greece has experienced the trade surpluses. In Romania, the productivity of foreign trade mainly increased under the influence of labour productivity growth, low inflation and appropriate structural composition of foreign trade.

On the other hand, Germany, France, Austria, Great Britain, Sweden and Italy recorded a decline in productivity of foreign trade in the years 2000-2015. In terms of determining the average rate of change in productivity, the highest change was recorded in 2009-2010, which was mainly related with the global economic crisis also affecting the EU Member States. Another result of empirical analysis is classification of the EU Member States into five clusters differing in typologies, which illustrates the extent of their productivity. Individual clusters are made up of a varying number of countries that at first glance differ in many ways (in terms of size, the level and structure of the economy), in terms of productivity the levels of foreign trade, however, are similar.

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