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Trade Performance in EU27 Member States

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Abstract

The European Union is one of the most important economic groupings and is a strong economic power in the world economy. The EU currently comprises 28 European states. Our analysis include 27 members excluding Croatia, because of analyzed variables for year 2011 when Croatia was not a member of the EU. The aim of this paper is, based on the analysis of basic macroeconomic and trade indicators, to determine the status of trade performance of economies of EU Member States, focusing on value of GDP, merchandise and commercial service exports and current account balance. Based on the results of the analysis we conclude that Germany is trade leader while all new members (those joining the EU in 2004) with some of old members are laggards when concerning trade performance.

Keywords: Commercial service exports, current account, Gross Domestic Product, European Union, merchandise exports.

1. Introduction

The European Union is one of the most important economic groupings in world economy, currently comprised of 28 European states. Even though it is important economic player, it consists of Member States with different economic characteristics as proposed in Table 1, which shows economic performance of EU Member States in 2011. We can clearly identify the differences between old Member States (those joining the EU before 2000) and new Member States (those joining the EU after 2000). None of the new Member States reached the average GDP p.c. of the EU, Cyprus being closest with 86.4% of EU average. Luxembourg ranked first with 335.9% of the EU average. Bulgaria showed the worst economic performance in terms of GDP p.c. reaching only 21.4% of the EU average. In general, comparing the average GDP p.c. of both old and new Member States to the EU average, yields results in favor of old Member States, which reach 140.4% of the EU average, while the average of new Member States reaches only 49.5% of the EU average.

Table 1 Economic performance in EU27, 2011, current USD

Rank	Country	GDP p. c.	Rank	Country	GDP p. c.
1.	Luxembourg	114211	14.	Cyprus*	29372
2.	Denmark	59889	15.	Greece	25631
3.	Sweden	57071	16.	Slovenia*	24478
4.	Netherlands	50085	17.	Portugal	22504
5.	Austria	49581	18.	Malta*	21964
6.	Finland	48843	19.	Czech Republic*	20580
7.	Ireland	48249	20.	Slovak Republic*	17790
8.	Belgium	46513	21.	Estonia*	16534
9.	Germany	44021	22.	Lithuania*	14155
10.	France	42522	23.	Hungary*	13909
11.	United Kingdom	38961	24.	Latvia*	13807
12.	Italy	36104	25.	Poland*	13382
	EU Average:	**33999**	26.	Romania*	8539
13.	Spain	31985	27.	Bulgaria*	7287

Source: WDI (2013)
Note: * states joining the EU after 2000

Based on economic performance measured as GDP p.c., we expect the trade performance (merchandise and commercial service exports and current account balance) to be in favor of old Member States. We expect these states to be the leaders of trade performance, while we expect new Member States to lag behind former EU members.

The aim of this paper is, based on the analysis of basic macroeconomic and trade indicators, to determine the status of trade performance of economies of EU Member States, focusing on value of GDP, merchandise and commercial service exports and current account balance and to identify which members are leaders and laggards within analyzed variables. We then attempt to formulate measures for the laggards in order to catch up with the leaders.

2. Data and Methodology

As a basis for analyzing the data, we used an online database of World Development Indicators of the World Bank (WDI, 2013). We chose the year 2011 as the base year for the analysis. We were able to obtain all necessary and relevant data for this year for all EU Member States. The 2012 and 2013 data were incomplete, which did not allow adequate

analysis of the state of trade in analyzed countries. Since we used data for 2011, we excluded from the analysis Croatia, which became one of the EU members on July 1 2013. For analysis of trade performance of EU Member States' economies, we selected macroeconomic indicators summarized in Table 2.

Table 2 Summary of input variables

Variable	Unit	Name
GDP (current USD)	USD billions	GDP
Merchandise exports (current USD)	USD billions	MER_x
Commercial service exports (current USD)	USD billions	SER_x
Current account balance (current USD)	USD billions	CA_b

Source: author

We decided to use Kaldor's magic square as the picture of the state of trade performance in a given time period (in our case the state of trade of EU Member States' economies based on 2011 data). For more information on the background and construction of magic square, see Kaldor (1971), Lisý (2002, p. 70), and Medrano and Teixeira (2013). Nevertheless, we did not use the indicators from original magic square. Instead, we used trade performance variables in combination with nominal GDP. Since our analysis covered a period of one year, we used nominal values for all analyzed variables. All variables are expressed in billions USD. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It was calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Dollar figures for GDP were converted from domestic currencies using single year official exchange rates. Merchandise exports show the f.o.b. value of goods provided to the rest of the world. Commercial service exports are total service exports minus exports of government services not included elsewhere. The IMF's Balance of Payments Manual (IMF, 1993) defines international transactions in services as the economic output of intangible commodities that may be produced, transferred, and consumed at the same time. Current account balance was calculated as the sum of net exports of goods and services, net primary income, and net secondary income.

In the next part of this paper, we apply cluster analysis for the selected set of variables for individual EU Member States. We analyzed 27 complete cases, which allowed us to make conclusions about the similarities and dissimilarities between EU Member States themselves. We chose cluster analysis based on its design to group observations or variables into clusters based upon similarities between them. The aim of the decomposition was to create several rather homogenous groups. We concentrated on joining the statistical units (EU Member States) in each cluster that were the most similar to each other. Units in different clusters were to be, however, the most dissimilar. The analysis consists of several steps:

1. Selection of distance metric (used to measure the distance between clusters)
2. Selection of the type of clustering process
3. Selection of clustering method (used to derive clusters)
4. Determination of the number of significant clusters
5. Interpretation of outputs

Before the distance calculation, we standardized all variables in the analysis by first, subtracting sample mean and second, dividing by sample standard deviation. When choosing distance metric, we used squared Euclidean distance. As a type of clustering procedure, we used an agglomerative hierarchical procedure with Ward's clustering method. This type of procedure begins by placing each observation into a separate cluster. Clusters are then joined, two at a time, until the number of clusters is reduced to the desired target. At each stage, the clusters joined are the pair that are closest together. Ward's method defines the distance between two clusters in terms of the increase in the sum of squared deviations around the cluster means that would occur if the two clusters were joined. Based on the results, we decided to determine the number of significant clusters as five. We provide interpretation of clusters in the next part of this paper. For the identification of dissimilarities among clusters, we used the centroids of the variables for all clusters in selected year. We obtained results in current USD. In the next step, we identified the geographical differences between clusters and provided cartographical interpretation of clusters together with interpretation of cluster composition from point of view of accession to the EU. In order to identify leaders and laggards we normalized the results of analysis according to following formula, where each indicator x_{ij} for cluster i is transformed into I_{ij} (OECD, 2008, p. 85):

$$I_{ij} = \frac{x_{ij} - min_j(x_i)}{max_j(x_i) - min_j(x_i)}$$

where $min_j(x_i)$ is the minimum value of x_{ij} across all variables and $max_j(x_i)$ is the maximum value of x_{ij} across all variables. Thus, normalized indicator I_{ij} have values lying between 0 (laggard; $x_{ij} = min_j(x_i)$) and 1 (leader; $x_{ij} = max_j(x_i)$). We chose to normalize the outputs of the analysis in order to provide easier to understand outputs with clearer view of leaders and laggards in trade performance among the EU Member States. Original results yielded extremely diverse numbers due to our use of nominal variables, which made it difficult to represent output in graphical form. However, after the data normalization we were able to create distinct graph demonstrating the leaders and laggards in trade performance. In discussion and conclusion, based on the synthesis of output analysis, we formulate conclusions regarding the state of trade performance of EU Member States and recommendations for those states lagging behind to catch up with the leaders.

3. Output Analysis

This section analyzes the composition and dissimilarities of clusters of EU Member States grouped on the variables from Table 2. In the first step of output analysis, we identify and analyze the structure of individual clusters. In the second step of analysis, we identify the main differences between clusters based on input variables. Table 3 provides the summary of cluster characteristics. Looking at the number of members in each cluster as well as the percentage, we

observe significant disproportions. Most of the EU Member States occur in cluster 2, which comprises 55.56% of all members. On the other hand, clusters 4 and 5 consist of only one member each, representing 3.7% of all members (or 7.4% in case of both clusters combined). Clusters 1 and 3 include six and four members or 22.22% and 14.81% of all members respectively.

Table 3 Summary of cluster characteristics.

Cluster	Members	Percent	Countries
1	6	22.22	Austria, Belgium, Denmark, Ireland, Luxembourg, Sweden
2	15	55.56	Bulgaria, Cyprus, Czech Republic, Estonia, Finland, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovak Republic, Slovenia
3	4	14.81	France, Italy, Spain, United Kingdom
4	1	3.7	Germany
5	1	3.7	Netherlands
Total:	*27*	*100*	

Source: author's own calculations

Concerning geographical distribution of members in particular clusters; we used a method of cartographical interpretation, which we provide in Figure 1. Based on the results of cluster analysis we observe significant geographical proximity of members of each cluster (omitting clusters 4 and 5 with one member each). The only exception is cluster 1, in which there are no members with common border (with the exception of Denmark and Sweden). All other clusters form relatively homogeneous geographic groups. For both cluster 2 and 3 members share a common border while connected through other members. Cluster 3 consists of Western European countries. France is the geographical center of the cluster and shares common borders with all other members. Within the cluster 2, countries of central Europe (Hungary, Poland, and Slovakia) are the link between different members of this cluster. These states are linked geographically to the northeast with small Baltic economies (Estonia, Latvia, and Lithuania) and Finland. In the south they are linked to Bulgaria, Greece, and Romania. Although members of the cluster 2 are geographically closer than members of cluster 1, we identified exceptions in this cluster. This is particularly the economies of Cyprus, Malta, and Portugal, which have no common border with other members of the cluster 2. Cyprus and Malta are small island states, although we can state the relative proximity and thus the imaginary boundary between Cyprus and Greece. We can derive similar statement also for Malta, even though Malta is much closer to Italy from cluster 3 than to any other member of cluster 2. Geographically, Portugal is located at the opposite end of the European Union as the other members of the cluster 2. Portugal is the only member of cluster 2, which is significantly differently geographically localized. On the one hand, Portugal geographically does not belong to cluster 2. On the other hand, it shows similar characteristics of trade performance than the other members of cluster 2. Portugal shows both geographic and trade characteristics that are similar to those of members of cluster 1 (geographical diversity and similarity in trade performance with other members within cluster 2).

In terms of the distribution of EU Member States to individual clusters based on their accession to the EU, we observe a very high homogeneity of the clusters. Nonetheless, there is a degree of heterogeneity when taking into account founder members and further waves of enlargement prior to 2000.

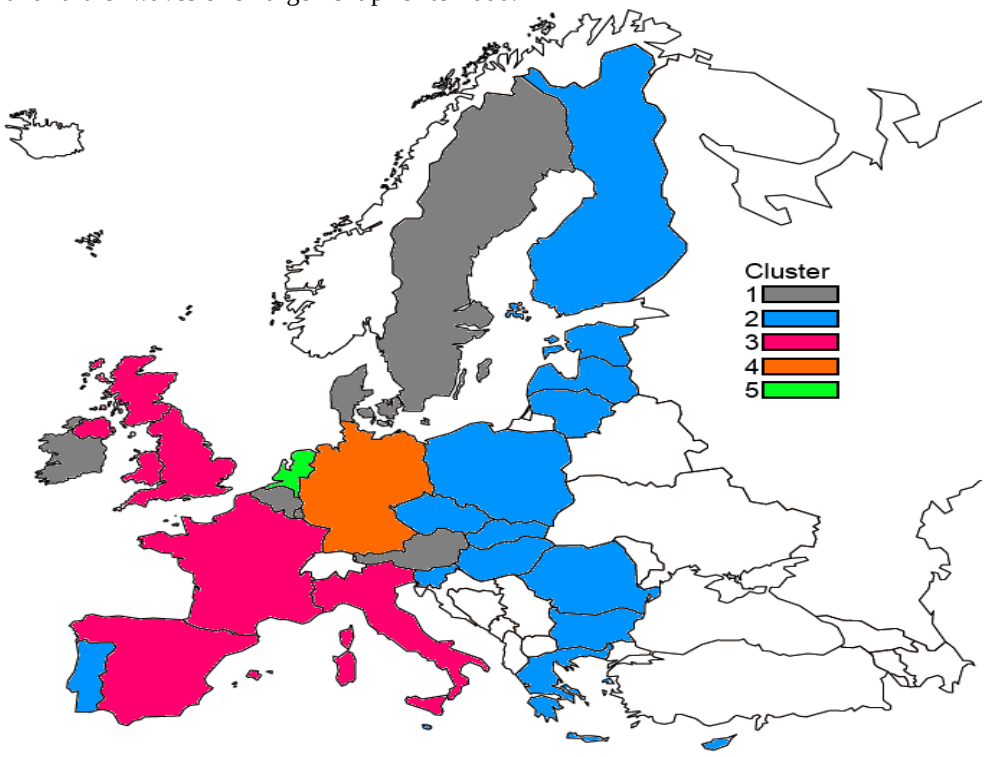

Figure 1 Geographical distribution of clusters

Source: author

Looking at Table 3 and Figure 1 we can clearly identify cluster 2 as a cluster comprised of new Member States (year of accession 2004 and 2007). The new Member States thus form a highly homogeneous group that is related not

only geographically, but also economically (Table 1) and by trade characteristics (Table 3 and 4). As regards basic economic performance in 2011, all new Member States appear in GDP p.c. at current prices below the EU average. Other members of this cluster, Greece and Portugal, have also achieved lower levels of GDP p.c. than the EU average. Finland constitutes the only exception in this cluster. In 2011, Finland reached 143.7% of the EU average. Cyprus as a new Member State with the highest GDP p.c. reached only 86.4% of the EU average. For the old Member States, we observed heterogeneity in terms of the founding Member States and the states of further EU enlargements before 2000. We can locate founding Member States, with the exception of cluster 2, in all clusters – Belgium and Luxembourg in cluster 1, France and Italy in cluster 3, Germany in cluster 4, and the Netherlands in cluster 5. In 1973, Denmark and Ireland (cluster 1) and United Kingdom (cluster 3) joined the EU. Greece (cluster 2) became EU member in 1981. In 1986, Portugal (cluster 2) and Spain (cluster 3) joined the EU. Last enlargement in the 20th century was the year 1995 when Austria and Sweden (cluster 1) and Finland (cluster 2) joined the EU. We see that the states of the various waves of enlargement are not members of the same clusters. We observe the biggest difference within the founding members of the EU.

Table 4 shows the differences among the clusters. The left part of the table gives the centroids, the average values of the variables for each cluster. The right part of the table gives the normalized centroids.

In the case of nominal GDP, cluster 4 reached the highest value of 3,600 billion USD. Member of this cluster is the largest EU economy – Germany. Given the economic performance in Table 1, cluster 2 reached the lowest average value of nominal GDP, consisting of, with the exception of Finland, only those EU Member States with lower than EU average GDP p.c. values. Although the Netherlands is ranked fourth in GDP p.c., cluster 5 is third in the average amount of nominal GDP. Cluster 3 achieved the second highest average nominal GDP of 2,223 billion USD. Even though the constituent states of this cluster show lower values of GDP p.c. than the Netherlands. On the other hand, economies of these countries are bigger in comparison with the Netherlands by 1.77 to 3.33 times in nominal GDP (these economies are on the 10th to 13th place in comparison of GDP p.c., though ranking the 2nd to 5th place in the comparison of nominal GDP. Netherlands is on the 6th place in nominal GDP).

Regarding the volume of the current account, two of the five clusters achieved deficit during the selected year. Cluster 3 reached the highest deficit at -51.05 billion USD. The second worst result (deficit) amounted to cluster 2. This variable was the only one in which cluster 2 did not reach the worst result. Germany (cluster 4) reached the highest value of current account surplus, which was about 2.64 times higher than in the Netherlands, which ranked second. Almost all the new Member States have reached current account deficits in selected year, except for Bulgaria, Estonia, Hungary and Slovenia. All members of cluster 3 contributed to the highest average deficit among all the clusters. In comparison with other EU Member States, members of cluster 3 ranked 1st to 4th with highest deficit.

In the case of merchandise and commercial service exports, we observe similar characteristics as with the nominal GDP. Cluster 4 reached the highest average value in both variables. On the other hand, we note that in the case of commercial service exports (SER_x), United Kingdom reached highest nominal value with Germany in second place. In the case of merchandise exports (MER_x), Germany dominated. Compared to the second Netherlands, Germany exported 2.21 more value of goods. Regarding commercial service exports, the new Member States are in last place. The only exception was Poland, which exported in nominal terms more services as Finland and Portugal, which belong to the old Member States.

Table 4 Cluster differences

	Centroids				**Normalized centroids**			
Cluster	**GDP**	**CA_b**	**MER_x**	**SER_x**	**GDP**	**CA_b**	**MER_x**	**SER_x**
1	347.41	10.57	183.34	76.84	0.06	0.22	0.09	0.24
2	144.72	-5.93	60.29	15.79	0.00	0.16	0.00	0.00
3	2223.46	-51.05	482.21	186.82	0.60	0.00	0.30	0.68
4	3600.83	223.32	1473.99	268.85	1.00	1.00	1.00	1.00
5	836.07	84.59	667.10	105.31	0.20	0.49	0.43	0.35

Source: author's own calculations

Based on data from the right side of Table 4, we constructed a graph (Figure 2), where we can clearly identify leaders and laggards in the EU Member States focusing on trade performance. Normalized centroids take values from 0 to 1. A value of 0 means that the cluster reaches the worst average of all the clusters in analyzed variable. On the other hand, a value of 1 means achieving the highest average level of the variable of all the clusters. Based on the output of the cluster analysis, in which we identified five clusters with different characteristics based on analyzed variables, we note that the absolute leader in all the variables is the cluster 4, i.e. Germany. Germany's economy reached the highest absolute values for all analyzed variables, in accordance with what we expected, as it is the largest economy of all EU Member States (in terms of nominal GDP; in terms of GDP p.c. at current prices in 2011 Germany ranked ninth). GDP at current prices in 2011 reached 3,600 billion. In terms of identifying the biggest laggards, we can clearly identify the members of the cluster 2, which reached the lowest values in three out of the four analyzed variables – GDP, MER_x, and SER_x. The exception is cluster 3, which reached the lowest value (highest deficit) of current account deficit (CA_b).

In other clusters, it is not possible to identify clearly leaders and laggards for all analyzed variables. Based on Figure 2, we can identify the followers of Germany in particular variables. In case of GDP, cluster 3 achieved the second highest value. If we look at the current account, the closest follower of Germany is cluster 5. It is also the closest follower in MER_x, where clusters 1 and 3 lag behind. The situation is different with SER_x. Cluster 3 is closest follower of Germany, followed by clusters 5 and 1. Focusing on clusters 3 and 5, each is the closest follower of cluster 4 in two of four analyzed variables – cluster 3 at GDP and SER_x; cluster 5 at CA_b and MER_x. Taking into account the fact that a larger area of a polygon yields better overall performance of set of variables, we note that the immediate follower of the cluster 4 is cluster 3. The area of its polygon is greater than the area of cluster 5 polygon. Conversely,

cluster 1 is the second biggest laggard after cluster 2. Cluster 1 achieves significantly lower mean values than clusters 3 and 5 (except CA_b, which is better than in cluster 3), as illustrated by the size of the area of a polygon for cluster 1 in Figure 2.

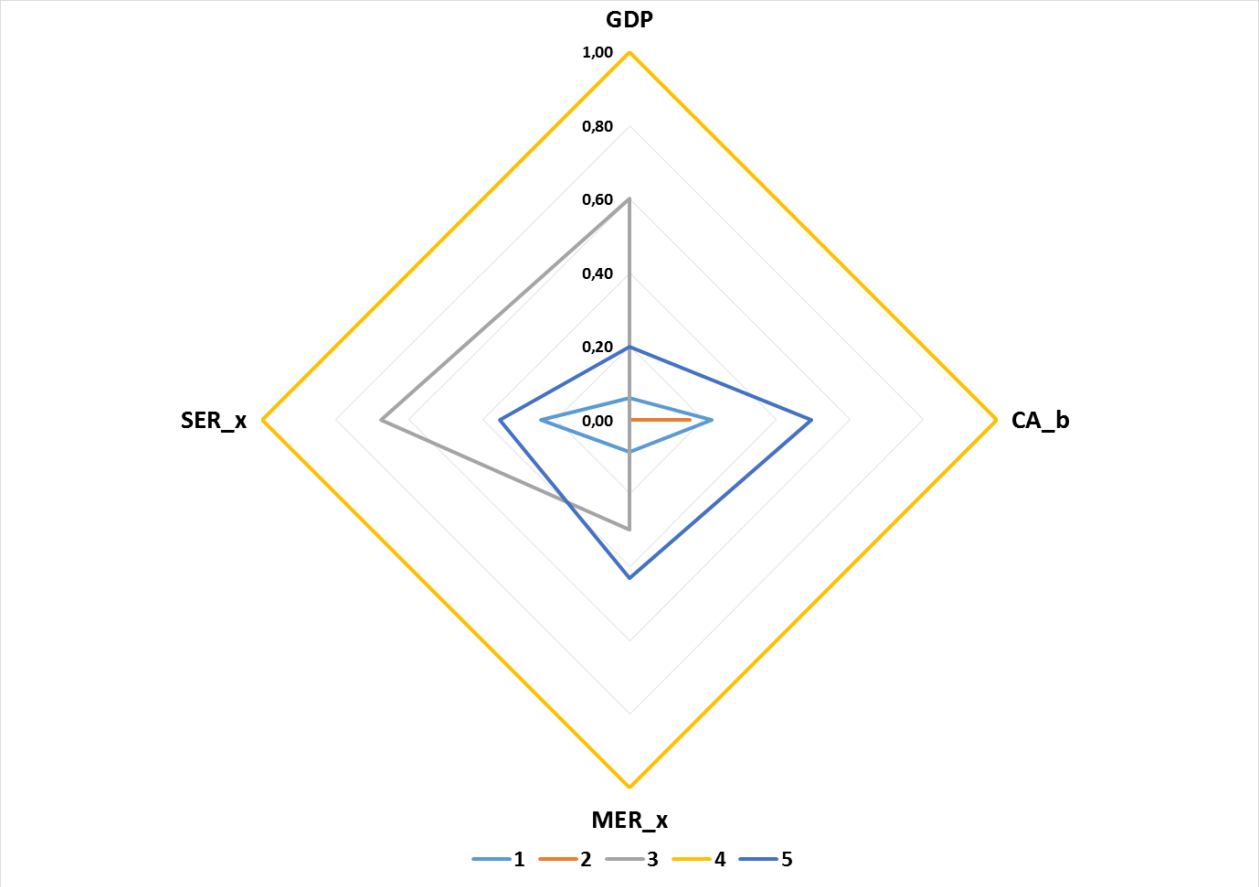

Figure 2 Trade performance of EU27 Member States

Source: author

4. Discussion and Conclusion

Our analysis revealed Germany to be an absolute leader in all analyzed variables. On the other hand, all new Member States are almost absolute laggards, with the exception of current account balance, where the biggest laggard were four old Member States – France, Italy, Spain, and United Kingdom. Even though members of cluster 3 performed in average the worst in current account balance, we consider them immediate followers of Germany, based on the results of all analyzed variables. Area of polygon for this cluster is greater than the area of polygon for cluster 5 (Netherlands), which performed second best in two out of four analyzed variables (CA_b and MER_x). We can identify cluster 1 as the cluster next to biggest laggards (cluster 2), demonstrating by Figure 2.

Based on the results of performed cluster analysis for selected variables, we try to formulate some general measures for biggest laggards concerning the trade performance. In order to increase the nominal values of merchandise and commercial service exports, we propose on macro level governments to focus more on export promotion of both goods and services. Increase in expenditures in order to promote trade with other countries will lead to increase in funds inflow to respective countries. This may provide positive effect on current account, which may turn to surplus from current deficit. This in turn will have a positive impact on nominal GDP and GDP p.c. On micro level, we propose increase in volume production of goods and services, which will lead, in case of realization of surplus production on foreign markets, to inflow of funds into the country. Increase in production should be carried out by either increasing productivity with no change in nominal wages or by increasing productivity at a higher level than increase in nominal wages. This will lead to higher competitiveness of domestic firms on foreign markets, to inflow of funds, and ultimately to increase in nominal GDP and GDP p.c.

We are aware of some limitations of our research. Firstly, number of variables for analysis. We used four main macroeconomic and trade variables in the analysis of the trade performance of economies of EU Member States. Secondly, chosen period for our analysis. The base year for the analysis was 2011, for which data were available for input variables for all statistical units. Despite these limiting factors of our research, we consider it as a basis for developing further economic analysis of trade performance. We recommend future research focusing on changing of the number of variables. This may lead to more comprehensive analysis of economic performance of EU Member States and not only trade performance. We also propose focusing on temporal dynamics, especially through increasing the number of observed years. Dynamics of changes in variables over time will allow for better understanding of the development and direction of the trade and economy than a static view of one year. In our case, for example, it would be suitable to follow the development of basic macroeconomic and trade indicators of the EU Member States before and after the financial crisis in the first decade of the 21st century or before and after joining the EU (especially for twelve new

Member States that joined the EU in 2004 and 2007). Given the size of German economy, we suppose it to be the leader even in temporal comparison, but there is a possibility of change in the structure of other clusters.

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