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Linkages of Macroeconomic Indicators  
of Competitiveness on the Example of Export  
and Transformational Performance in Selected  
Countries of the Visegrad Group Plus

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## **Abstract**

Ingrid Majerová, Jan Nevima: **Linkages of Macroeconomic Indicators of Competitiveness on the Example of Export and Transformational Performance in Selected Countries of the Visegrad Group Plus**

*Export performance and transformational performance are some of indicators for measuring outputs through which macroeconomic competitiveness is reported. The first one shows the productivity of the export and the second one value added in foreign trade. This paper deals with the relationship of them in three selected countries – Czech Republic, Poland and Austria during the period 1995-2010. These countries belong to the members of Visegrad Group plus and are examined for two reasons: the first is geographic proximity and the second is the heterogeneous size, which plays important role. While the Czech Republic and Austria belongs to the small economies whose openness should be large (and research results should therefore be similar), Poland is ranked to the economies of medium size with an expected lower level of openness. It is considered that increasing productivity of foreign trade tend to increasing its value added and thus contribute to improvement of macroeconomic competitiveness. The observations were being proven by using the correlation and regression analysis. The positive relationship between export and transformational performance was found in all analyzed countries.*

### *Key words*

macroeconomic competitiveness, export performance, transformational performance, comparison, correlation, regression analysis

*JEL: F14, O11, O57*

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## **Introduction**

There are many interpretations of how to understand the concept of competitiveness – from the ability to provide an ever-increasing standard of living till an elusive essence that can not be defined or measured. Competitiveness can be applied to the economy as a whole, but also to the region (see Kiszova and Nevima, 2012, Heijman et al., 2012, or Boháčková and Svatošová, 2012) or the company. The first named level of competitiveness will be analyzed in this paper that This kind of comparison was used in our previous research where we compare selected member states of EU and Switzerland (see Majerová and Nezval, 2013 and Majerová, 2014).

On the beginning the macroeconomic competitiveness was synonymous with export performance. Over time, this concept has been replaced by a broader concept that includes the concept of Outrata (2012) that considered the competitiveness as the ability not only to produce goods and services that will succeed in the international market, but also the ability to maintain and enhance a high and sustainable level of economies. According to Slaný et al. (2006) competitiveness is aggregate variable, which is based on the growth of productivity through the growth of macroeconomic indicators, living standards and employment, but where all of these variables must have a sustainable basis. According to Hindls et al. (2003), if the economy is able to penetrate foreign markets and international trade to gain comparative advantages, it is competitive.

Macroeconomic competitiveness is measured by two kinds of indicators, both those measurable, quantitative, to which we rank the indicators of inputs (costs) and outputs (measure results) as well as non-measurable, in other words, qualitative. Measurable data include only part of competitiveness and are calculated on the basis of hard data. Non-measurable indicators, respectively those difficult to measure, include comprehensive competitiveness of the economy and use both hard data and soft data (questionnaire surveys to capture indicators that can not be measured with hard data), which may be on the basis of subjective views of correspondents misrepresented.

The aim of this paper is to confirm or refute the hypothesis of the existence of a positive correlation between selected "output" indicators, namely between export performance and transformational performance. For this purpose the three economies – Czech Republic, Poland and Austria were chosen. These countries belong to the members of Visegrad Group plus and are examined for two reasons: the first is geographic proximity and the second is the heterogeneous size, which plays important role. While the Czech Republic and Austria belongs to the small economies whose openness should be large (and research results should therefore be similar), Poland is ranked to the economies of medium size with an expected lower level of openness. It is considered that increasing productivity of foreign trade tend to increasing its value added and thus contribute to improvement of macroeconomic competitiveness. Annual data were collected from Eurostat database (Eurostat, 2013) in period 1995-2010 and converted into indexes. In addition to the comparative method, the methods of correlation and regression analysis are used.

### **1. Definition of Problem**

As mentioned above, the measurable indicators of competitiveness are the "input" indicators (analysis of unit labour costs, labour productivity, relative prices and the real effective exchange rate) and "output" indicators among which we rank the degree

of openness of the economy and the export performance of the economy, intensity and structure through specialization indicator of relative specialization, value-added exports through transformational effect and per unit (kilogram) export prices. The export performance and transformational performance will be analysed and the relation between them will be found.

### 1.1. Export Performance as the Productivity of Exports

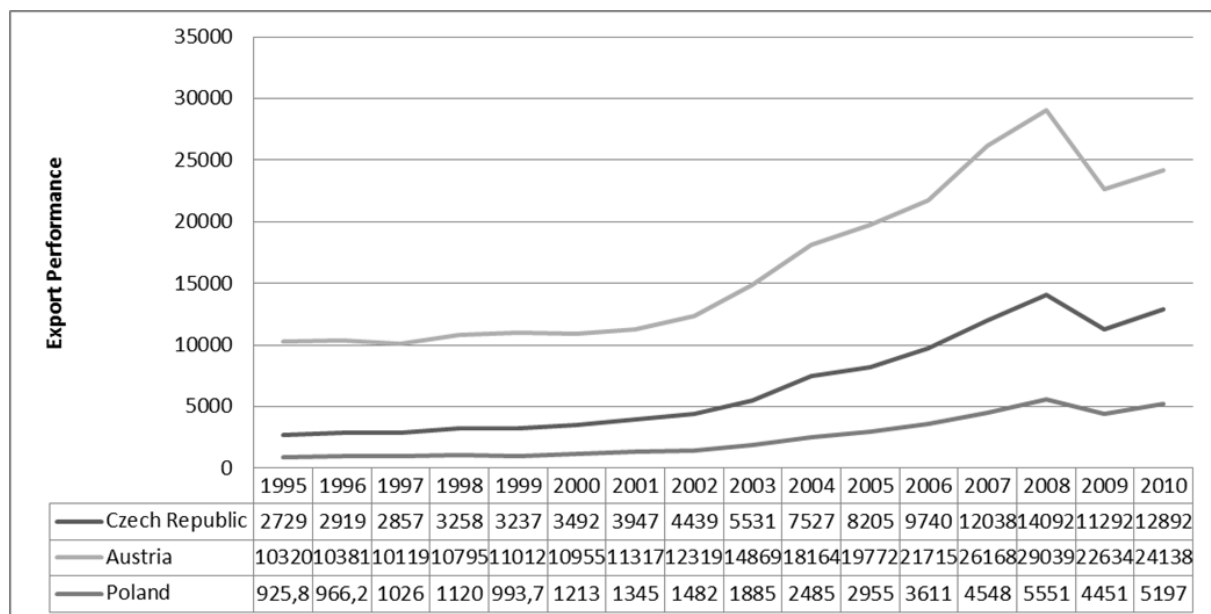
Export Performance (EP) is the productivity of the economy in foreign trade. Higher values of EP correlated with greater competitiveness of the economy (Plchová, 2011) and their share of the world market (Cheptea, 2012). According to Rojíček (2010), successful export performance is vital for some economies (especially for the small one).

Export performance is measured by the volume of exports per capita (see equation 1). This indicator should grow in every country, and differences in this indicator demonstrate the ability of countries to participate in international division of labour and benefit from it.

$$EP = \frac{EX}{C} \quad (1)$$

where *EX* is the value of exports and *C* is the number of citizens.

The values of indicators of export performance are dependent on the size of the economy, meaning namely that the smaller the economy is, the higher the level of export performance should be achieved compared to a large economy. As we can see from Figure 1, this assumption is valid in these economies, as the smallest performance is achieved by the second largest monitored economy (Poland) and the highest performance is achieved by the small economies (Austria and Czech Republic behind it). There is widening of the gap in this expression of competitiveness - Poland has stagnated, Austria showed substantial progression, Czech Republic show medium one (with the impact of the economic crisis of the developed world).



**Fig. 1: Development of export performance in the years 1995-2010**  
(Source: Eurostat)

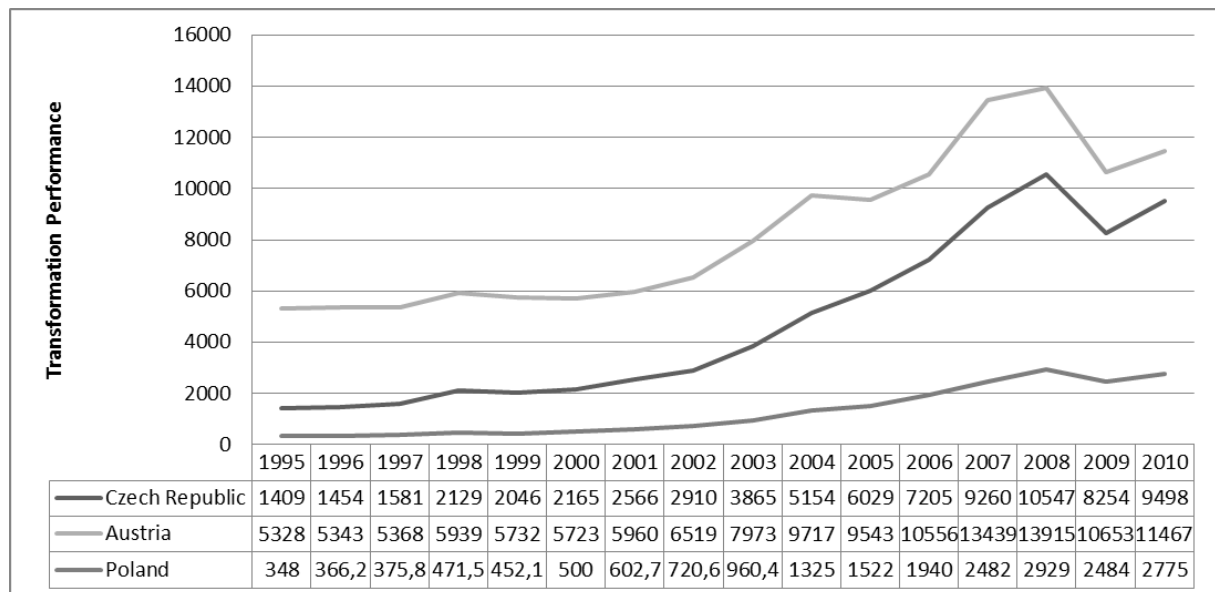
## 1.2. Transformational Performance as Value Added of Exports

In addition to the productivity of exports, an analysis of its effectiveness will also be subjected. This efficiency is expressed by a transformational performance indicator that represents added value with processing of imports and reflects the ability of the extent of their appreciation. The same rule is applied as for the previous indicator - the higher the indicator, the higher value added exports per capita, the higher the efficiency and competitiveness. Like the indicator of export performance, this relationship is expressed through the difference of manufactured products' exports and the import of primary production per capita:

$$TP = \frac{X_M - I_P}{C} \quad (2)$$

where  $X_M$  is export of manufactured products (SITC 5-8) and  $I_P$  represents the import of primary production,  $C$  is number of citizens.

As the figure 2 shows, the added value of exports per capita is the highest in Austria, in comparison with other economies by almost half, and in the case of Poland consists nearly ten times the added value. The second economy in the order is the Czech Republic and last Poland. The most improvement was in the Czech Republic (till 2008), whose added value more than doubled in the analysed period, and second formerly centrally planned economy also achieved similar improvement, but its level is still low.



**Fig. 2: Development of transformational performance in the years 1995-2010**  
(Source: Eurostat)

## 2. Methodology

The aim of this paper is determine the dependence of transformational performance on the productivity of exports of every analysed economy, the correlation and regression analysis

was performed on data from the years 1995-2010. Values of transformational and export performance for individual member states of V4+ were calculated from the data in Eurostat database (Eurostat, 2013).

Regression analysis is carried out using least squares method. Firstly, spatial correlation was determined by using the Pearson correlation coefficient, further constancy variance was tested using graphical methods. Secondly the test of significance and T-test were used. These assumptions were tested in program Excel.

Correlations were performed using Pearson's correlation coefficient (see equation 3), on two levels of significance  $\alpha = 0.05$  and  $\alpha = 0.01$ . By using the Pearson correlation coefficient  $r$  the assumption should be fulfilled that both variables are random variables and have a common two-dimensional normal distribution - then a correlation coefficient of zero means that the variables are independent, with a value of one factor shows the absolute dependence of the monitored variables.

$$r_{xy} = \frac{\sum_i (x_i - \bar{x})(y_i - \bar{y})}{(n-1)s_x s_y} \quad (3)$$

where  $n$  is the number of measurement,  $i$  is 1, ...,  $n$ ,  $x_i$ ,  $y_i$  are normally distributed random variables  $X$  and  $Y$ ,  $\bar{x}$ ,  $\bar{y}$  are average values and  $s_x$ ,  $s_y$  are standard deviations.

The basic equation for expressing simple linear function is the following equation (4).

$$y = \beta_0 + \beta_1 x + \varepsilon \quad (4)$$

where  $\beta_0$  and  $\beta_1$  are the values of the parameters of the regression line,  $\varepsilon$  is a random component.

These values obtained estimates  $b_0$  and  $b_1$ , which are called the regression coefficients, and can be calculated using the least squares method.

Regarding the statistical significance of the model as a whole, it is first necessary to establish a zero ( $H_0$ ) and alternative ( $H_1$ ) hypothesis and then test these hypotheses at the significance level  $\alpha = 0.05$ .

$H_0$ : The linear regression model is statistically insignificant.

$H_1$ : The linear regression model is statistically significant.

Another important requirement is to perform T-test, which examines each parameter  $\beta_0$  and  $\beta_1$  separately, if they are not equal to zero. Even in this case null and alternative hypotheses are determined and tested at a significance level  $\alpha = 0.05$

$H_0$ : Parameters  $\beta_0$  a  $\beta_1$  are equal to zero.

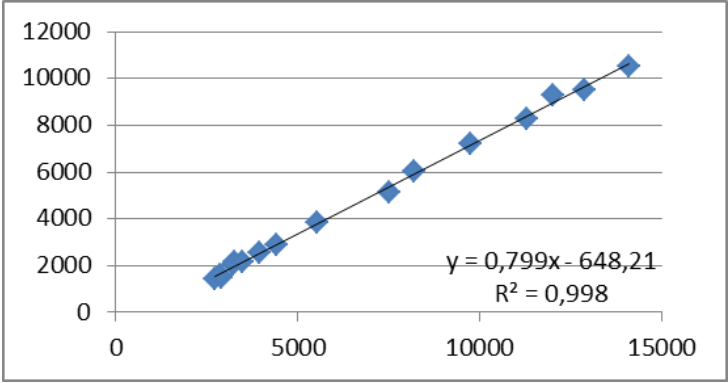
$H_1$ : Parameters  $\beta_0$  a  $\beta_1$  are not equal to zero

### 3. Results of Analysis

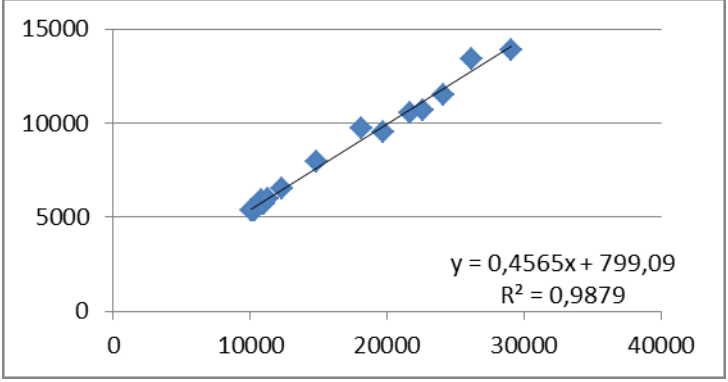
To perform regression analysis, one independent variable was selected, that explain one dependent variable in individual economies for the period 1995-2010. The dependent variable

in the model is transformational performance, expressed as a difference of manufactured products' exports and the import of primary production per capita. Figure 3, 4 and 5 below shows the dependence of the TP and EP in the three states of V4+.

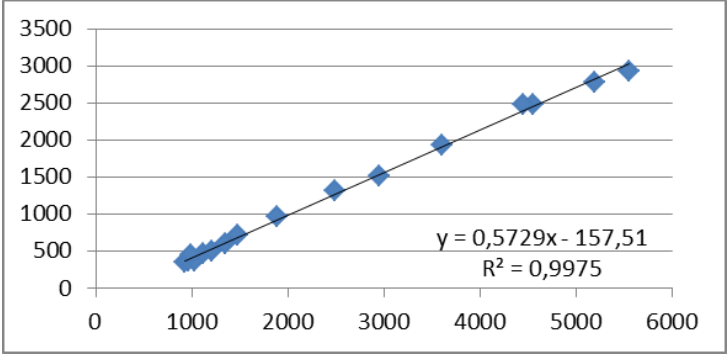
The intensity of foreign trade (X axis) affects the value-added exports (Y axis) very significantly. The increase in the export performance of one unit would result in an average increase of about 61 % of transformational performance (the highest in the Czech Republic, the lowest in Austria). Low value of value-added export can also be traced from the linear function in the event that the intensity of foreign trade was at low levels.



**Fig. 3: Regression of export and transformational performance – Czech Republic**  
(Source: own proceedings)



**Fig. 4: Regression of export and transformational performance – Austria**  
(Source: own proceedings)



**Fig. 5: Regression of export and transformational performance – Poland**  
(Source: own proceedings)



From the equation of line of regression analysis is evident that in all countries is confirmed the positive relationship of examined variables, therefore, when the value export performance rises, the transformational performance rises as well.

The following Table 1 shows the concrete results of the regression analysis. Output from Excel has been modified so that the table contained only the data necessary for our purposes.

**Tab. 1: Results of regression analysis**

	<b>R-squared</b>	<b>Adjusted R-squared</b>	<b>P-value(F)</b>	<b>P-value</b>
Czech Republic	0.9990	0.9980	2.66577E-20	5.29414E-07
Austria	0.9939	0.9879	7.95189E-15	0.00474299
Poland	0.9987	0.9975	1.41855E-19	7.47902E-06

Source: own proceedings

In this model, the probability value (significance F) is less than tested significance level of 0.05, which means that the null hypothesis is rejected, and regression model is statistically significant.

The value of correlation coefficient, which is shown in Figure as multiple R indicates the strength of dependence of selected variables. Specifically, this means that the transformational performance is approximately 99% dependent on changing of the export performance in all countries. Other value that table shows is the value of reliability R – also coefficient of determination. This indicates how much of the total variance of the dependent variable, ie transformational performance, is explained by the regression model. It is more than 98% in all cases.

The level of significance is compared with the P-value in the table above. Thus, if P-values are lower than the level of significance (all values are <0.05), we reject null hypothesis and so alternative hypothesis is valid, therefore, that both parameters are not equal to zero.

## **Conclusion**

The latest trends on the international markets are characterized by a strengthening of competitive pressure. The ability of the adjustment to new market circumstances is especially important for the achievement of continual growth in exports through growth in domestic production. But not only the size of exports is an indicator of the competitiveness of the economy, its quality is taking into account more and more. This quality is evaluated through added value and that is the basis of indicator of transformational performance.

The export and transformational performance belong to output indicators of macroeconomic competitiveness. In the analysis of competitiveness the two indicators of output were chosen, namely the export performance and transformational performance. These two indicators are very close to each other, the question is whether they influence each other. We tried to test it. They were calculated for the period 1995-2010 and three selected economies of Visegrad Group plus - the Czech Republic, Austria, and Poland were carried out.

Regarding the hypothesis of the interdependence of measurable output indicators of competitiveness, a strong linkage was found between export performance, which reflects the productivity of foreign trade, and transformational performance, which reflects the value-

added exports, as in the analysis of each year, so in the analysis of individual economies. The estimated hypothesis was thus confirmed.

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