Macroeconomic determinants of competitiveness in the countries of Visegrad Group plus

I. Majerová, J. Nevima

Abstract— The competitiveness is the cornerstone of the development of countries, regions and companies. Competitiveness can be so understood at different levels: micro-level, regional level and macro-economic level. The high competitiveness is the objective of the European Union and its member states. This article discusses the macroeconomic competitiveness of the selected EU countries that form the Visegrad Group plus - Czech Republic, Slovakia, Hungary, Poland, Austria and Slovenia. Namely, relation between measurable output indicators is analyzed, among them the degree of openness, export performance, transformational performance and relative power of specialization are ranked. These relationships have been tested through a panel regression in the years 1995-2013, when we assumed significant correlation between export performance and other variables and the degree of openness and the others variables. However, this assumption was confirmed only in the case of export and transformational performance.

Keywords—Competitiveness, macroeconomic determinants of competitiveness, panel regression, Visegrad Group plus.

I. INTRODUCTION

THE competitiveness is the ability of a country to facilitate an environment in which enterprises can generate sustainable value [1]. Because of its relative value, the competitiveness must be constantly compared with other economies and regions [2]. Competitiveness is divided into microeconomic, sectoral (regional) and macroeconomic competitiveness.

The last one will be discussed, which is measured by two kinds of indicators, both those measurable, quantitative, to which we rank the indicators of inputs (costs) and outputs (measure and quantitative) as well as non-measurable, in other words, qualitative. To the input (measurable) indicators we rank the analysis of unit labour costs, labour productivity, relative prices and the real effective exchange rate. Output (measurable) indicators are degree of openness of economy and the export performance of economy, intensity and structure of specialization through relative specialization indicators and adding value of exports through the transition effect/performance. Non-measurable indicators include comprehensive competitiveness of the economy and are determined by two ways: trough the World Competitiveness Scoreboard of the Institute for Management Development (IMD) and though the Global Competitiveness Index of the World Economic Forum (WEF). Measurable data include only part of competitiveness and are calculated on the basis of hard data. Non-measurable indicators use both hard data and soft data because the questionnaire surveys capture indicators that can not be measured with hard data.

In our previous studies, we have dealt with the analysis of both quantifiable and measurable indicators of macroeconomic performance in various economies, like other authors, see Part II. Very popular is the comparison of the competitiveness of the European Union and the countries of the Visegrad Group (hereafter V4). We decided, as part of a research project to analyze this problem on an extended group of countries namely selected countries of the Visegrad Group plus (hereafter V4+), which include the V4 countries and Slovenia and Austria on the ground of Regional Partnership Agreement from 2001. There are two reasons: first - these countries are economically and politically part of the Central European region, which plays an important role in the development of Europe and its competitiveness. The second reason is that the enlargement of the V4 was relevant in the past and the most suitable candidates were Austria and Slovenia. Nevertheless, consensus on this problem has been never achieved and nowadays the open V4+ format is to be used for cooperation with other countries or regional groups such as Ukraine, Slovenia and Austria.

This article aims to analyze various macroeconomic measurable indicators and their mutual relations in the V4+ from 1995 to 2013. Longer time series could not be used with respect to availability of certain data. For this analysis all measurable output indicators were selected, for which is assumed, according to the general usage, that interact each other. It was also our hypothesis. Annual data were collected

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from the database of Eurostat and converted into indexes. Given the length of the time series the verification of the mutual relations made through panel regression, and tested for statistical significance, implemented t-test, autocorrelation and heteroskedasticity.

It was found that only model with verified relation between export performance and transformational performance was statistically significant without autocorrelation and heteroskcedasticity.

II. THEORETICAL APPROACH TO THE PROBLEM OF COMPETITIVENESS

According [3], the competitiveness as one of the most monitored characteristics of national economies is becoming part of evaluation of their prosperity, welfare and living standards. According [4] is just competitiveness often associated with the question of how to increase economic welfare, prosperity, living standards and wealth distribution. [5] claim that competitiveness remains a concept that is not well understood and that can be understood in different ways and levels despite widespread acceptance of its importance.

[6] approaches to competitiveness as to the reflection of the important features of the world economy, while refusing the neoclassical theory of equilibrium prices of production factors. In his concept, competitiveness is obvious only in such economies where the benefit of increased productivity in the form of rents remains in the country of its origin. According [7] the competitiveness is a function of dynamic progress, innovation and ability to change and improve. [8] defines competitiveness as the ability to provide an ever-increasing standard of living in the decreasing involuntary unemployment. The source of national (macro) competitiveness is regional competitiveness [9].

A. Macroeconomic Competitiveness

Competitiveness can be related to the economy, respectively to the country as a whole, but also to the company, to the product, or to the sectors and otherwise defined group of manufacturers. We could argue that the basis for the competitiveness of the economy is the competitiveness in foreign trade, therefore the exported goods and that it holds the sequence: the product - the company - the economy. But in economics, there is a certain business environment of the government's economic policy and the effective operation of the state. The state thus by setting the economic environment retrospectively affects companies and their activities, either stimulates or inhibits on the contrary, and thus feedback between the economy and the company exists.

So that the economy could be competitive, as a whole and in the functioning of its various entities, it must operate with certain conditions. These conditions - the golden rules of competitiveness - provided [10] ("update" version in 2014) and are listed in Table I.

Table I. The Golden Rules of Competitiveness

No.	Rule
1.	Create a stable and predictable legislative and administrative environment
2.	Ensure speed, transparency and accountability in the administration
3.	Pledge to maintain budget, fiscal and debt discipline
4.	Diversify the economy, from a sectorial and geographical point of view
5.	Invest in traditional and advanced infrastructure, logistics and the linkage of activities
6.	Support medium sized enterprises, with home grown technology and export orientation
7.	Balance aggressiveness on international markets with attractiveness for added value activities in order to sustain a current account surplus
8.	Preserve the industrial base of the nation, and the "made in..."
9.	Focus on a dual track education system (apprenticeship and higher education) to foster the employability of the younger generation and reduce youth unemployment
10.	Promote a science and entrepreneurial culture
11.	Maintain social consensus on policies and social mobility upward
12.	Return the tangible signs of competitiveness success to the people (better roads, hospitals, schools, housing, etc.) as a symbol of achieved prosperity

Macroeconomic competitiveness is young term it was mentioned in the literature in the beginning of 80es of the last century [11]. The [12] defined competitiveness as the degree of production that passed the test of international competition, but in the same time to maintain and develop its incomes at national level. This narrower concept and initially synonymous of export performance has been replaced by a broader concept [13]. This concept 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 [14] as aggregate competitiveness, 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 [15], if the economy is able to penetrate foreign markets and international trade to gain comparative advantages, it is competitive. [16] claim that the idea of national competitiveness shows the ability of a country to sustain a high level of national income and a favourable position in the world economy and the ability of a country to create a business environment in which the local firms are able to compete internationally.

III. MACROECONOMICS DETERMINANTS OF THE COMPETITIVENESS

Macroeconomic competitiveness was initially the synonym for export performance, on the basis of which the evaluation and testing was practiced [17]. Over time, this narrower conception has been replaced by a broader concept, which includes the concept of competitiveness explained 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 high and sustainable level of economies. [18]

International competitiveness is measured by two kinds of indicators: measurable, to which we rank indicators of inputs (costs) and outputs (measured results) as well as non-measurable, qualitative. Measurable data include only a part of competitiveness and are calculated on the basis of hard data. Non-measurable indicators use both hard and soft data (interview surveys for recording indicators that cannot be measured with hard data. These measurements are made by international organizations such International Institute for Managerial Development in Lausanne (IMD) or World Economic Forum in Geneva (WEF).

We will deal with the first type of indicators, specifically measurable "output" indicators, among which the degree of openness of the economy, the export performance of the economy, intensity and structure of specialization through indicator of the relative strength of specialization and value-added exports through

A. Degree of openness

As mentioned, macroeconomic competitiveness was initially the synonym for export performance, on the basis of which the evaluation and testing was practiced. Over time, this narrower conception has been replaced by a broader concept, which includes the concept of competitiveness explained 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 high and sustainable level of economies.

The degree of openness of economy is the basic indicator that characterizes the intensity of foreign trade. It shows the degree of connection to national economy with the world economy. It is measured by the share of exports (turnover) of the country's GDP in the year, as shown in (1).

$$DOE = \frac{VX}{GDP} \tag{1}$$

where DOE is degree of openness, VX is value of exports of goods and services and GDP represents gross domestic product.

There is a relationship between the size of economy and its maturity on one hand, and its openness on the other hand. From the empirical analyses of foreign trade in the world economy, the following relations were made out: The greater the economy, the less is the average relative involvement into international division of labour, for small economies it is vice

versa and the more advanced the economy is – regarding comparable economic size, the more intensive is its involvement in the international division of labour, compared to the economy with a lower level of economic development.

The above problem can be seen from our point of view in two ways. When we analyze the individual economies in particular, we can conclude that the above rule does not apply, since Slovakia and Hungary would be the most open economy, followed by the Czech Republic, Slovenia (the smallest one), Austria and Poland. But if we take into account the division by country´s size, ie Austria, Slovakia, Hungary, Slovenia and the Czech Republic as small economies and Poland such as the economy of medium size (ie larger), the rule is confirmed (see Figure 1).
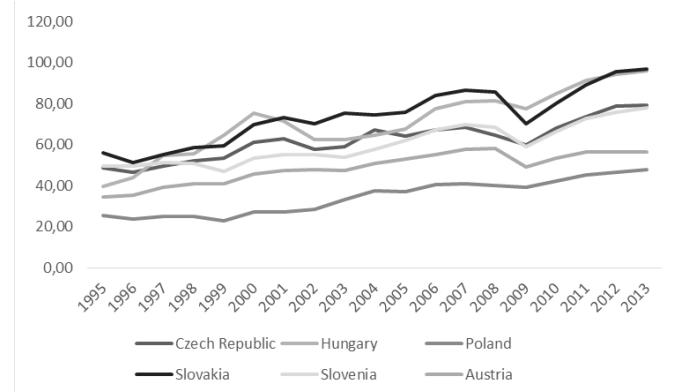

Fig. 1 Development of degree of openness in the V4+ in the 1995-2013

B. Export performance

The export performance reflects the productivity of economy in foreign trade. We measure it by the volume of exports per capita, see (2). In all countries, this indicator should grow and the differences in this indicator suggest the ability of the country to participate in international division of labour and have benefits from it.

$$EP = \frac{VX}{NC} \tag{2}$$

where EP represents export performance, VX is value of exports of goods and services and NC is number of citizens.

Fig. 2 shows the evolution of export performance of economies in time and here it is observed that although Slovakia and Hungary are the most open economy of the six compared, the productivity of foreign trade is up for Austria. Poland has the worst value of EP in the comparison with Austria and less than half that of the Czech Republic. On the other hand, we can say that the consequences of the economic crisis (in the form of a drop EP) are the mildest in Poland, while Austria has seen a significant drop.
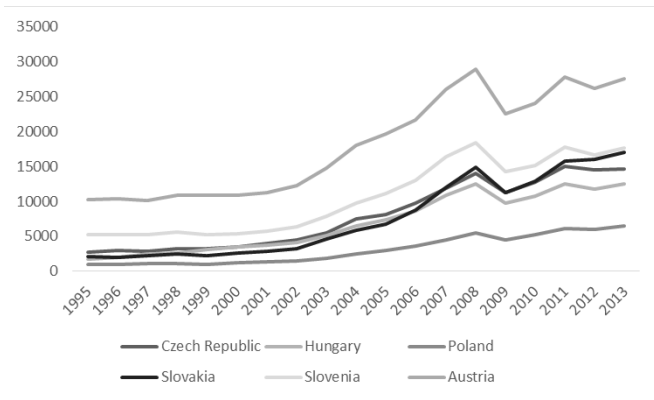
Fig. 2 Development of export performance in the V4+ in the 1995-2013

Export performance of economies, which is a more conclusive indicator of competitiveness measuring, is no longer valid in distinction between small and large economies, since the smallest performances are reached by the largest monitored economy (Poland) and the highest performance is reached by the third smallest economy (Austria). In this statement of competitiveness, we see an opposite effect than in the previous indicator - while in DOE the economies mutually converged, in the EP the divergence appears.

C. Intensity and structure of specialization

In the measurement of international competitiveness is important not only quantitative measure of exports, but also its structure. For a more competitive economy it is vital that mainly technologically intensive commodities were represented in the exports. We are for the purposes of our analysis, selected one indicator that reflects the structure of specialization in international trade, and that is an indicator of the relative strength of specialization.

This indicator characterizes a relative advantage or disadvantage in the trade for a specific product or group of products of selected economies in the group of countries. This indicator can be expressed by the following equation (3).

$$RSS_k = \frac{\dfrac{X_{ij}}{\sum_i Xij}}{\dfrac{Xi}{\sum_i \sum_j Xij}} \quad (3)$$

where RSSk is the coefficient of relative strength of specialization, Xij is the export of j-commodity or group of commodities from i-economy, ΣiXij represents the sum of world export of j-commodity or commodity group from i-economy, Xi is export of commodity of manufacturing industry and ΣiΣjXij represents the whole world export of manufacturing industry.

In our analysis, we have selected for X the technologically demanding products (high-tech, such as medicine, communications equipment, computer equipment, medical

equipment, aircraft, etc.). Based on the above formula, we have compiled a ranking of economies according to their relative strengths of specialization in the period 1995-2013. Those economies that show a high rate of specialization, should achieve greater competitiveness than others and vice versa.
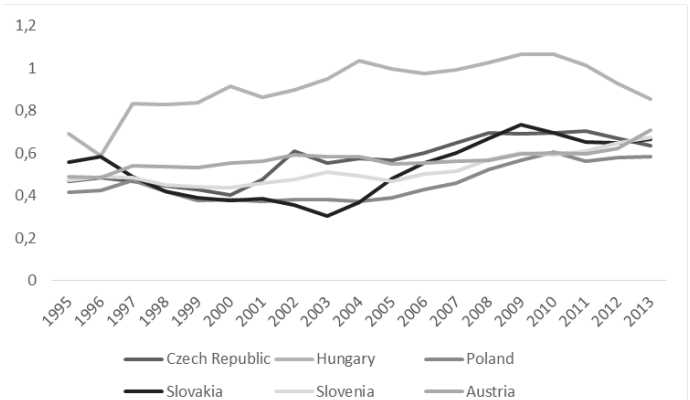

Fig. 3 Development of structure of specialization in the V4+ in the 1995-2013

Fig. 3 shows that the most competitive is surprisingly Hungary, although with a declining trend, which approximates to other compared economies. Other results are also remarkable - in the last five years, the level of specialization in all the remaining economies consolidates and approaches the same level. It seems that efforts of economies to maximize export of high-tech products are successful (with the exception of Hungary, which gets the same level than in 1995).

D. Transformational Performance

In previous output intensity, productivity and structure of export was examined, now its effectiveness is also subjected to a brief analysis. This efficiency is expressed by transformational performance indicator that represents added value by processing of imports and reflects the ability and the degree of their appreciation. The same rule is applicable as in the previous indicator - the higher the value of the indicator, the higher value of added exports per capita, the higher the efficiency and competitiveness. Like an indicator of the relative strength of specialization, this indicator reflects the relationship, and so difference between export manufacturing industries and import of primary production per capita, see (4).

$$TI_i = \frac{X_m - I_p}{NC} \quad (4)$$

where TI_i is the indicator of transformational performance of i-economy, Xm represents the export of the manufactured commodities (SITC 5-8), Ip is the import of the primary production (SITC 2 a 3) and NC is the number of citizens.
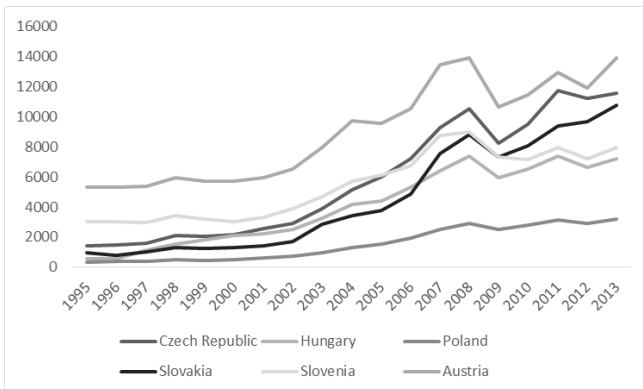
Fig. 4 Development of added value of export in the V4+ in the 1995-2013

According to Fig. 4, the added value of exports per capita is highest in Austria, constitutes almost ten times of value added of Poland. The second economy in order is the Czech Republic, further Slovakia, than Slovenia, Hungary and Poland the last. Highest improvement achieved the Czech Republic which added value more than doubled in the period, a similar improvement reached other former centrally planned economy - Slovakia. Poland has the smallest progression which value added remained in the period almost unchanged.

IV. METHODOLOGY AND EMPIRICAL APPROACH

As noted above the comparison of the competitiveness is very popular in the case of the countries of the V4. The authors used and use various method to obtain the required results.

[19] used two selected methodological approaches to evaluating competitiveness: macro econometric modelling and Data Envelopment Analysis (DEA). Econometric panel data regression model determine the order of impact of each V4 NUTS 2 region on overall competitiveness of the European Union. DEA method provides a different view of regional competitiveness assuming that efficiency mirrors competitiveness

[20] investigates the competitiveness of V4 economies from a new angle, related to fragmentation of global value chains (GVC). In the paper, a new methodology of analyzing competitiveness of economies, developed by [21], was employed, making use of World Input-Output Database. [22] used for ranking the V4 countries in the field of macroeconomic competitiveness the polardiagram and dendogram. Bartha and Gubik used the FOI model that offers a new typology of development factors, but it is also capable of structuring these factors along three clear development directions.

According to Ramík and Hančlová the technology for the evaluation of regional competitiveness is based on the application of two methods of multi-criteria decision making. The first one is the method of Ivanovic deviation, the second one is the known DEA.

[23] focus on the evaluation of the competitiveness of countries based on the country's involvement in international trade by individual commodity areas and highlight the comparative advantages of the countries surveyed. For this purpose she use the RCA index and Michaely index.

We decided to analyze the problem of competitiveness on an extended group of countries namely selected countries of the V4+, which include the V4 countries, plus Slovenia and Austria. The aim of this paper is determine the dependence of measurable determinants of macroeconomics competitiveness of analyzed economies, by using the correlation and panel regression analysis with the period of the years 1995-2013. Values of determinants were calculated from the data in Eurostat database [24].

For evaluating the competitiveness we used the method of panel regression analysis. This method is carried out using least squares method, using 114 observation, included 6 cross sectional units and time series length of 19. 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 Gretl. A correlation has been made of mutual linkages of measurable aggregates of macroeconomic competitiveness in individual economies for the period 1995-2013. The analyzed indicators are correlated, and the information is supposed to show the relationship among them.

By using the Pearson correlation coefficient r, see (5) 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.

$$r_{xy} = \frac{\sum_i (x_i - \bar{x})(y_i - \bar{y})}{(n-1)s_x s_y} \tag{5}$$

where n is the number of measurement, i is 1, ..., n, xi, yi are normally distributed random variables X and Y, are average values and sx, sy are standard deviations.

The basic equation for expressing panel regression is the following (6).

$$y = \beta_0 + \beta_1 x + \varepsilon \tag{6}$$

where β_0 and β_1 are the values of the parameters of the regression, ε is a random component.

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 β_0 and β_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 β0 a β1 are equal to zero.
H_1: Parameters β0 a β1 are not equal to zero.

To perform regression analysis, one independent variable was selected, that explain one dependent variable in individual economies for the period 1995-2013. The dependent variable in the model 1 to 3 is export performance, in the model 4 and 5 it is the degree of openness and in the model 6 the relative strength of specialization.

The autocorrelation was tested mathematically by Durbin – Watson (D–W) test. The value at D–W test at estimated model is below 1. The value acts for evaluation of autocorrelation presence (serial dependency of residual components connected with sectional and time influences of panel model). According to critical values of D-W test, the presence of autocorrelation was proved. The test of heteroskedasticity was made by using the White test.

The results of our tests are shown in the Table II.

Table II. The Results of Panel Regression

Model 1 EP

	Coefficient	Std. Error	t-ratio	p-value
const	350.055	2079.07	0.1684	0.8666
DOE	149.181	34.12	4.3722	<0.0001

R-squared	0.1458
adjusted R-squared	0.1382
p-value(F)	0.0002

Model 2 EP

	Coefficient	Std. Error	t-ratio	p-value
const	3168.56	2148.41	1.4748	0.11431
RSS	9905.64	3472.38	2.8657	<0.0001

R-squared	0.0683
Adjusted R-squared	0.0599
P-value(F)	0.0049

Model 3 EP

	Coefficient	Std. Error	t-ratio	p-value
const	-61.4674	304.962	-0.2016	0.8406
TI	1.79364	0.04883	36.7308	<0.0001

R-squared	0.9233
Adjusted R-squared	0.9227
P-value(F)	2.67e-64

Model 4 DOE

	Coefficient	Std. Error	t-ratio	p-value
const	26.8307	4.7688	5.6263	<0.0001
RSS	53.3102	7.7076	6.9165	<0.0001

R-squared	0.2992
Adjusted R-squared	0.2930
P-value(F)	3.02e-10

Model 5 DOE

	Coefficient	Std. Error	t-ratio	p-value
const	46.7143	2.47055	18.9085	<0.0001
TI	0.00230	0.00039	5.8186	<0.0001

R-squared	0.2321
Adjusted R-squared	0.2253
P-value(F)	5.73e-08

Model 6 RSS

	Coefficient	Std. Error	t-ratio	p-value
const	0.511824	0.02737	18.7003	<0.0001
TI	1.5895e-05	4.3825e-09	3.6268	0.0004

R-squared	0.1051
Adjusted R-squared	0.0971
P-value(F)	0.0004

The level of significance is compared with the p-values (F) in the table above. Thus, if these values are lower than the level of significance (they are in all cases), the null hypothesis can be rejected and so the alternative hypothesis is valid, therefore, variables are statistically significant. In all models, 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 level of significance is compared with the value P in the table above. Thus, if P value is lower than the level of significance, as in all of cases, we reject null hypothesis and so alternative hypothesis is valid, therefore, that both parameters are not equal to zero.

The values of correlation coefficient, which are shown as R-squared indicates the strength of dependence of selected variables only in model 3. Specifically, it means that the values set by export performance are approximately 92% dependent on changing of the transformational performance. In other models the indicators are independent of each other.

Other values shown in the Table II are the values of adjusted R-squared – it indicates how much of the total variance of the dependent variable is explained by this model. With exception of export performance variable with 92%, it is less than 30% in other cases.

The tests of autocorrelation and heteroskedasticity showed that our models have the high value of the first mentioned one (exept model 3) and no heteroscedasticity.

V. CONCLUSION

Competitiveness is a frequent subject for discussions and vocational articles. It is very important part of economic issue from the national, regional and firm point of view.

The measurement of macroeconomic competitiveness can be approached from the perspective of input indicators and output indicators. The output indicators of were chosen. They were based on these mathematical results the comparison of the economies of Visegrad Group plus - the Czech Republic, Hungary, Slovakia, Poland, Slovenia and Austria were carried out.

The aim of this paper was determine the dependence of measurable determinants of macroeconomics competitiveness of analyzed economies, by using the correlation and panel regression analysis with the period of the years 1995-2013. The autocorrelation and heteroskedasticity was tested as well.

According the model of panel regression we found, that all models are statistically significant, but only model with export performance and transformational performance showed the strong dependence without autocorrelation and heteroskedastiticy.

In our future research we try to make the test with the method GMM (Generalized Method of Moments) to compare our past results with the results of it.

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