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Nominal and Real Convergence of European Union and Western Balkan Countries: A Panel Data Analysis

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Diellza Kukaj[1]

Abstract:

Purpose: *In view of the fact that the economic future of the region is the European Union, this research paper studies the economic progress of the Western Balkan countries towards the EU, based on the performance of macroeconomic indicators. The purpose of the research paper is to analyse the macroeconomic indicators of the Western Balkan countries, the assessment of the economic growth per capita during the period 2000-2020, the expectations for the future, and the measurement of the economic progress of such countries towards the European path.*
Design/Methodology/Approach: *Through panel data using several econometric models, the consideration of the Maastricht criteria in achieving convergence between the Western Balkan countries and the European Union countries, is examined. Using the indicator of economic growth and the GDP per capita in purchasing power parity, the direct significance of the Maastricht criteria in the real convergence between these countries is measured.*
Findings: *Empirical results showed that there is a relationship between real and nominal convergence, with the nominal convergence being considered a prerequisite for achieving real convergence.*
Practical Implications: *The agenda for the idea of European expansion should become a genuine economic policy based on economic parameters measured and analyzed with research and scientific methods. As the study highlights different aspects of economic growth promoters, the quality of institutions is one of the critical indicators that mobilize macroeconomic factors to ensure economic growth in WB countries.*
Originality/Value: *This paper provides a fine scientific and research example in analyzing the convergence process. The results can serve as a good guide for policymakers in navigating the right path to EU membership.*

Keywords: *Convergence, panel data, economic growth, European Union, Western Balkan.*

JEL classification: *E50, E52, E58.*

Paper Type: *Research article.*

[1]*South East European Universitey, Business and Economy, dk28369@seeu.edu.mk;*

1. Introduction

Under the Treaty establishing the European Union, the reduction of the disparities in the level of development between EU regions and the monitoring of the progress of these countries is one of the main goals of the EU's economic policy, namely the convergence of regions with slower development towards common standards with the developed countries of the European Union. The 1992 Maastricht Treaty was one of the biggest developments of that time in the creation of the Economic and Monetary Union in Europe.

The membership of the countries in the EU required the fulfilment of some of the predetermined criteria contained in the Treaty. Such criteria are directly related to the achievement of nominal convergence, which basically aim to avoid asymmetric shocks, as well as to reduce the disparity in economic development between the EU countries before the establishment of the EMU in 1999. Compliance with such criteria caused some of these countries to lose some form of monetary sovereignty by leaving the EMU monetary authority in charge, making it impossible for such countries to have flexible powers at the level of economic policies.

The exchange rate and monetary policy were two of the key points over which member countries lost management control, with the European Central Bank having total control of the above policies. However, the fiscal policy remains the responsibility of the member countries under the limits of the requirements arising from the Stability Pact, which in principle aims to maintain public finances, price stability, low inflation pressures, and the promotion of policies that guarantee prosperous economic development.

Although most of the countries managed to have price stability and high control in keeping deficits in the Eurozone, for some of the countries the last two decades were not very productive in reaching the peak of economic development and stability in the employment rate.

The European Union, since its establishment, has as its primary goal the promotion of peace, stability and economic development in the Western Balkans as the only path in the perspective of integration. The Maastricht criteria for the Eurozone refer to indicators of economic convergence, such as inflation, public debt, budget deficit, interest rates and exchange rates, as mandatory criteria for becoming part of the Eurozone.

The time period of the study from 2000-2020 intrigues the analysis of the economic performance from the perspective of the global economic crises that hit the world economy. The perspective of the crisis prompts the analysis of two very important issues: analysing the last crisis since the birth of the common currency of the common monetary system in 1999, and the relationship between real and nominal convergence from 2000-2020.

The economic crisis has left its mark on the standard of living in the WB countries. The fall of the former Yugoslavia and the global crisis were accompanied by great economic uncertainties which in the long term made the recovery of the WB countries difficult.

However, the detailed analysis of the macroeconomic indicators opens up the opportunity to evaluate the common denominator of the WB countries that helps in the convergence towards the EU. According to Soukiazi and Castro (2005), the Maastricht criteria regarding the nominal convergence and its requirements have imposed some restrictions which can be called neither useful nor useless in the performance of the labour market or employment.

According to him, the EMU has put emphasis on maintaining price stability more than on promoting growth or increasing the employment rate in the EU, given that the indicators of the unemployment rate over a relatively long period of time do not seem to have undergone substantial changes.

From this point of view, the purpose of this research paper is to look at how the monetary criteria established by the Maastricht Treaty have influenced the real convergence in the Western Balkan countries and whether such parameters have had an impact on the acceleration of convergence towards the European Union.

To this end, some of the research questions based on the main objectives of the research are as follows:

1. What are the macroeconomic indicators that have a significant impact on the economic growth of the countries subject to the study?
2. How has the global crisis affected the economic perspective, namely the real convergence?
3. What is the impact of public debt on the economic development of the Western Balkan countries and the EU countries?

On this basis, the following hypotheses that answer the research questions are formed:

Hypothesis 1: Meeting the Maastricht criteria ensures economic sustainability for WB and EU countries.
Hypothesis 2: The economic crisis has negatively affected the real convergence of WB and EU countries.
Hypothesis 3: Public debt above 60% has a negative impact on economic growth in WB and the EU.

In order to test the hypotheses, the Pooled OLS method with a robust model and panel data has been used since there is more data available than with the time series method, as well as the fixed and random effects, and finally the Hausman-Taylor

method as an econometric method that determines the right model of study. The panel data approach is an econometric model through which β convergence is measured.

Applied dynamic panel data model or generalized method of moments is also known as the GMM estimator. Initially, this method is used in the dynamic panel data evaluation and the dynamic panel data system known as the GMM-SYS estimator (Arellano and Bond, 1991), and in the end the GLS regression one step and two step difference method shall be used.

The data are obtained from relevant statistical bodies, such as Eurostat, the World Bank and the International Monetary Fund. Although the Western Balkan countries stand out for the lack of data, especially for the initial period of 2000, various scientific works, reports and analyses issued by the central banks of the respective countries enabled the recognition of the economic circumstances of the countries subject to study.

2. Literature Review

Convergence theory has been studied by different authors at different times. Among the first authors who have studied the theory of beta convergence was the author Baumol (1986) through the Cross-Sectional method. Afterwards, with the same method, the same convergence was studied by Barro and Sala-i-Martin (1992) and Mankiw, David, and David (1992), namely with the same data approach, but analysing the type of conditional convergence.

Whereas, with the panel data approach through the generalized method of moments (Esposti and Stefania, 2008) have studied the absolute correlation (Bernard and Durlauf, 1996; Lopes, 2016) through time series have analysed the convergence of time series. It was Islam (1995) who, in the three groups of countries studied, found evidence for beta conditional convergence, but not absolute convergence.

The author found the possibility of reproducing the results of Mankiw, David, and David (1992) according to whom, based on the NCGT model, the results have shown low convergence rates and higher α value. Whereas, with the use of the panel approach, namely the fixed effect regression models, a higher rate of convergence as well as a lower α rate are shown. Yet, the analysis of this topic is also supported by Temple, (1999), De la Fuente, (1997), as well as others whom we will discuss below.

The cross-sectional data approach has been used among the first studies done on beta convergence. Baumol (1986) in a study of OECD countries for a relatively long period of time found evidence for absolute convergence but not for the relative one. Whereas, Barro (1991) in a sample of countries known as Maddison countries found evidence for conditional convergence but not for absolute convergence. The same,

Barro and Sala-i-Martin, (1991) in their two studies, one for US countries and the other for 73 regions of 7 Western Balkan countries, found evidence for absolute convergence as well as conditional convergence.

In addition, many authors have analysed conditional and absolute convergence using time series and panel data approaches. Among the main studies carried out using the panel data approach were those of Islam 1995 from which empirical evidence was found for conditional beta convergence.

Svvides (1995) generates the same result for 28 African countries, however, in addition to the evidence for conditional convergence, he also found evidence for absolute beta convergence. Young, Higgins, and Levy (2008) in their study of the 50 US countries through panel data applying the regression method found sufficient evidence for two types of beta convergence – the conditional and the absolute ones. Using the time series approach, different authors have also produced different results in terms of beta convergence. Among the firsts, Bernard and Durlauf (1996) in OECD countries failed to find sufficient evidence for none of beta convergence type.

However, unlike the mentioned authors, Greasley and Oxley (1997) found different evidence in the different countries subject to the study. Convergence of both types was found in two groups of countries; initially in countries such as Belgium, the Netherlands, France, Italy, Australia, and then in the second group composed of the United Kingdom, Sweden and Denmark.

Meanwhile, for the 7 OECD countries, no evidence was found for the two types of Beta convergence. Among recent studies of convergence in OECD countries, Lopes (2016) found evidence of unconditional convergence for countries such as Austria, Denmark, France, Germany, Italy, Japan and the Netherlands.

Meanwhile, Austria, Belgium, Canada, Finland, Norway, UK, Switzerland and Sweden did not show empirical evidence for this type of convergence. Meantime, in the analysis of nominal convergence through the study of the impact of macroeconomic factors on economic growth, the authors Soukiazi and Castro (2005) reached interesting results through the panel data approach. Although the coefficient for the initial level of output is negative for all estimates, not all of them were significant.

In the assessment of convergence in the EU countries, the author came to the conclusion that the rate of convergence is very slow. If the macroeconomic indicators are to be referred, the author estimates that the public debt does not have a negative effect on economic growth, while the debt ratio shows a positive effect on economic growth, suggesting that the reduction of the public deficit affects the degree of convergence. Among the indicators with the highest impact was inflation. As a result of its negative impact on economic growth, the increase in inflation reflects the reduction of purchasing power and lowers income performance.

Krstevska (2017) in her study of real convergence with empirical evidence in WB countries concluded that real and nominal convergence are related to each other and that nominal convergence is presented as a precondition that ensures macroeconomic stability in favour of real convergence.

Thus, achieving nominal convergence with macroeconomic indicators is a prerequisite for achieving real convergence. According to her, during the global crisis, the reduction of the gap in unemployment and current account deficit has ensured real convergence and economic growth. In addition, the global crisis was one of the main indicators that estimated that the great distance from the reference points (defined by the Maastricht criteria), such as the budget deficit and inflation, are factors that negatively affect the achievement of the degree of convergence.

3. Research Methodology and Data

In this section, the empirical econometric model that assesses the degree of convergence of the WB and EU countries is developed and discussed, namely the analysis of sigma and beta convergence through the cause-and-effect relationship, namely the impact of macroeconomic factors determined by the Maastricht criteria on economic development.

Given the advanced scientific models, the hypotheses presented are confirmed or refuted. In this respect, Pooled OLS, Dynamic panel data estimation GMM, fixed and random effects, as well as Hausman-Taylor tests are used. Hausman-Taylor are used in the role of determining which of the fixed or random models is empirically more reliable. While for the analysis of sigma convergence, the formula of the standard deviation of the logarithm for GDP per capita is applied.

4. Empirical Model

The multiple regression method is used to predict the value of the dependent variable in the study, namely the impact of public debt, exchange rate and inflation on the economic development of the countries subject to the study. A large part of the literature deals with the dynamic evaluation of panel data in providing optimal linearity through econometric evaluation methods, one of them being GMM (Blundell, Bond, and Windmeijer, 2012). GMM is an econometric estimator widely used in statistics as a generalized method of moments to identify and estimate parameters in statistical models (Ahn and Gadarowski, 1999; Zampeta and Chondrokoukis, 2022; 2023).

According to Sayrs (1989), Pooled OLS is a type of regression which does not contain cross-sectional effects or time effects. The structure of the errors is simple and their distribution is independent and uniform, which means they have zero mean and variance (Thalassinos *et al.*, 2015). The effects of the Pooled old model will be presented in the summary of empirical results in section 5. As for the Hausman-

Taylor model, this model is considered to be more consistent than the fixed and random models. This analysis in our study is used to test the relationship between variables, such as public debt to GDP in the case of analysing the economy of the Western Balkans, while in the case of the European Union countries the relationship between inflation, budget deficit and public debt with GDP per capita is studied.

By using the Hausman-Taylor approach we also solve the endogeneity problem which is of particular importance in the econometric field.

The empirical model of Hausman-Taylor is presented below:

$$y_{it} = c + \beta_1(y_{it-1}) + \beta_2\,(inflation)_{it} + \beta_3\,(exchrate)_{\,it} + \beta_4\;\;(gpv\_debt)_{it} + \beta_5\,(deficit\_gdp)_{it} + \beta_6(gpv\_debtsqr)_{it} + u_{it} \quad (1)$$

wherein Y_{it} is the dependent variable that represents the real GDP per capita for each i country, while t represents the years; the constant term is represented by c; and explanatory variables including lag1 of GDP per capita, inflation, exchange rate, public debt, budget deficit, and debt squared. Table 1 presents the countries included in the study and Table 2 the descriptive statistics.

Table 1. *Countries included in the study*

Acronym	**Description**	**Countries**
C/PC	Candidate countries and potential candidate countries for EU membership	Albania, Montenegro, Macedonia, Kosovo, Bosnia and Herzegovina, and Serbia
EU27	Since the study covers the time period from 2000-2020 and the UK left the EU in January 2020, we will refer to the EU member states as the EU27	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Finland, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia, Germany, Denmark, Spain, France, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Sweden and United Kingdom.
CEE/SEE	Countries in transition C/PC and EU10;	Albania, Montenegro, Macedonia, Kosovo, Bosnia and Herzegovina, Serbia, Bulgaria, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

Source: *Author's elaboration.*

The study uses Panel data that have been collected by relevant institutions for statistical data, such as the World Bank, the International Monetary Fund, Eurostat and other institutions mentioned throughout this research paper. The study includes the Western Balkan countries, EU member countries and countries that have gone through transition in the last two decades.

The time period is from 2000 to 2020, since this period has marked two major shocks known as the global crisis of 2008 and the Covid crisis, which makes the data structure more interesting. The selected time period also provides data in time series for all variables included in the model GDP per capita, inflation, public debt, and budget deficit, as it provides data for all countries subject to the study, such as the EU27, the Western Balkan countries and CEESEE. Table 1 defines the abbreviations of the countries part of the study, the group division, and the content of each group of countries in which nominal and real convergence is analysed, and Table 2 provides a brief statistical summary for the variables part of the econometric models.

Table 2. *Descriptive statistics*

Variable	Obs	Mean	Std.Dev.	Min	Max
lngdp_cap_~p	588	10.29925	0.4915989	8.674303	11.70323
inflation	588	2.459031	3.265092	-4.48	45.67
exchrate	588	11.02194	44.77296	0.5	308
gpv_debt	588	58.91905	34.63522	3.8	206.3
deficit_gdp	588	-2.588639	3.616097	-32.1	6.9

Source: *Author's calculation*

5. Empirical Results

In this part, the results of beta convergence are presented in the form of tables and their interpretation for the three groups of countries subject to the study: the Western Balkan countries, the European Union countries and the countries in transition. The methods used are Pooled regression OLS, System dynamic panel-data estimation GMM - SYS (one step and two step difference), Dynamic panel-data estimation GMM - DIFF, one-step difference, and in the end, the Random-effects GLS regression.

The measurement results of the models applied to the groups of countries subject to the study showed a not very high empirical significance of convergence β. Although the regression equations show a negative slope, or a negative ratio for each analysed period, the non-significant statistical properties reflected by a lower R square clearly speak of the small number of variables included in the model. However, the significance at the level of the variables is extremely high, shown by the fact that the p value in almost all cases is lower than 0.01.

When analysing beta convergence for socialist countries (Rapacki and Prochniak, 2009) said that beta convergence usually appears in shorter periods. However, our empirical results indicate that such short-term movements do not become very visible compared to the long-term ones (Kočenda, 2001; Battisti and De Vaio, 2008; Próchniak and Witkowski, 2013; Barro and Sala i Martin, 2004).

Using the theories of the authors in the study, the concept of half-life is also calculated, which shows how many years pass until the economy covers half the distance between the current positions and the stable steady state.

Table 3 shows the empirical results of the Pooled OLS regression model. In this case, based on the result of coefficient α_1 it is noted whether there is convergence or not. In cases where there is no convergence, we say that we have divergence, that is, the countries produce a counter-converging effect throughout the studied period.

Our evidence shows that per capita beta convergence has an average rate of 2 in the Pooled OLS effect estimates, therefore it is estimated that it takes 52 years to eliminate half of the differences in living standards between EU countries – 37 years between WB countries and 57 years between CEESEE countries. Similarly, the authors (Battisti and De Vaio, 2008) with the same method failed to find evidence for absolute convergence but only conditional convergence of certain regions.

Table 3. *Pooled OLS regression model results*

Pooled OLS

Sample	BP6	BE27	CEESEE
Period	2000-20	2000-20	2000-20
β	-0.019	-0.013	-0.012
p value	0.0000	0.0000	0.0000
Absolute β Convergence	yes**	yes**	yes**
Half-life	37	52	57
const	1.174	1.136	1.118
	0.0000	0.0000	0.0000
obs	125	587	335

Note: ****1%; ** 5%; * 10% - level of significance*
Source: *Author's calculation.*

The random model is generally known as the change components model, through which it is assumed that the data is analysed in line with different sample hierarchies. An element that makes this method more specific is the possibility of longer inclusion of invariant variables.

Table 4 contains the empirical findings according to the GLS method. The results for the three groups of countries show presence of convergence with a relatively high level of significance.

Table 4. *Randmos-effects GLS regression*

Random-effects GLS regression

	BP6	BE27	CEESEE
β	-0.019	-0.013	-0.012
	0.0000	0.0000	0.0000
_cons	1.202	1.136	1.118
	0.0000	0.0000	0.0000

obs	125	587	335
Wald chi2(1)	13.71	46.23	23.91
Prob > chi2	0.000	0.000	0.000

Note: ****1%; ** 5%; * 10% - level of significance*
Source: *Author's calculation.*

Table 5 contains the results from the GMM estimators with the dynamic Arellano Bond model with panel data. The null hypothesis of the Sargan test assumes that "instruments as a group are exogenous".

Table 5. *System dynamic panel-data estimation GMM - SYS*

System dynamic panel-data estimation GMM - SYS

	BP6		**BE27**		**CEESEE**	
	1-step	2-step	1-step	2-step	1-step	2-step
L1.	-0.012	0.016	-0.027	-0.1	0.007	0.007
	0.519	0.709	0.026	0.000	0.486	0.081
β	-0.004	-0.026	-0.005	-0.007	-0.006	-0.007
	0.0000	0.2350	0.0000	0.0000	0.0000	0.0000
convergence	yes	no	yes	yes	yes	yes
half life						
_cons	1.058	1.231	1.083	1.18	1.053	1.064
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wald chi2(2)	19.47	2.21	48.46	3282.24	75.28	418.4
Prob > chi2	0.0000	0.3320	0.0000	0.0000	0.0000	0.0000

Note: ****1%; ** 5%; * 10% - level of significance.*
Source: *Author's calculation.*

Usually, the test for AR1 in the first difference rejects the null hypothesis, whereas the AR2 test is considered to be more important because it identifies autocorrelation in levels.

The second part of the table contains post estimation tests known as correlation tests and instrument validity tests. The autocorrelation test, namely the null hypothesis, says that there is no autocorrelation in the model, thus for AR1 for EU27, WB6 and CEESEE countries, the null hypothesis cannot be rejected.

Meanwhile, for AR2 for the groups of countries subject to the study, the null hypothesis is accepted. As for the hypothesis of the Sargan test, in all the groups analysed the hypothesis of the validity of instruments is accepted. This means the existence of beta convergence in all the groups of countries analysed.

Above all, these results are evidenced at a high-level significance. This theory is also consistent with Esposti and Stefania (2008), and Próchniak and Witkowski (2013) who, with the same method, measured convergence for groups of countries within the European Union.

Table 6. *Dynamic panel-data estimation, GMM - DIFF*

Dynamic panel-data estimation, GMM - DIFF						
	BP6		BE27		CEESEE	
	1-step	2-step	1-step	2-step	1-step	2-step
β	-0.024	-0.02	-0.038	-0.012	-0.026	-0.011
	0.000	0.036	0.000	0.000	0.000	0.000
Absolute β convergence	yes**	yes*	yes**	yes**	yes**	yes**
obs	119	125	559	587	319	335
Wald $chi^2(1)$		5.00E+06		7.00E+07		3.00E+06
Prob > chi^2		0.000		0.000		0.000
Arellano-Bond test for AR(1) in first differences:	z = -0.71 Pr > z = 0.479	z = -0.97 Pr > z = 0.330	z = -2.61 Pr > z = 0.009	z = -1.02 Pr > z = 0.306	z = -0.28 Pr > z = 0.779	z = -1.04 Pr > z = 0.298
Arellano-Bond test for AR(2) in first differences:	z = 0.20 Pr > z = 0.841	z = 0.58 Pr > z = 0.559	z = 0.14 Pr > z = 0.888	z = -2.54 Pr > z = 0.011	z = 0.15 Pr > z = 0.879	z = -0.48 Pr > z = 0.634

Note: ****1%; ** 5%; * 10% - level of significance.*
Source*: Author's calculation.*

5.1 Nominal Convergence

Based on convergence equation 1, this section interprets the result from the linear regression. First, referring to the equation, variables are shown when GDP per capita in PPP represents y or the dependent variable, while lag of GDP per capita, inflation, exchange rate, public debt, and budget deficit are independent variables and represent the error term. Table 7 presents the results observed from the evaluation of the convergence equation applied to panel data for EU27 countries for the time period 2000-2020.

Using the Pooled estimates regression technique, with the application of the factors determined according to the Maastricht criteria, the first column from Table 5 presents the empirical results achieved by this method, the second column presents the empirical results of the method with fixed effects, the third column the random method effect, and finally the fourth column presents the specification of the Hausman-Taylor model or the determinant of which of the Fixed or Random methods used is more suitable or statistically more reliable for interpretation.

In general, the results consist of the effect that in theory each of the macroeconomic indicators have on economic development in general, namely on the performance of

income per capita. The negative indicator for estimators proves the negative relationship that the variables have to GDP per capita.

Table 7. *Regression Results*

Variables	OLS gdp_percapita	Fixed effects gdp_percapita	Random effects gdp_percapita	Hausman Taylor gdp_percapita
gdp_percapita				
L1.	0.0000204*	0.0000121*	0.000017*	-0.00000485
s.e.	**(0.000000671)**	**(0.000001)**	**(0.000000821)**	**(0.000000573)**
inflation	-0.0383724*	-0.035574*	-0.0376865*	0.0021125
s.e.	**(0.0034907)**	**(0.0034121)**	**(0.0034492)**	
exchrate	-0.0003565***	-0.0005408	-0.0005527***	0.0000119
s.e.	**(0.0002415)**	**(0.0012369)**	**(0.0003851)**	**(0.0011754)**
gpv_debt	0.0054233*	0.0071078**	0.0054545*	0.0016533
s.e.	**(0.0009927)**	**(0.0015499)**	**(0.0012336)**	**(0.0009383)**
deficit_gdp	0.0123915*	0.0101491**	0.0115992*	-0.0014501
s.e.	**(0.0032862)**	**(0.0032316)**	**(0.0032637)**	
gpv_debtsqr	-0.0000241*	-0.0000257	-0.0000224*	-0.00000329
s.e.	**(0.00000587)**	**(0.00000816)**	**(0.00000704)**	**(0.00000412)**
nr obs	587	587	587	587
R-square	0.7327			
F	264.96			
Chi^2				77.77
Prob>chi^2				0.0000

Note: ***Statistically significant at 1% level; **Statistically significant at 5% level; *statistically significant at 10%

Source: *Author's calculation.*

As for public policy, the ratio of public debt and economic growth is seen to be negative, suggesting that the high level of public debt, in this case its doubling according to our analysis, shows that the high levels, which on average exceed the limits of the Maastricht criteria (debt square), have a negative impact on the standard of living and have a damaging effect on the converging process as well. As for the ratio of economic growth and the budget deficit, empirical evidence shows that currently the budget deficit does not have a negative impact on the growth of production per capita.

From the perspective of monetary policy, inflation according to empirical results has a negative impact, which reflects in the reduction of purchasing power and reduces the economic performance of the countries. The same applies to the exchange rate. The empirical results show that it has a significant negative impact on income per capita. It is worth noting that the overall model significance indicator F statistic of 72%, shows that the importance of all variables part of Maastricht regulatory

framework is accepted in all regressions, and that the included variables represent reasonably or explain 72% of the problem presented. All such mentioned implications are in accordance with the theory and study carried out by the author (Soukiazi and Castro, 2005).

6. Conclusions

The main purpose of this study was to measure the real and nominal convergence for the three groups of countries, the European Union countries, Western Balkan countries and the transition countries of Europe. As a result, the interdependence of real and nominal convergence should also be considered. The empirical results from the analysis are quite interesting. Having applied the Pooled OLS, GLS, and GMM methods, the empirical results on absolute convergence confirm absolute β convergence for all sample groups, namely the countries subject to the study.

In some cases, there have also been found mixed results which show both convergence and divergence. Finally, the dynamic GMM model confirms conditional convergence with a rate of 1.2% in the Western Balkan countries, 2.6 in the CEESEE transition countries and 2% in the EU15 countries of the European Union (joined before 2004).

As for the nominal convergence, the empirical results prove that the Maastricht criteria are relevant for the health of the economies as defined. The effect of the Maastricht criteria is also important in achieving real convergence as well. That shows the connection between them and, as the theory predicts, real convergence is considered to be a prerequisite for achieving nominal convergence.

When the influence of the Maastricht components was approached separately, it was seen that the public budget exceeding the predetermined threshold and inflation had the greatest and most important influence on the growth of income per capita. Inflation and the excess of public debt showed a negative impact on economic performance in EU countries. Meanwhile, the budget deficit at a considerable level of significance did not show a negative trend in the economic health of the EU states.

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Appendix:

```
. regress lngdp_cap_ppp gdp_cap_ppplag1 inflation exchrate gpv_debt deficit_gdp gpv_debtsqr
```

Source	SS	df	MS	Number of obs	=	587
				F(6, 580)	=	264.96
Model	103.939502	6	17.3232503	Prob > F	=	0.0000
Residual	37.9203682	580	.065379945	R-squared	=	0.7327
				Adj R-squared	=	0.7299
Total	141.85987	586	.24208169	Root MSE	=	.2557

lngdp_cap_ppp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gdp_cap_ppplag1	.0000204	6.71e-07	30.43	0.000	.0000191	.0000217
inflation	-.0383724	.0034907	-10.99	0.000	-.0452283	-.0315164
exchrate	-.0003565	.0002415	-1.48	0.141	-.0008308	.0001179
gpv_debt	.0054233	.0009927	5.46	0.000	.0034736	.007373
deficit_gdp	.0123915	.0032862	3.77	0.000	.0059371	.0188458
gpv_debtsqr	-.0000241	5.87e-06	-4.10	0.000	-.0000356	-.0000125
_cons	9.542314	.0421897	226.18	0.000	9.459451	9.625177

```
. xtreg lngdp_cap_ppp gdp_cap_ppplag1 inflation exchrate gpv_debt deficit_gdp gpv_debtsqr, re

Random-effects GLS regression                   Number of obs      =       587
Group variable: code                            Number of groups   =        28

R-sq:                                           Obs per group:
     within  = 0.4357                                         min =        20
     between = 0.9442                                         avg =      21.0
     overall = 0.7287                                         max =        21

                                                Wald chi2(6)       =    822.32
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000
```

lngdp_cap_ppp	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
gdp_cap_ppplag1	.000017	8.21e-07	20.68	0.000	.0000154	.0000186
inflation	-.0376865	.0034492	-10.93	0.000	-.0444468	-.0309261
exchrate	-.0005527	.0003851	-1.44	0.151	-.0013075	.000202
gpv_debt	.0054545	.0012336	4.42	0.000	.0030367	.0078722
deficit_gdp	.0115992	.0032637	3.55	0.000	.0052024	.0179959
gpv_debtsqr	-.0000224	7.04e-06	-3.19	0.001	-.0000362	-8.63e-06
_cons	9.646	.0516614	186.72	0.000	9.544745	9.747255
sigma_u	.07339814					
sigma_e	.22679792					
rho	.09480556	(fraction of variance due to u_i)				

```
. hausman fe re
```

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
gdp_cap_pp~1	.0000121	.000017	-4.85e-06	5.73e-07
inflation	-.035574	-.0376865	.0021125	.
exchrate	-.0005408	-.0005527	.0000119	.0011754
gpv_debt	.0071078	.0054545	.0016533	.0009383
deficit_gdp	.0101491	.0115992	-.0014501	.
gpv_debtsqr	-.0000257	-.0000224	-3.29e-06	4.12e-06

```
                b = consistent under Ho and Ha; obtained from xtreg
     B = inconsistent under Ha, efficient under Ho; obtained from xtreg

  Test:  Ho:  difference in coefficients not systematic

              chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =       77.77
            Prob>chi2 =      0.0000
            (V_b-V_B is not positive definite)
```