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Article

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THE EFFECTS OF GAPS AND DISPARITIES ON ECONOMIC GROWTH.
A STUDY OF 10 FORMER SOCIALIST COUNTRIES
FROM CENTRAL EASTERN EUROPE, MEMBERS OF THE EU

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Abstract

The goal of this research paper is to empirically assess the potential effects of macroeconomic determinants of economic growth and to determine the impact of income inequality on economic growth in the long-run in ten former socialist countries from Central and Eastern Europe (CEE) which are members of the European Union (EU) during the period 2006-2014, using the System Generalized Method of Moments (GMM) as the research method. In order to achieve all the desired research objectives the following explanatory variables were used: income inequality (Gini Index), foreign direct investments (FDI), education, research and development expenditure, exports, population growth, labour productivity, tax rate, inflation rate and the Corruption Perception Index (CPI). The dependent variable employed in the empirical analysis, a proxy for the economic growth, is GDP per capita growth (annual %). The main finding of this paper's investigations is that income inequality has a positive and statistically significant impact on economic growth and a 1% increase in the Gini coefficient enhances the GDP by 0.68% in the ten former socialist Central and Eastern European (CEE) countries which are members of the European Union (EU) during the period 2006-2014.

Keywords: economic growth, income inequality, Central and Eastern European (CEE) countries, European Union (EU), system Generalized Method of Moments (GMM), disparities, macroeconomics.

JEL Classification: C51, C52, O11, O15, O23, O47, O57

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Introduction

The aim of this paper is to assess the role of income inequality in the economic growth of ten former socialist Central and Eastern Europe (CEE) member states of European Union (EU), during the period 2006-2014, to identify the macroeconomic factors that explain the economic development of a country and to evaluate their impact on the well-being of said country. Keeping in mind that the EU is currently expanding, the focus put on the CEE countries is of real interest, given the particularity of this group of EU member states. Although income inequality in CEE countries was significantly lower during socialism compared to other countries at similar levels of development, it raised in the last decades following the collapse of communist regimes.

Having chosen these countries as a geographically specific area for analysis is explained by the fact that they are part of a homogeneous group of former socialist countries that generated specific cases and situations, benefiting from greater comparability considering that they are members of the EU and have the same political and economic changes imposed and carried out in just two and a half decades.

The authors of this paper have approached economic growth as "an increase in the capacity of an economy to produce goods and services, when compared one period of time with another" (Business Dictionary, 2016), while the significance of economic development was linked to "the progress in the economy or the qualitative measure of it. It usually refers to the implementation of new technologies, the transition from agriculture-based to the industry-based economy, and general improvement of the living standards" (Business Dictionary, 2016). There are various ways and instruments to measure economic development, the most often mentioned is that of the Human development index (HDI) which combines three indexes: Life Expectancy Index, Education Index, Income Index (GNI at PPP).

"Income inequality refers to the extent to which income is distributed in an uneven manner among a population or, in other words, the gap between the rich and everyone else" (Inequality.org 2016).

The Gini coefficient is "a measure of statistical dispersion intended to represent the income distribution of a nation's residents, and is the most commonly used measure of inequality (Wikipedia, 2016). If all people have non-negative income, the Gini coefficient can theoretically range from 0 (complete equality or absolute income diversification) to 1 (complete inequality or absolute concentration of income)" (Săvoiu, 2010).

The Struck coefficient is a corrected form of the Gini coefficient and the values it can take are in the range of [0,1].

"Concentration is meant generally as an agglomeration of units of statistical population or global values of a distribution around a typical value of the analyzed variable X. Complementary, it is defined the concept of diversification. The greater the differences between two distributions of structure the greater disparities between the groups of units, which means that there is a concentration that tends to increase, and vice versa, if the differences between the distributions of structure are smaller, the concentration is lower (higher diversification), tending towards equipartition (egalitarian distribution). The concentration is at its maximum (diversification is minimum) when one unit of the population holds the global value of the variable analyzed" (Voineagu, Mitruț and Maniu, 2003).

From the WDI data it is observed that the average GDP per capita growth (annual %) for the 10 CEE countries was steady and above the EU28 average except for the year 2009, the year immediately afterwards the onset of the economic crisis. The CEE countries depend heavily on exports to the EU15 member states and taking into consideration the economic crisis hit hard their economy, the CEE economies had also a lot to suffer. Moreover, the best year for the CEE10 countries was 2007 and the worst 2009.

As concerns the HDI statistics from the United Nations Development Programme (United Nations 2016) it is noted that the average of the EU28 is above the CEE10 average for the period 2010-2014. This means that, although the CEE10 countries have higher economic growth than the EU28, their level of economic development is inferior to the latter. Regarding the Gini index (World Bank estimate) for the CEE10 countries, it is observed it ranges from 30% to 32% in the analyzed period, and it is slightly below the EU27 average. Thereby, the authors notice that the income inequalities from the CEE10 countries are slightly below the EU27 member states and can be quantified as being medium.

The research aim of the investigation will be attained through the following objectives:

- identifying the macroeconomic factors that might explain the economic development of a country, to test them empirically and to evaluate their impact on the well-being of that country;
- establishing empirically if the relationship between income inequality and economic growth is positive or negative in the long-run for ten former socialist countries of Central and Eastern Europe (Romania, Bulgaria, Estonia, Latvia, Lithuania, Czech Republic, Slovakia, Slovenia, Hungary and Poland).

The central research questions that arose after studying the literature are the following:

- What are the macroeconomic factors that explain the evolution of economical development of a country and what is their impact on the well-being of that country?
- What are the effects of income inequality on economic growth in the long-run?

The paper is structured as follows: in the first section are presented the importance and motivation for studying the economic growth macroeconomic factors for an economy and a comparative analysis between the EU average and ten former socialist CEE countries, members of EU; Section 2 presents a review of the recent theoretical and empirical literature; in the third section the research methodology and the data are described; in the fourth section the main empirical results are displayed, while in the last section are the conclusions and presentation of ideas for future research.

1. Review of the scientific literature

In the 1950's and 1960's Nicholas Kaldor (1957) and Simon Kuznets (1955) showed that there is a trade-off relationship between diminishing inequality and increasing economic growth. During the 1990's many empirical studies suggested the negative and statistically significant impact of inequality on growth.

Forbes (2000) used more elaborate econometric methodology to overpower the risk of biased estimators, and employed in his research a broader dataset for inequality created by

Deininger and Squire (1996). The author discovered a positive and statistically significant relationship in the short-term and medium-term.

Afterwards, the first-differences GMM estimator (variation in the log output regressed against variation in the lagged inequality) is employed in the empirical literature which solves the problem of unobserved heterogeneity but is criticised for ignoring cross-sectional variation, so the system GMM estimator is used (log output is regressed against a lagged Gini coefficient) which exploits the cross-country variation.

When the researchers employ the first-difference GMM estimator, it picks up only the short- and medium-run effects and finds a positive relationship between income inequality and economic growth whereas when they use the system GMM estimator they find a positive relationship in the short-run and negative in the long-run between the inequality and growth.

The authors decided to employ as a proxy for economic growth the dependent variable GDP per capita growth (annual %) from the World DataBank (2016). The Gross Domestic Product, the main aggregate for measuring the economic growth and development of a country is a commonly used measure to assess its economic potential. Aimed at assessing the effects that income inequality has on economic growth, it is necessary to select a macroeconomic indicator that best capture the dynamics of economic growth in the context of income distribution disparity. Thus, this variable was selected to reflect the constraints of economic growth and to capture the best the differences in economic growth in several countries, including their relative performance, given the fact that the database analyzed is panel-type.

The list of variables whose potential impact on economic growth has been appraised is long. Below the independent variables that frequently appear in the research articles are enumerated:

- A measure of inequality such as the Gini coefficient for income inequality in the papers of Barro (2000), Forbes (2000), Banerjee and Duflo (2003), Knowles (2010), Voitchovsky (2005), Castelló-Climent (2010), Ostry, Berg and Tsangarides (2014) and Halter, Oechslin and Zweimüller (2014) or land inequality in the papers of Deininger and Olinto, (2000) and Keefer and Knack, (2000) or human capital inequality in the paper of Castelló-Climent (2010);
- The human capital dimension was proxied by the following variables: years of schooling at beginning of period (Barro, 2000), average years of schooling (Forbes, 2000), mean years of education (Lundberg and Squire, 2003), secondary and higher education (Banerjee and Duflo, 2003) and college graduates (Rooth and Stenberg, 2012);
- Trade openness (exports) was studied by Barro (2000), Barro (2008), Lundberg and Squire (2003), Castelló-Climent (2010) and Afonso and Furceri (2008);
- The fiscal policy is assessed through the following variables: distortionary and non-distortionary taxes, productive and non-productive government spending in the work of Kneller, Bleaney and Gemmel (1999) and the government consumption per GDP in the investigations of Barro (2000), Lundberg and Squire (2003), Croix and Doepke (2003), Romer and Romer (2006) and Afonso and Furceri (2008);

- The monetary policy was estimated by the inflation rate in the works of Barro (2000), Castelló-Climent (2010) and Lundberg and Squire (2003);
- The financial sector development was proxied by M2/GDP in the study of Lundberg and Squire (2003);
- Labour force growth or population growth (average growth rate of population) were introduced in the studies of Afonso and Furceri (2008) and Kneller, Bleaney and Gemmel (1999);
- The investments variable is found in the investigations of Barro (2000) and Afonso and Furceri (2008) as investment share of GDP and the works of Croix and Doepke (2003), Voitchovsky (2005) and Kneller, Bleaney and Gemmel (1999) as investment rate;
- The New Economy dimension expressed by the variable research and development expenditure (% of GDP) which was used in the studies of Goel and Ram (1994) and Pop Silaghi et al. (2014);
- The business environment – legal system was proxied by the Corruption Perception Index (CPI) which was employed in the works of Glaeser and Saks (2006) and Johnson, LaFountain and Yamarik (2011).

Regarding the Gini coefficient for income inequality, Panizza (2002), Keefer and Knack (2000), Croix and Doepke (2003) and Ostry, Berg and Tsangarides (2014) found a negative relationship between income inequality and economic growth; Forbes (2000) and Rooth and Stenberg (2012) found a positive correlation between these variables and Banerjee and Duflo (2003), Voitchovsky (2005) and Castelló-Climent (2010) discovered that the income inequality impacts positively the economic growth of rich or developed countries or the ones situated at the top of the distribution, whereas the income inequality has a negative effect on the growth of poor or developing countries or the ones located at the bottom of the income distribution.

Taking into consideration that the Gini coefficient of income inequality was the most frequently used measure of inequality the authors have also employed it in their investigation.

According to Cingano (2014), “econometric analysis suggests that income inequality has a negative and statistically significant impact on subsequent growth.” Matins-bekas and Kulkarni (2009) apply in their paper the Kuznets hypothesis to the Brazilian case and their tests show that the Gini index has behaved as Kuznets predicted.

As concerns the Gini coefficient for land inequality, Deininger and Squire (1998) discover that its effect on growth is negative for the whole sample, insignificant in democracies and negative in non-democracies, insignificant in rich and negative in poor countries.

Concerning the Gini coefficient for human capital inequality, Castelló-Climent (2010) finds that its impact on growth is negative for the whole sample, even when income and human capital inequality are considered simultaneously.

According to Lundberg and Squire (2003), education is correlated with both faster growth and lower income inequality. Rehme (2007) establishes that “education simultaneously affects growth and income inequality. Increases in education first increase and then

decrease growth as well as income inequality when measured by the Gini coefficient". According to Colombier (2011), public expenditures on education support growth.

Lundberg and Squire (2003) observe that Sachs-Warner openness index increases growth but decreases equality (coefficients and joint significance test). Barro (2008) also discovers that the openness ratio has an increasingly high inequalising effect, yet it stimulates growth.

As Kneller, Bleaney and Gemmell (1999) state, "distortionary taxes reduce growth whereas non-distortionary taxes do not; productive government expenditures stimulate growth, whereas non-productive expenditures do not". Afonso and Furceri (2008) finds that government revenue and spending in OECD and EU countries are detrimental to growth.

In assessing the monetary policy's impact on economic growth, Lundberg and Squire (2003) discover that inflation is correlated with both faster growth and lower income inequality.

In the works of Moore and Vamvakidis (2007) and Kneller, Bleaney and Gemmell (1999), the population growth is negatively correlated with the economic growth of the investigated country.

The FDI inflows are considered an important channel for the spread of new technologies and business skills across national borders. Also, FDI is seen as „an indicator of economic openness and integration in the world market" (Pazienza and Vecchione, 2009). Moreover, „FDI is viewed as a major determinant of economic growth, both directly and indirectly, via exports for both long and short-run cases" (Andraz and Rodrigues, 2010).

According to Borensztein, De Gregorio and Lee (1998), "inward foreign direct investment (FDI) promotes the economic growth in a less developed host country only when the host country obtains a threshold level of secondary schooling". Pereira, Jalles and Andresen (2012) discover that FDI is negatively related to GDP per capita, but positively related to trade openness and GDP growth. Békés, Kleinert and Toubal (2009) find that FDI will only improve the performance of enterprises that have already obtained a certain level of productivity. Also, FDI into less developed regions is likely to have a negative impact on the majority of firms

Andraz and Rodrigues (2010) studies the relationships between inward FDI, exports and economic growth in Portugal and concludes that „exports and FDI foster growth in the long-run (Andraz and Rodrigues, 2010). Tekin's (2012) results indicate direct, unidirectional causality from exports to GDP.

The impact of R&D expenditures on growth appears positive and numerically large and stronger in the Least Developed Countries group (Goel and Ram, 1994). The results of a recent study are the same: an increase in business R&D intensity boosts economic growth in the short (long) run (Pop Silaghi et al., 2014).

Glaeser and Saks (2006) consider that the level of corruption is correlated with the degree of income inequality and that there is a weak negative relationship between corruption and economic development in a state. Johnson and Yamarik (2011) also discover that corruption plays an important and causal role in reducing growth.

2. Research methodology

In order to achieve all the research objectives and to establish if the independent variables explain the endogenous variable GDP per capita growth (annual %), the authors collected data on the following explanatory variables selected based on the empirical literature review for a nine-years period (2006-2014) for 10 former socialist countries of Central and Eastern Europe (Romania, Bulgaria, Estonia, Latvia, Lithuania, Czech Republic, Slovakia, Slovenia, Hungary and Poland): Income inequality (Gini Index), Foreign direct investments (net inflows - % of GDP), Labour force with tertiary education (% of total), research and development expenditure (EUR/inhabitant), Exports of goods and services (annual % growth), population growth, Labour productivity and unit labour costs, Total tax rate (% of commercial profits), Inflation rate and corruption perception index.

The database was created with the help of Eurostat (2016), The World Bank (2015) and CESinfo Group Munich (2016) data for the Corruption Perception Index, data which were most well-suited for the analysis.

According to the empirical literature review of the impact of income inequality on economic growth, the majority of investigations have employed as research methodology the following: Ordinary Least Squares (OLS): Deininger and Squire (1998) and Knowles, (2010); Two-Stage least squares (2SLS): Clarke, (1995); Three-Stage least squares (3SLS): Barro (2000) and Lundberg and Squire (2003); Kennel regression: Banerjee and Duflo (2003); Fixed Effects, Random Effects: Li and Zou (1998); Vector Autoregressive model: Romer and Romer (2006); First difference GMM: Forbes (2000) and Halter, Oechslin and Zweimüller (2014) and System GMM: Voitkovsky (2005), Castelló-Climent (2010), Ostry, Berg and Tsangarides (2014) and Halter, Oechslin and Zweimüller (2014).

Taking into consideration the most recent and most frequently used method is the System GMM the authors also have decided to employ it in their investigation.

The database will be prepared in Excel, and the econometric analysis will be performed in the econometric software Stata.

The econometric model considered in this analysis includes income inequality among the determinants of economic growth. The authors included a panel of data that covers the ex-socialist Central and Eastern European countries over the period 2006-2014.

The dynamic panel data model is estimated using GMM estimation techniques and has the following form:

$$GDP_{it} = \alpha_1 GDP_{it-1} + \alpha_2 GDP_{it-2} + \alpha_3 Pop_{it-1} + \alpha_4 Productiv_{it-1} + \alpha_5 Infl_{it} + \alpha_6 Infl_{it-1} + \alpha_7 CPI_{it} + \alpha_8 RD_{it} + \alpha_{10} Tax_{it-1} + \alpha_{11} FDI_{it} + \alpha_{12} FDI_{it-1} + \alpha_{13} Educ_{it} + \alpha_{14} Exports_{it-1} \quad (1)$$

where all the factors are expressed as percentage (%):

GDP – the GDP/capita growth rate (%);

Gini – Corrado Gini's coefficient of equalised disposable income; it ranges between 0% and 100% where 0% means perfect equality of income and 100% means perfect inequality;

Pop – the population growth (%);

Productiv – the real labour productivity per hour worked;

Infl – the annual inflation rate (%);

CPI – the Corruption Perception Index that ranges between 0-10 for the years 1995-2011 and between 0-100 afterwards. 0 means a country is very corrupt and 10/100 means is perceived as a very clean country;

RD – the Research and Development expenditure calculated as EUR/inhabitant, Purchasing Power Standard;

Tax – the total tax rate (% of commercial profits);

FDI – Foreign direct investment, net inflows (% of GDP);

Educ – the labour force with tertiary education (% of total);

Exp – the exports of goods and services (annual % growth).

The Gini coefficient is determined classically as:

$$C_G = \sqrt{\sum_{i=1}^n g_i^2} \quad (2)$$

in the interval $\left[\sqrt{1/n}, 1\right]$ and where g_i represents population structures grouped by income.

Gini was improved by R. Struck with the aim of rigorously stabilizing the membership within the limits and became the Gini-Struck through a transformation of the unstable lower limit in one constant, which made its field stock $\left[\sqrt{1/n}, 1\right]$ to become $[0,1]$. Finally, Gini-Struck in its established formula is calculated by the relation:

$$C_{G-S} = \sqrt{\frac{n \sum_{i=1}^n g_i^2 - 1}{n - 1}} \quad (3)$$

is defined by the interval $0 \leq C_{G-S} \leq 1$ and determined as an index it is placed between 0% and 100% (Săvoiu and Dinu, 2012).

If this coefficient tends to 1 it means that the structure of the analyzed market has a high degree of concentration and if it tends to 0, the structure has a high degree of diversification. The society with a maximum equalization trend will be one in which each person receives the same income (the Gini-Struck coefficient equals to 0, also known as absolute equality) and the society with the prospect of maximum inequality will be one in which one person receives 100% of total income and the remaining people do not receive any income (the Gini-Struck coefficient is equal to 1, also named absolute inequality).

Given that the econometric model is focused only on factors expressed as a percentage, the authors found appropriate the similar expression of the Gini-Struck coefficient as an index drawing on a variation calculation based on regional vector lengths.

The Gini coefficient is defined as the ratio of value between 0 and 1 – represented as a percentage, and is called the Gini index. If the Gini coefficient exceeds 0.3, it can be said that there is a concentration that can be said, and if it exceeds 0.5 then the concentration is important. The higher the concentration, the more important are the disparities, and vice versa (Barabaş, 2014).

In order to calculate the Gini coefficient, the vector's length is first established for the region j , $\|p_j\|$, by using the following formula:

$$\|p_j\| = \sqrt{\sum_{i=1}^n p_{ij}^2} \quad (4), \quad \frac{1}{\sqrt{n}} \leq \|p_j\| \leq 1, \quad \|p\|_{\min} = \frac{1}{\sqrt{n}} \Rightarrow \text{maximum diversification} \quad (4)$$

$$\|p\|_{\max} = 1 \Rightarrow \text{maximum concentration} \quad (5)$$

The Struck coefficient employed in this paper represents the corrected form of the Gini coefficient; this one has values in the range [0, 1]. The Struck coefficient is calculated as (Barabaş, 2014):

$$CS = \frac{n \sum g_i}{n-1} \tag{6}$$

The reason why the authors considered the GMM estimators to be the most appropriate technique to study the effect of income inequality on economic growth is that conditional convergence affects growth models. Thus, standard panel data estimation models may lead to biased estimation results of the parameters.

The GMM estimator uses an instrumental variable that is correlated with the variable of interest, in this case, the GDP/capita growth but not with the error term. Furthermore, this type of estimation removes the country specific effect by differencing the variables. The instruments under consideration for this model are the lagged values of the dependent variable.

By employing the model on a sample of similar economies (ex-socialist CEE countries), the authors make the assumption that the level of development of an economy plays no role in the relationship between income inequality and economic growth.

The first step in analyzing the sample of data is to look at the summary statistics. In the table below it can be seen that the mean of the GDP/capita growth in the ten countries included in the analysis was 2.6%. The mean of the Gini coefficient is 30.5 which shows that the income in these ex-socialist CEE countries is unequally distributed. There has been a decrease of 0.38% on average, in the population of these countries and an increase in labour productivity of only 0.85%. The Corruption Index has a small value of 20 which shows the countries are perceived as being corrupted. The mean of the R&D expenditures is 70.79 Eur/inhabitant and it was noticed these have fluctuated significantly over the period 2006-2014 if the maximum and minimum values are analyzed. The tax rates have an average value of 43.82% and the FDI of 5.4%. The inflation rate fluctuated from -9.68% to 20.12% in the analyzed period (table no. 1).

Table no 1: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
GDP	90	2.634952	5.268087	-14.55986	12.93336
Gini	90	30.52667	4.736134	22.7	38.9
Pop	90	-0.3884073	.6452671	-2.258464	.9038755
Productiv	90	100.8544	5.789203	87.5	118.2
CPI	90	20.91099	23.23816	3.1	69
RD	90	70.79889	77.38144	12.5	347.5
Exp	90	6.737035	9.033431	-20.30817	24.17053
Tax	90	43.82778	8.068276	27	66.8
FDI	90	5.480829	8.636999	-16.09109	50.78472
Educ	90	25.15778	7.084878	13	39.7

Source: The authors' calculations in Stata using data from Eurostat (2016), World Bank (2016) and CESIFO Group Munich (2016)

The correlation matrix shows that the GDP growth is negatively related to population growth, labour productivity, CPI, R&D expenditures and labour force with tertiary education. There is a strong positive correlation between exports and GDP/capita growth, tax rate and FDI (table no. 2).

Table no. 1: The correlation matrix

	GDP	Gini	Pop	Productiv	CPI	RD	Exports	Tax	FDI	Educ
Inflati ⁿ										
GDP	1.0000									
Gini	0.1969	1.0000								
Pop	-0.1730	-0.7743	1.0000							
Productiv	-0.0413	0.0061	-0.0316	1.0000						
CPI	-0.0567	-0.0206	0.0627	0.6078	1.0000					
RD	-0.1861	-0.5900	0.4859	0.1734	0.2590	1.0000				
Exp	0.6745	0.0625	-0.0825	0.0207	-0.1162	-0.0776	1.0000			
Tax	0.0440	-0.2980	0.2068	-0.1126	-0.0731	-0.0766	0.1035	1.0000		
FDI	0.1908	0.0721	-0.0338	-0.2168	-0.2192	-0.1529	0.1892	0.1767	1.0000	
Educ	-0.0488	0.3383	-0.3719	0.1447	0.3789	0.1091	-0.0367	-0.1827	-0.0311	1.0000
Infl	0.5380	0.3651	-0.2824	-0.1185	-0.2998	-0.2257	0.1970	0.0055	0.3325	-0.0909

Source: The authors' calculations in Stata using data from Eurostat (2016), World Bank (2016) and CESIFO Group Munich (2016)

On the other side, the income inequality is negatively correlated with population growth, CPI, R&D expenditures and tax rates. There is a positive relationship between income inequality and labour productivity, exports, FDI and education.

The values of the Gini coefficient for the ten countries included in the analysis between 2006-2014 fluctuate between 20 and 40 which means the CEE countries have an approximatively normal distributed income. According to Săvoiu, Crăciuneanu and Țaicu (2010) in markets excessively concentrated the Gini-Struck coefficient exceeds 0.40, while in the excessively diversified markets it is below the relative limits of 0.06. It can be seen in the above graphic that over the period analyzed the values of the Gini index tend to converge to 30 in 2014 compared to 2006 (figure no. 1).

Similarly, the GDP/capita growth concentrates around the value of 0 in 2014 compared to 2006. The countries analyzed are emerging economies, so the data analysis confirms their economies are very much alike.

Panel type data sets and their transformation require a lot of attention. Because the authors are using annual data in this article, the first step in analyzing the time series is to check if they are stationary in time (Wooldridge, 2011).

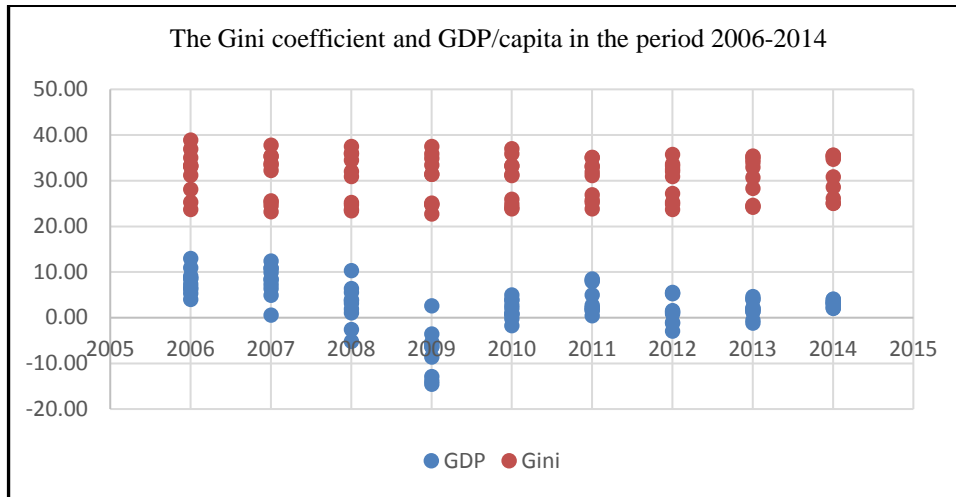


Figure no. 1: The Gini coefficient and GDP/capita in the period 2006-2014
Source: The authors' calculations using data from Eurostat, 2016

The variables are tested for stationarity by using the Levin-Lin-Chu unit-root test before the GMM estimation is conducted. The authors have tested the series in the levels and in the first difference in order to establish if they are stationary. The results of the Levin-Lin-Chu unit-root test are reported in the table no. 3 for the level of each of variable.

Table no. 2: Stationarity test results

Variable	Level
GDP	-5.19*
Population	-3.8*
Labour productivity	-2.29
Inflation	-3.77*
R&D expenditures	1.39
Exports	-8.16*
Tax rate	-6.31*
FDI	-4.75*

Note: * it shows that the variables are significant at 5% p-value
Source: The authors' calculations in Stata using data from Eurostat (2016), World Bank (2016) and CESIFO Group Munich (2016)

All variables are stationary except for R&D expenditures and labour productivity, which will be stationarized by introducing in the model the first difference of them.

3. Results and discussions

After the authors applied the GMM estimation, the model takes the following form:

$$GDP_{it} = 0.35GDP_{it-1} - 0.38GDP_{it-2} - 0.22Pop_{it-1} - 0.23Productiv_{it-1} + 0.77Infl_{it} - 0.38Infl_{it-1} + 0.12CPI_{it} + 0.08RD_{it} + 0.24Tax_{it-1} + 0.14FDI_{it} - 0.12FDI_{it-1} - 0.34Educ_{it} - 0.21Exp_{it-1} \quad (7)$$

Lagged variables have been included in order to check if these also have a significant impact on the economic growth.

The countries with emerging economies are forced to face many limitations and constraints in the economic growth and development to support economic growth. Since the countries included in the analysis are all emerging economies, the dependent variables were chosen to reflect the constraints in the economic growth and the chosen model allows us to study the relationship between these limitations and growth.

The GMM estimator includes lagged values of the GDP/capita as instrumental variables. The estimation results show that the first and the second lag of the GDP/capita have a statistically significant impact on economic growth. Thus, a 1% increase in the lag value of the GDP/capita, increases the current value with 0.35%. The lagged GDP coefficient is significant at 1% level indicating the assumption of the dynamic nature of the GDP (table no. 4).

Regarding the relationship between income inequality and economic growth, economists and economic researchers used to argue that income inequality is a necessity to stimulate economic growth. However, more recent studies show that income inequality leads to economic instability (Thewissen, 2014). As emerging economies are included in this analysis, the expected result is that the pace of economic growth is positively influenced by income inequality. The reason is that until savings reach a certain level of economic development, income inequality can be a positive growth factor (Cingano, 2014). In this context, the estimation results show that income inequality has a positive and statistically significant impact on economic growth and a 1% increase in the Gini coefficient increases GDP / capita by 0.68%.

One of the most common constraints to economic growth is a rapid population increase or decline. If the calculated mean of the variable in the summary statistics table is analyzed, it can be stated that the population of the analyzed countries has decreased on average by 0.38% between 2006-2014. The probability of the estimated coefficient for the population variable in the above model is higher than 0.05, so this is not significant to explain the impact that the population growth has on economic growth. The demography of the European Union has undergone a major change with the integration of ex-socialist countries because their population was either declining or registering slight increases. The reason the population coefficient in the economic growth model is insignificant may be attributed to the fact that the decrease or increase in population is a constraint on economic growth which the EU countries are only now beginning to face. For example, developed countries such as Sweden, Norway, Germany or the Netherlands start facing major changes in terms of their demographic landscape, following the wave of migrants from Asia and Africa that took place in 2015. Certainly the impact and the economic and politic consequences of this massive migration policy will be a major one, but it remains to be seen how this will have an impact on subsequent growth performance.

The coefficient of the variable “labour productivity” shows that increases in the lagged value of productivity determine a decrease in economic growth. Fortunately, the impact is limited to -0.23%. There is no statistically significant impact on the current values of productivity, and, consequently, this variable has been excluded from the model.

Table no. 3: The results of the econometric model

System dynamic panel-data estimation		Number of obs	=	70		
Group variable: statenum		Number of groups	=	10		
Time variable: Year						
		Obs per group:	min =	7		
			avg =	7		
			max =	7		
Number of instruments =	47	Wald chi2(15)	=	168.64		
		Prob > chi2	=	0.0000		
One-step results						
	GDP	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
	GDP					
	L1.	.3598521	.1779542	2.02	0.043	.0110683 .7086359
	L2.	-.3824953	.1330224	-2.88	0.004	-.6432143 -.1217763
	Gini	.6877607	.3467685	1.98	0.047	.0081068 1.367415
	Pop					
	L1.	-.2273145	1.798739	-0.13	0.899	-3.752779 3.298149
	Productiv					
	L1.	-.2342897	.093217	-2.51	0.012	-.4169917 -.0515876
	Infl					
	--.	.7743739	.1723909	4.49	0.000	.4364939 1.112254
	L1.	-.3812619	.1794319	-2.12	0.034	-.732942 -.0295819
	CPI	-.1272706	.0369176	3.45	0.001	.0549135 .1996276
	RD					
	--.	.0876638	.0385076	2.28	0.023	.0121903 .1631372
	Tax					
	L1.	.2483359	.1684849	1.47	0.140	-.0818884 .5785602
	FDI					
	--.	.1422777	.0813967	1.75	0.080	-.0172569 .3018122
	L1.	-.1269085	.0745244	-1.70	0.089	-.2729737 .0191566
	Educ	-.3465195	.2616106	-1.32	0.185	-.8592668 .1662278
	Exp					
	L1.	-.2122545	.0822145	-2.58	0.010	-.3733919 -.0511171
Instruments for differenced equation						
GMM-type: L(2/.)GDP						
Standard: D.Gini LD.Pop LD.Productiv D.Inflation LD.Inflation D.CPI D.RD LD.RD						
LD.Tax D.FDI LD.FDI D.Educ LD.Exports						
Instruments for level equation						
GMM-type: LD.GDP						

Source: The authors' calculations in Stata using data from Eurosta (2016), World Bank (2016) and CESIFO Group Munich (2016)

A rapidly growing rate of inflation can have bad consequences on economic growth. So the inflation rate was included as a dependent variable in the model in order to see its impact on growth. Moreover, the lagged values of the inflation were checked if they had any significant impact on GDP/capita. The results show that both coefficients are statistically significant and that a 1% increase in inflation rate leads to a 0.77% increase in GDP/capita growth. The relationship between the lagged inflation and GDP / capita turned out to be negative for the states analyzed. In order to have sustainable economic growth, it is

necessary for economies to fight a high rate of unemployment, and according to Philips curve this means higher inflation. Therefore, the results regarding the relationship between inflation and economic growth in the countries of Central and Eastern Europe are consistent with the economic theory.

Corruption is considered a barrier to economic growth because it damages investments. Thus, the authors obtained an estimated negative coefficient of the CPI which shows that corruption costs the countries included in the analysis -0.12% of the GDP/capita growth.

Economists look carefully into the R&D accumulation when studying economic growth (Aghion, Akcigit and Howitt, 2013). In order to see how important are R&D expenditure for economic growth, the authors included it as a dependent variable to measure how much will the GDP/capita growth rise when the R&D increases. The estimated coefficient is statistically significant and shows that a 1% increase in the R&D expenditures determines a raise of the GDP/capita with 0.08%.

The effects of the fiscal policy on economic growth are explored in this model through the estimated coefficient of the tax rate. Since reducing corporate tax should encourage investments, it is expected that the estimated coefficient that shows the relationship between tax rate and GDP/capita to be negative. A coefficient that is not statistically significant it was obtained so tax rates cannot be used to explain the economic growth of the 10 CEE countries included in the model. The authors tried to include the lag of the variable tax rate to see if economic growth feels the lagged effect of the tax policies but the coefficient is, yet again, not significant.

The significance of the FDI coefficient at 10% is expected, and the positive sign is consistent with the economic theory that shows a positive relationship between investments and economic growth. The relationship between GDP/capita and investments states that at 1% increase in investments, the GDP will rise by 0.14%.

The reason labour force with tertiary education was included in this model as it was discovered that it plays a more important role than primary and secondary education on economic growth (Zhang and Zhuang, 2011) in the majority of situations. Results show that higher values of labour force with tertiary education are associated with lower values of economic growth which contradict the economic theory, but the coefficient is not statistically significant.

Frequently, economists have studied the relationship between exports and economic growth and the results of their investigations show that exports accelerate economic growth. The estimation results show that for the ten CEE countries, higher values of exports are associated with lower values of economic growth. But the effect of the exports on GDP/capita is lagged. The way the results are interpreted is as follows: a 1% increase in exports in the previous period would lead to 0.21% decrease in economic growth in the current period.

Conclusions

Analyzing the income inequality data from the World Bank, it can be observed that the CEE10 countries have an imperfect distributed income. Moreover, although the CEE10 countries have higher economic growth than the EU28, their level of economic development is inferior to the latter. Also, the Gini index for the CEE10 countries is slightly below the EU27 average, so it

can be said that income inequalities from the CEE10 countries are slightly below the EU27 member states and can be quantified as being average.

Based on the econometric model results, the authors found that income inequality has a positive and statistically significant impact on economic growth and that one percentage point increase in the Gini coefficient enhances the GDP by 0.68%. The results of this paper are inconsistent with the most recent literature review because lately, economists found that this relationship is negative and income inequality lowers economic growth. For example, in their research, Banerjee and Duflo (2003), Voitchovsky (2005) and Castelló-Climent (2010) show that in the case of developing countries such as the CEE, the relationship between income inequality and economic growth is negative.

However, Arthur Okun was one of the economists who showed that it is not possible for economies to have perfect equality and efficiency, and that they should sacrifice one for the other. Some economists who still hold the old view of the positive relationship between inequality and growth argue that “efficiency is bought at the cost of inequalities in income and wealth” (Hopkin and Blyth, 2012).

In conclusion, the authors find that the negative relationship between inequality and growth is explained by the fact that developing countries have gone through a transition period and that it will reverse once they get to a certain level of development.

The authors found that a 1% increase in inflation rate leads to 0.77% increase in GDP/capita growth, so the model’s results from this paper are consistent with the research work of Lundberg and Squire (2003).

The investigation of this article identifies corruption as an increase of costs of the countries included in the analysis of 0.12% of the variation in GDP per capita. The results on the direction of the association obtained from the analysis of the group of CEE countries are consistent with the findings of Glaeser and Saks (2006) and Johnson (2011) who have discovered that „there is a weak negative relationship between corruption and economic development in a state” (Glaeser and Saks, 2006).

The econometric deducted elasticity shows that a 1% increase in the R&D expenditures increases the GDP per capita with 0.08%, which is similar to the results quantified in the research signed by Pop Silaghi et al. (2014). The positive sign of the FDI coefficient is in line with the economic theory that shows a positive relationship between investments and economic growth (Andraz and Rodrigues, 2010).

In the recent empirical literature, economists have studied the relationship between exports and economic growth and the results of their investigations show that exports accelerate economic growth (Andraz and Rodrigues, 2010). The estimation results show that for the ten CEE countries, higher values of lagged exports are associated with lower values of economic growth.

For future investigations, in the analysis the Human Development Index (HDI) will be harnessed as the dependent variable, defined as proxy for economic development. A group of member states of the EU-15 or the Eurozone can also be integrated into the analysis, to see if there is a difference between the impact of inequality on economic development between the EU-28 and EU-15 and the Eurozone. The authors didn’t include in their work indicators for financial sector development, infrastructure, labour market (unemployment) and health (health expenditure) and they intend to integrate them in future research.

Taking into consideration the inconsistency of the results with the recent literature review as concerns the relationship between income inequality and economic growth, the authors will include in future studies a dummy variable to account for the economic crisis. Its aim will be to check if the economic crisis or its consequences has any impact on the positive relationship the authors obtained between the two variables.

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