Comparative analysis of economic growth determinants in Romania and Central and Eastern European countries

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Abstract. *Economic growth is one of the most studied topics in the literature in the field due to its significant role in the development of each country. Studies divide economic determinants into two categories based on their influence on economic growth: endogenous and exogenous. The study aims to estimate economic growth against two types of determinants for Romania and Central and Eastern European countries using data for 1995-2017 in order to compare the two cases. For Romania, we used time series specific methods (e.g. stationarity checking using Augmented Dickey-Fuller test, OLS model). In case of Central and Eastern European countries, we employed methods specific for panel data (e.g. estimation of the OLS general model, fixed effects model, random effects model, and feasible generalized least squares model). The results showed that in Romania, in the studied period, only the exogenous determinants (e.g. high technology exports) have a significant influence on economic growth, while Central and Eastern European countries were influenced by both types of determinants (e.g. life expectancy, foreign direct investments). In case of Romania, foreign direct investment did not represent a significant determinant for economic growth during 1995-2017 due to slower transition from communist regime to market economy.*

Keywords: economic growth, stationarity, econometric model, panel data, Romania

Introduction

Economic growth worldwide has been one of the main objectives of economic policy in any country, being one of the most researched topics in the literature in the field.

Long-term economic growth reflects a potential increase in the productivity of any economy. It is the outcome of the evolution of economic, political, psychological or cultural determinants.

Economic determinants have been divided in the literature (Sharipov, 2016) into two categories according to their influence on economic growth: endogenous (which quantify the dynamics of internal economic environment in a country) and exogenous (which quantify the dynamics of external economic environment in a country) determinants.

The study aims to identify the determinants of economic growth from two categories of factors for Romania and Central and Eastern European countries between 1995 and 2017. Economic evolution of the post-communist period in Romania should be compared against that of other Central and Eastern European countries. The novelty of the paper resides from

this comparative analysis because, although Romania and the other CEE countries had a similar level of development at the beginning of the 1990s, in the long run, these countries encountered different evolutions regarding the factors which influence economic growth. Also, the fact that in the recent literature there are few studies that analyze the dynamics of economic growth in the CEE countries, it determined us to focus on economic dynamics in this group of countries.

For this purpose, we set the following objectives: literature review aimed to make a selection of most often used indicators for measuring endogenous and exogenous influences on economic growth, econometric modeling of economic growth in Romania based on previously selected determinants using time-specific methods, econometric modeling of economic growth in Central and Eastern European countries depending on the same determinants using panel-specific methods; comparison of econometric modeling results for the two cases in order to pinpoint similarities and differences between Romania and the other Central and European countries.

The research is based on the following working hypothesis: even though all Central and European countries were marked by the oppression of the communist regime, their economic evolution in the post-communist time has been different. Therefore, we assume that the determinants of economic growth in Romania differ from those identified for the Central and European countries.

Further, the paper presents: i) a synthesis of literature on the indicators that quantify the two types of influence on economic growth: endogenous and exogenous; ii) the research methodology, with the presentation of used indicators and statistical methods; iii) the results of quantitative analyses and their interpretation; iv) conclusions of analysis, research limitations and future lines of research.

Literature review

Endogenous determinants

Human resources alongside natural resources are one of the endogenous economic determinants of long-term economic growth. There are studies (Sundman (2011), Popa (2012), Gideon (2013), O'Connor (2010), Brunow (2015) and Bove (2017)) in which economic growth in the long run is studied in relation with indicators measuring human resources.

Sundman (2011) studied the relationship between demographic changes and economic growth in Japan. The results have shown that the demographic transition has a negative impact on GDP per capita: higher is the national income, lower is the number of births. In addition, since technological progress has an impact on lifestyle and health care, longer is the life expectancy, higher is the number of the elderly population.

In another study, Popa (2012) made a comparison between Romania and the other states of the European Union in what regards demographic and social determinants influencing the economic environment. So, in case of Romania, he concluded that life expectancy had a positive influence on economy due to the fact that the structure of population and its capacity to work play a significant role in the formation of GDP.

Gideon (2013) argues that, in case of Kenya, there is a strong and positive link between the size of population and economic growth. The results of his study show that for Kenya, the assumptions that economic growth is the result of changes within the population have been confirmed, and that it may ultimately lead to economic development.

O'Connor (2010) conducted a study correlating the number of migrants and immigrants in EU countries with their level of education, and underlines the impact of this correlation on economic growth. Therefore, people with high level of education are more likely to occupy a legal job in a foreign country compared to people with low level of education. Level of education of migrants and their work experience in various fields of activity can support the economy of their country.

In a study in 2015, Brunow stresses out the major advantage of emigration, it encourages companies in migrant host countries to invest in their country of origin, with foreign direct investment being one of the drivers of economic growth. Also, an important aspect of the effect of emigration on economic growth is that people returning to their home country take knowledge and innovation from the host countries and apply them later in their countries of origin.

Bove (2017) conducted a panel analysis covering the period 1960-2010 for the United Nations member countries and emphasized the fact that the diversity of migrants plays an important role for boosting economic growth. The main results of the Bove study have shown that the fractional index and the polarization index have a positive effect on economic growth, a 1% increase in the index growth rates leads to a 0.1% increase in the income per capita in the developed countries.

The evolution in time of population's life expectancy and changes in income levels have been determined by investments in human capital. These investments have led to increased level of knowledge and its dissemination, better training and education, health improvement, migration development and demographic transition; in other words, the process of change involved progress in human capital (Krasniqi, 2016).

Exogenous determinants

From the category of exogenous determinants, the most important factor influencing economic growth is foreign direct investment, as it indicates the level of aid in the economy obtained through external entities.

Foreign direct investment is an external factor of a country's economic growth. Since national economies are often insufficient to ensure the accumulation of capital goods, countries either resort to foreign loans from other countries or from the International Monetary Fund, or attract foreign investors, foreign direct investment being a quick way for a country to accelerate economic growth.

Both parties win from the collaboration between a country and foreign investors. On one hand, foreign investors earn a profit, and on the other hand, their investments increase the rate of capital accumulation in the developing countries, resulting in higher economic growth rates and higher labor productivity. At the same time, another gain, for developing countries, is that foreign investors apply more advanced technologies.

The importance of foreign capital also arises from the need of developing countries to import capital goods, technologies and materials needed to improve the industry and build an efficient infrastructure. In the absence of external resources, developing countries will have a lower rate of development because they do not have sufficient resources of this kind in the internal environment (Mahembre, 2014).

Nistor (2014) conducted a study on the link between foreign direct investment and economic growth in Romania during 1990-2012. The results of the study showed that there is a correlation between foreign direct investment and economic growth. At the same time, it

should be noted that in case of Romania, foreign direct investment can be considered an important factor for development and transition to a market economy and competitiveness.

In Eurozone survey in 2015, Pegkas analyzed the influence of foreign direct investment on economic growth over the period 2000-2012. The main results showed that foreign direct investment has a significant positive impact on economic growth. Foreign direct investment is, therefore, beneficial for achieving macroeconomic stability and reducing market disparities.

Liu (2015) conducted a study using panel data for 92 countries during the period 1970-2007. The study included the following indicators: foreign direct investment, domestic investment, research and development investment, degree of openness of the economy, human capital rights, protection of intellectual property rights and economic growth. The author emphasized that all the indicators considered in the analysis had a significant positive impact on economic growth. Also, according to a classification of countries by level of development, the results showed that domestic investments, degree of openness of the economy, human capital and R & D investments are the key elements of economic growth in countries with a high level of development, and foreign direct investment is one of the fundamental elements of economic growth for the underdeveloped or developing countries.

Technological progress is an important factor for creating economic growth. The influence of technological progress is internal, when a new technological product is emerging that is useful to the country where it was created, and it is also external through the export of high technology products.

In the recent studies, the emphasis was placed on long-term economic growth based on technological progress. In 2013, Y. Zhang and W. Wang conducted a study in which they studied the influence of science rate of contribution and technological progress on Chinese economic growth during 1980-2009. They concluded that the investments and technological progress have become a major factor for economic growth stating that investment in human capital education is essential.

Along the same lines, Haixiang et al. conducted a regression analysis with data for China regions for the period 1998-2007 and discovered that there is significant link between technological progress and GDP.

Analyzing the 1870-2008 data for the three states (Italy, USA and UK), Torre and Marsiglio, in 2010, found that in the last century technologies have led to steady growth in industrialized countries, and, in order to highlight this fact, the theory of economic growth considered endogenous technological changes.

Hudson and Minea (2013) conducted a panel-based study of 62 developed and developing countries between 1980 and 2009. In this study they analyzed the influence of innovation and intellectual property rights on economic development. To measure innovation, R&D spending and number of patents were considered. Intellectual property rights were measured through the Park Developed Intellectual Property Rights Index (2008). The results have shown the significant impact of these indicators on the level of development in considered countries, the GDP growth rate per inhabitant being positively influenced by innovation, and negatively, by intellectual property rights.

Methodology

The study was applied on 1995-2017 data both for Romania and 16 Central and Eastern European countries. Data used in this analysis was collected from Worldbank and Eurostat

international databases. The analysis was conducted by using specialized software for the selected methods: EViews for the time series analysis and STATA for the panel data analysis.

Economic growth is measured by the GDP Growth Rate (GDP_GR). The endogenous growth determinants considered in the study were Dependency Rate (R_DEP), Life Expectancy (L_EXP), Unemployment Rate (R_UNEMP), and Urbanization Rate (URB). The exogenous growth determinants used in the study were Foreign Direct Investment (FDI), High Technology Exports (HIGH_EXP_E), and Technological Gap (TECH_GAP).

The analysis of the time series included 3 steps. The first step checked the stationarity of the time series considered using the Augmented Dickey-Fuller test. In the case of identifying a deterministic trend, we removed it by modeling the time series in relation to the time variable and then rechecking the stationarity of the time series. For non-stationary series, we applied I or II grade differences in order to make them stationary. In the second step, we estimated an OLS regression model using the stepwise method of variable selection. The last step in the time series analysis included the validation of the estimated regression model for the hypotheses formulated on the modeling errors: mean zero errors (t Student test), normality (Jarque-Bera test), autocorrelation (Breusch test -Pagan), and homoscedasticity (White test).

Panel data analysis is divided into 3 steps. The first step describes the three models used in the modeling of economic growth in the CEE countries in relation to the determinants: the OLS general model, the fixed effects model and the random effects model. The second step includes the tests applied to select the "best" model for the available panel data: the Chow test (Greene, 2002), the Breusch-Pagan test (Greene, 2002), and the Hausman test (Frondel et al., 2010). The last step of the analysis presents the verified hypotheses validating the previously selected static data panel model. To validate the chosen model, there were needed tests verifying a set of assumptions on the two components of the model: deterministic and stochastic. For the deterministic component, we checked the multicollinearity hypothesis. The hypotheses regarding the stochastic component were: the hypothesis of independence, the hypothesis of homoscedasticity and the hypothesis of autocorrelation. If these hypotheses are not fulfilled, a corrected model is estimated. Depending on the relationship between N and T, either the Feasible Generalized Least Squares (FGLS) estimator can be applied if $T > N$ or the Panel-Corrected Standard Error (PCSE) estimator when $T < N$ (Reed and Ye, 2011). Since the number of periods was greater than the number of countries, the FGLS estimator was applied.

Results and discussion

For the econometric modeling of Romanian economic growth, we used time series specific methods. We checked the stationarity of the time series considered in the analysis by applying the Augmented Dickey-Fuller test. The test showed that GDP Growth Rate and Technological Gap were stationary in the level, the other time series being non-stationary.

In the case of the High Technology Exports, Life Expectancy, Dependency Rate and Urbanization Rate, the Augmented Dickey-Fuller test showed that each of them has a deterministic trend. The graphic representations of these 4 time series showed that the deterministic trend presented different polynomial representations as follows: linear in the case of the High Technology Exports and Life Expectancy, quadratic in the case of the Dependency Rate, and cubic in the case of the Urbanization Rate. After removing the deterministic trend, the time series became stationary. For Foreign Direct Investment and

Unemployment Rate, we applied a first difference in order to make them stationary.

After making the time series stationary, we estimated an OLS model for each of the 2 types of determinants – endogenous and exogenous. The results of econometric modeling are shown in Table 1.

Table 1. Characteristics of regression models for Romania during 1995-2017

Category of determinants	Variable	b_j	Std. error	t	Sig
endogenous	Constant	3.059	0.916	3.337	0.003
	L_EXP	-2.058	3.065	-0.671	0.510
	R_DEP	-1.078	2.576	-0.418	0.680
	R_UNEMP	-0.886	1.395	-0.635	0.533
	URB	-23.391	15.067	-1.552	0.139
exogenous	Constant	3.261	0.815	3.999	0.000
	HIGH_TECH_E	-0.839	0.475	-1.764	0.092
	FDI	0.507	0.461	1.098	0.286
	TECH_GAP	-0.316	0.254	-1.244	0.229

Source: Authors' own research results.

For the econometric modeling of the economic growth in Central and Eastern European countries, we applied panel data specific models. For each of the 2 types of determinants – endogenous and exogenous – we estimated the following models: OLS general model, fixed effects model and random effects model.

In order to choose the “best”, most appropriate, model for our data, we applied 3 tests: Chow test to choose the best model from comparing the OLS general model with the fixed effects model, the Breusch-Pagan test to determine whether the random effects model is more appropriate than the OLS general model for the considered data, and the Hausman test to choose the best model between the random effects model and the fixed effects model. For both endogenous and exogenous determinants, the fixed effects model represented the most appropriate model for our data.

In order to validate the 2 selected models, we checked the following hypotheses: homoscedasticity, autocorrelation, independence, and multicollinearity. Because these hypotheses were not accomplished, we applied 2 feasible general least square models, these models satisfying the hypotheses tested. The results obtained after applying the corrected models are shown in Table 2.

For Romania, the results of analysis indicate that between 1995 and 2017, the endogenous determinants used in the analysis did not have a significant influence on economic growth.

Table 2. Characteristics of regression models for Central and Eastern European countries during 1995-2017

Category of determinants	Variable	b_j	Std. error	t	Sig
endogenous	Constant	70.310	13.935	5.050	0.000
	L_EXP	-0.702	0.152	-4.620	0.000
	R_DEP	-0.059	0.086	-0.680	0.497
	R_UNEMP	-0.058	0.045	-1.270	0.206
	URB	-0.180	0.040	-4.510	0.000

Category of determinants	Variable	b_j	Std. error	t	Sig
exogenous	Constant	2.979	0.602	4.950	0.000
	HIGH_TECH_E	-0.043	0.047	-0.920	0.358
	FDI	0.087	0.037	2.310	0.021
	TECH_GAP	0.057	0.068	0.840	0.400

Source: Authors' own research results.

As for the influence of exogenous determinants on economic growth in the analyzed period, it could be observed that exports of high technology goods exert a statistically significant influence, with a 10% risk (Table 1). This indicator had low values in Romania and the degree of innovation is lower compared to Western Europe or other continents. The econometric model is econometrically validated for a 10% risk in what regards the significance of the coefficients and the assumptions made about the errors. The modeling errors are null, normally distributed, uncorrelated and homoscedastic.

Unlike Romania, in the category of endogenous determinants, life expectancy and degree of urbanization have a significant influence on the economic growth in the Central and Eastern European countries in the considered period (Table 2). The negative influence of life expectancy may be related to the level of development of countries in the region. Thus, richer the country is, more resources it can allocate to health care. If we also take into account the fact that raising living standards translates into a better diet and a different lifestyle, it is easy to understand why people live longer in more developed countries. Also, the negative effect is evident from the fact that an increase in life expectancy, together with the increase of the elderly dependency ratio, and the decrease in the employment rate of the youth, causes an imbalance between the number of people actively supporting the economy and the number of the elderly. Ultimately, this imbalance contributes to lowering the economic growth rate.

In Central and Eastern European countries, foreign direct investment has a significant and positive influence on economic growth. This indicates that the relationship with neighboring countries plays a beneficial role for economic growth as foreign investment brings extra capital to the country benefiting from it, and trade relations bring additional resources and goods available for personal or institutional consumption.

The econometric models estimated by panel data are validated based on the assumptions formulated on modeling errors (homoscedastic, uncorrelated and cross-sectional independent), and their coefficients are statistically significant for a 5% risk.

Conclusion

The aim of this paper was to identify the similarities and differences between the economic evolution of Romania and that of Central and Eastern European countries in the post-communist period. Thus, we estimated economic growth in relation to the two types of determinants, endogenous and exogenous, for Romania and Central and Eastern European countries using data for the period between 1995 and 2017.

The results have shown that economic growth in Romania is influenced by different factors compared to Central and Eastern European countries, and the working hypothesis was validated. Also, there are no similarities between these economies in regard of determinants of economic growth considered in the analysis. Regarding the influence of endogenous factors, we have not identified significant influences for Romania. For Central

and Eastern European countries, life expectancy and urbanization have exerted significant and negative influences on economic growth, this means that the existence of a large number of elderly people, together with a low number of people who are active in the labor market, generates a heavy burden on the economy.

As for the factors exerting a significant influence from external economic environment, we have noticed that for Romania and the Central and Eastern European countries, the determinants which exert significant influences are different. In case of Romania, exports of high technology goods have a significant and negative influence, while in Central and Eastern European countries, foreign direct investment has a significant and positive influence on economic growth.

The fact that foreign direct investment for Romania does not represent a significant determinant of economic growth can be explained by the fact that the foreign investors are discouraged by political instability and high degree of corruption.

One of research limitations was represented by the availability of data for panel data analysis for Central and Eastern European countries. Some indicators had missing values for some years or countries, the panel was unbalanced and determined the impossibility of applying more effective tests to verify the validity of the estimated model. Another limitation of research was the large number of indicators used in the literature to measure endogenous and exogenous determinants of economic growth. Thus, it was left to the authors to choose the indicators they considered representative for their research based on the literature.

The results obtained in this study can provide a clearer picture on the evolution of economic growth in Romania and in Central and Eastern European countries during 1995-2017 in relation to its determinants. These results could be useful for people involved in making decisions on possible policies that could be implemented at the determinants level to stimulate long-term economic growth.

In Romania, attempts could be made to stimulate both production and export of high technology goods by encouraging investment in research and development so that it could reach a level of approximately 3% of GDP (Europe 2020 strategy). Also, there could be encouraged trade openness in order to lower the technological gap between Romania and the mean level of EU.

For Central and Eastern European countries, policies could be correlated with some of Europa 2020 targets in order to stimulate economic growth. One of the policies could aim at lowering the level of unemployment rate below 25% for people aged between 20 and 64 (Europe 2020 strategy). In this way, the number of active workforce could be higher and the dependency rate could be reduced, as well as the economic burden. Efficient management of the evolution of these indicators could lead to sustainable economic growth.

Future research could comprise the inclusion of non-economic determinants into the analysis, such as political and cultural ones, as to highlight in more detail which are the most representative determinants of economic growth in Romania and in Central and Eastern European countries.

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