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REAL CONVERGENCE, STEPS FROM ADHERENCE TO INTEGRATION. COUNTRIES FROM CENTRAL AND EASTERN EUROPE

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Abstract

The macroeconomic model Solow-Swan shows that the marginal rates of capital, technology and labor force, with positive values, have the capacity to stimulate the economic growth of the emergent economies, as in the case of Romania, for the 2005-2014 period, facilitating the determination of specific correlations between macroeconomic indicators to analyze the convergence towards the average European Union (EU). The economic theory, highlighted in particular by the Solow-Swan model, was applied in the current paper, to determine the potential of real convergence. Moreover, the statistics for the period 2005-2014 facilitated the analysis of the growth and recession factors specific to economies of Central and Eastern Europe and placed Romania amongst the EU countries with emergent economies and potential of economic growth. The European Commission's reports regarding the macroeconomic imbalance procedure draw attention on the same indicators presented in the article to address proper recommendations and support corrective measures. Making a step from nominal to real convergence, the latter derives naturally from the need to recoup the gaps in comparison with developed economies amongst countries of the Euro Area.

Keywords: economic growth, emergent economies integration, real convergence, macroeconomic model.

JEL Classification: O18, O31, L84

Introduction

The adhesion of Romania to the European Union in 2007, as consigned in Luxemburg by the Treaty of adhesion on 25 April 2005, was the first step towards the integration of the Romanian economy and culture in the European Union, once the *acquis communautaire* was transposed in the key sectors.

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Integration, a complex process in evolution, means a complete harmonization of the economic indicators and thus, diminishing gaps between developed countries of EU and less developed from Central and East Europe, such as: Bulgaria, Croatia, Czech Republic, Greece, Hungary, Poland, Romania, Slovakia and Slovenia. The process of uniformization through reduction of gaps is defined by economic literature as real convergence. In the attempt to quantify the existent gaps for adjustment, the economic theory is built on the neoclassic model of economic growth, based on the macroeconomic indicator, i.e. gross domestic product per inhabitant. As well, the EU regional and cohesion policy indicate on the necessity to reduce the gaps between EU regions and recommends effective measures for redress so to support the undeveloped areas. The same indicator, gross domestic product per inhabitant, represents a basic criterion to classify the regions based on the degree of economic development.

The determinant factors that influence the capacity to cover the gaps may vary. In the approach of Hoskisson et. al. (2000), the emergent economies have potential of growth due, in particular, to the liberalization process. This hypothesis is supported by Edwards (2001), in whose opinion the economic growth rates are more visible in case of open economies, driven by capital flows. The importance of direct investments is observed by Konings (2000) who determined a direct link between the level of direct investments and the economic growth rate.

The economic theory, although comprises a variety of approaches, goes in the direction of capital transfer between economies as long as these are open or semi-open economies, if we refer to countries who passed or are currently passing through a liberalization process of certain economic sectors. Irrespective of the approach, the model Solow Swan explains empirically the process of convergence and identifies the relevant determinant factors.

The concept of economic growth in the long run was introduced by Solow (1956) and Swan (1956) in a macroeconomic model to become a classic, inserting in growth patterns made by economists Harrod (1939) and Domar (1946), a relationship expressing population growth and a requirement on more efficient use of labor. These factors were considered exogenous before Solow-Swan's model, which determined the subsequent development of the theory of general equilibrium (Barro and Sala-i-Martin, 1992). Koopmans (1951) and Cass (1965) enriched the neoclassical growth model introducing consumer optimization analysis, which allowed determination of endogenous saving rate. Poor countries tend to catch up with developed economies through positive economic growth rates, influenced by the potential of the human resource (Barro, 1991). In his paper, the author shows that the level of private investment is inversely proportional with the economic indicator represented by the current government spending.

Economic convergence between the Central and Eastern European countries, focusing on the shift between accession and integration was frequently approached in the economic literature of the last decades. Therefore, the real convergence would seem to depend crucially on the ability of the countries to harness technological innovations, in particular through foreign direct investment (Martin et. al, 2001). Zaman and Goschin (2014) performed an analysis of the convergence of real wages in Romania, at a regional level, under the impact of the recent global financial and economic crisis.

Regarding the high costs of adopting the single currency for the countries of Central and Eastern Europe, a gradual convergence is required for compliance with institutional criteria

provided for the Maastricht Treaty (Boone and Maurel, 1998). In his work, Nuti (2002) shows that there is no economic justification for the negativistic attitude regarding the affiliation to the Eurozone for the Central and Eastern European countries. Regional and cohesion policy play a central role in ensuring solidarity in the Central and Eastern Europe (Funck and Pizzati, 2003).

Behind the developments of the classical model of economic growth, the authors conceptualize the economic growth model to determine the main impact factors, then to build on empirical data, in an attempt to define the position of Romania in the Central and Eastern European region.

1. Conceptual analysis of the Solow – Swan model

In the economic literature, the reduction of gaps is explained by the paradigm Solow-Swan. In 1956, the economists Robert Solow and Trevor Swan developed the macroeconomic model of long term economic growth, based on certain variables, such as: accumulation of capital, evolution of number of employed population and variation of technologized labor force, the latter being an expression of technological progress. A Cobb-Douglas function stands at the basis of the model.

The information released from the application of Solow-Swan model denotes a trend of homogeneity through capital flows from developed to less developed economies. When the rates of savings are similar, the trend is increased and more visible, supporting the process of real convergence. Although the model suffered changes following the improvements brought by Mankiw et. al. (1992), the convergence steps may be observed in countries with high degree of innovation, by connection between information technology and productivity (Brynjolfsson, 1993; Black & Lynch 2001; Aral et. al., 2007; Busu, 2012).

The function of production is built in the model of economic growth, as shown below:

$$Y(t) = K(t)^\alpha (A(t)L(t))^{1-\alpha} \quad (1)$$

Where:

t - the time interval;

α - represents the elasticity of production dependent on the capital, $0 < \alpha < 1$;

Y(t) - a function type Cobb-Douglas representing the total output;

A(t) - the technological labor force;

L(t) - the labor force and

A(t)L(t) – the effective technological labor.

We presume that all production factors are fully engaged and the rates of growth for A(t) and L(t) are noted with n, respectively g. The initial values for technological labor, capital and labor are A(0), K(0) and L(0).

$$\{ L(t) = L(0) \cdot e^{nt}; A(t) = A(0) \cdot e^{gt} \quad (2)$$

Under these conditions the effective labor at a given moment will be $A(t)L(t)$, with an exponential rate of growth $(n+g)$. The amortization capital rate is noted with δ , while consumption is noted with $c \cdot Y(t)$ and $0 < c < 1$, where c represents the share of consumption and $s=1-c$ represents the share of savings or of the net investments.

We obtain the following:

$$\dot{K}(t) = s \cdot Y(t) - \delta \cdot K(t) \quad (3)$$

$\dot{K}(t)$ represents the derivative of capital function dependent on time, so $dK(t)/dt$ represents the share of unused capital remained for savings. In other words, it describes the net investment.

Now we determine production based on effective labor force:

$$y(t) = Y(t) / A(t)L(t) = k(t)^\alpha \quad (4)$$

The target is the dynamic of capital function, i.e. k per unit of effective labor. The behavior of one investor on the market may be integrated in the model Solow–Swan, as following:

$$\dot{k}(t) = s \cdot k(t)^\alpha - (n+g+\delta) \cdot k(t) \quad (5)$$

where:

- $s \cdot k(t)^\alpha = s \cdot y(t)$: savings per unit of effective labor;
- $(n+g+\delta) \cdot k(t)$: threshold from which the investment becomes profitable.

$k(t)$ converges to k^* , defined by $s \cdot k(t)^\alpha - (n+g+\delta) \cdot k(t)$, i.e. the equilibrium level or the net investment threshold.

$$k^* = [s / (n+g+\delta)]^{1/(1-\alpha)} \quad (6)$$

If we presume the growth rates to be constant, the rate of economic growth per inhabitant is determined by the rate of technological progress.

If $K(t)/Y(t) = k(t)^{1-\alpha}$, where k^* represents the equilibrium level, then:

$$K(t)/Y(t) = s / (n+g+\delta) \quad (7)$$

As a result, in conditions of equilibrium, the capital factor depends only by savings rate, technological growth and amortization rate.

If we derive production based on capital, we obtain:

$$MPK = \delta Y / \delta K = \alpha A^{1-\alpha} / (K/L)^{1-\alpha} \quad (8)$$

It is noted that a lower value of the indicator K/L determines a higher rate of investment because $(1-\alpha)$ is below the unit. As an consequence, in open economies, capital flows will emerge from developed economies to those less developed, if the capital rate K/L overall reaches the productivity rate Y/L .

2. Empirical analysis of the econometric model

The model would be estimated starting from the derivative of the production function with respect to the variable capital we got at eq. (8).

$$MPK = \delta Y / \delta K = \alpha A^{1-\alpha} / (K/L)^{1-\alpha}$$

For small percentage increases, the derivative of the production function can be approximated by the first difference. Thus, the above equation is equivalent to:

$$\Delta Y / \Delta K = \alpha A^{1-\alpha} / (K/L)^{1-\alpha} \quad (9)$$

To linearize this exponential equation, we will logarithm both members of the equation:

$$\ln(\Delta Y / \Delta K) = \ln[\alpha A^{1-\alpha} / (K/L)^{1-\alpha}] \quad (10)$$

equivalent with:

$$\ln(\Delta Y / \Delta K) = \ln \alpha + (1-\alpha) \ln A - (1-\alpha) \ln(K/L) \quad (11)$$

To achieve the growth rate of Y / L , the first order differential equation will be calculated for the previous equation and we will get:

$$\Delta \ln(\Delta Y / \Delta K) = \Delta \ln A + \alpha [\Delta \ln(K/L)] \quad (12)$$

In this context, the base value Y/L will also be included in our model, in order to control states' convergence effect with their low level of incomes that have rapid growth rates.

$$\Delta \ln(\Delta Y / \Delta K) = \beta_0 + \beta_1 \cdot \Delta \ln(A) + \beta_2 \cdot \ln(Y/L) + \beta_3 \cdot [\Delta \ln(K/L)] \quad (13)$$

where:

Y- GDP;

L- active labor input;

K- fixed capital input and

A- number of people employed in tech fields.

When this model is run with SPSS statistics software, we use the following:

- $\Delta \ln(\Delta Y / \Delta K)$ the percentage increase of $\ln(\Delta Y / \Delta K)$ and
- $\Delta \ln(K/L)$ the percentage increase of $\ln(K/L)$.

3. The concrete model for the Romanian economy between 2005 and 2014

The econometric model derived in (13) is a multilinear regression equation, describing the evolution of an endogenous variable in relation to the three major exogenous variables:

$$y = \beta_0 + \beta_1 \cdot x_1 + \beta_2 \cdot x_2 + \beta_3 \cdot x_3 + \varepsilon \quad (14)$$

where:

- $y = \Delta \ln(\Delta Y / \Delta K)$ – dependent variable;
- $x_1 = \Delta \ln(A)$ – independent variable;
- $x_2 = \ln(Y/L)$ – independent variable;
- $x_3 = \Delta \ln(K/L)$ – independent variable;
- $\beta_0, \beta_1, \beta_2, \beta_3$ -model parameters and
- ε – residual variable.

The multilinear regression equation we have built, has been performed by means of the *Least Squares Method*. We have used this method for estimating the coefficients of the equation we have derived before. In other words, we want to estimate the derivative of the production function with respect to the independent factors: GDP, active labour, fixed capital and number of people employed in tech fields. Data has been extracted from the Eurostat website and they represent the corresponding values of Romania for the 2005-2014 period.

Overall, the regression equation is significant (Sig. = 0.048), with the coefficient of determination equal with 0.832 and a value of R-squared adjusted equal with 0.706, while Durbin Watson test validates the modeling approach itself (DW = 1.8). Correlation ratio value of 0.912 certifies that the endogenous variable is strongly correlated (0.912) detached from a cumulative determination of exogenous variables which argues for 83.2% of the variance in the dependent variable.(table no. 1)

Table no. 1. The econometric model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0.912 ^a	0.832	0.706	1.04598	1.878

Note: a. Predictors: (CoNstant), X3, X2, X1
 b. Dependent Variable: Y

ANOVA model for the estimated econometric model indicates that this multilinear regression model is statistically significant (F = 6.596; Sig. = 0.048). (table no. 2)

Table no. 2. ANOVA^a model

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	21.646	3	7.215	6.595	.048 ^b
Residual	4.376	4	1.094		
Total	26.022	7			

Note: a. Dependent Variable: Y
 b. Predictors: (Constant), X3, X2, X1

From table no. 3 above we could see that the parameters of the model are significant (p_value < 0.05 for all three independent variables). Moreover, the values of VIF (variance inflation of the estimated regression coefficients β_1 , β_2 and β_3) confirm the expectations on the convergence effect of the derivative of the production function with respect to the labour, fixed capital and the productivity rate.

Table no. 3. Estimation of regression coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1 (Constant)	-1.541	.901		-1.711	.162	-4.042	.960		
X1	1.674	1.226	1.225	1.365	.024	-1.730	-5.077	.582	1.915
X2	.697	1.362	-.455	-.512	.036	-4.479	-3.086	.573	1.881
X3	.022	.007	-.652	-3.050	.038	-.042	-.002	.920	1.087

The regression equation resulted through the econometric analysis, leads to the following equation:

$$\Delta \ln(\Delta Y/\Delta K) = -1,541 + 1,674 \cdot \Delta \ln(A) + 0,697 \cdot \ln(Y/L) + 0,022 \cdot [\Delta \ln(K/L)] \quad (15)$$

Hence, we could conclude that the derivative of the production function with respect to the variable capital is proportional with the tech labor, productivity rate and fixed capital rate, respectively. Therefore, the Solow-Swan Model applied to Romania indicates a high potential economic growth determined by productivity, capital and tech labor. The statistical data presented in the following chapter allow an analysis of the Central and Eastern European economic framework evolution.

4. Results and discussion: convergence in Central and Eastern Europe

Although the EU countries from Central and Eastern Europe may have in common certain characteristics specific to the communist regime, the International Economic Forum shows in its recent publication (2015) that Romania has a particular situation, also pointed by the European Commission in the country recommendations. This regards the scanty infrastructure, observed especially in the transport sector. If indicators like corruption, red tape, excessive taxation are common to other member states from EU, the poor infrastructure is specific to Romania and it is similar to other countries from a) Africa: Tanzania, Liberia and Uganda; b) Asia: Iran, Nepal and Lao; c) Latin America: Colombia and Bolivia (Liao *et. al.*, 2009; Rozyłowicz, 2006; Matsukawa & Habeck, 2007, Klimaszewski & Nyce, 2009; Busu *et. al.*, 2015).

Nevertheless, the ranking of countries published by the International Economic Forum places Romania above some countries from Central and Eastern Europe, like Bulgaria, Slovakia, Slovenia, Hungary, Croatia and Greece, given the swift rate of catching up with developed economies pointed out in the last years. Savoiu *et. al.* (2014) performed an analysis of the convergence degree between Romania and the average of the European Union countries, in terms of standardized economic indicators.

Previously to the assessment of the country specific recommendations, we have presented below some evolving macroeconomic indicators to better understand the evolution in time of these economies. Each macro-economic indicator is analyzed in the context of the economic growth theory.

The indicator GDP per capita showing the economic growth in Solow-Swan model highlights accurately the country-specific living standards in the region. It is noted that

Poland, Hungary, Bulgaria, Romania and Slovakia have recorded constant growth in the last 10 years. Slovenia is in the top of the countries from Eastern and Central Europe, followed by Greece and Bulgaria on the last place, preceded by Romania. The average in the European Union is well above the level of the best performing economies in the region (Slovenia compared to the EU-28). (figure no. 1)

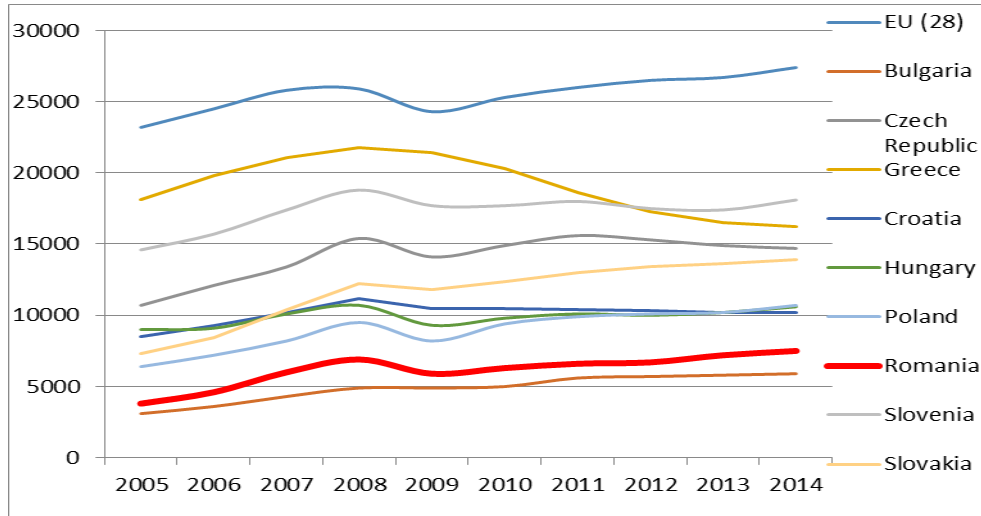


Figure no. 1. GDP/capita, in euro

Source: based on processed data provided by Eurostat, 2015

In the Solow – Swan model, the productivity is a key factor to determine whether there is potential for catching up with the developed economies. Similarly, the growth potential of the tech workforce leads to GDP growth. Below, it is presented an evolution of this indicator. (figure no. 2)

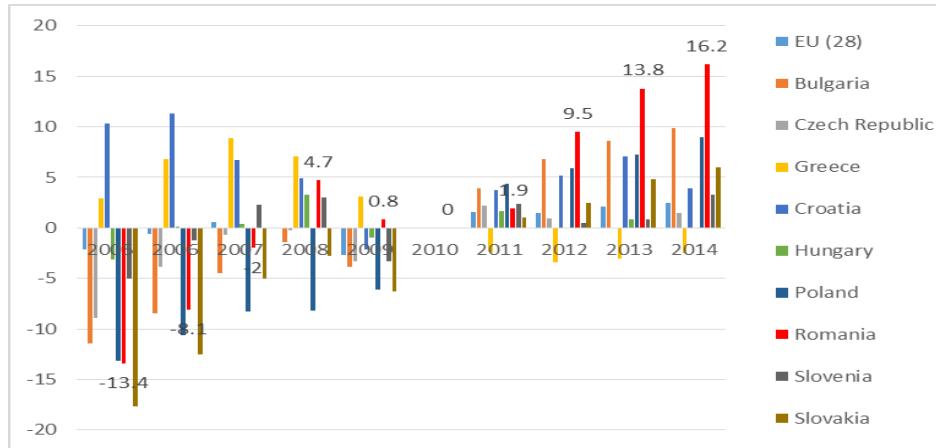


Figure no. 2. Real work productivity per capita, base year 2010

Source: based on processed data provided by Eurostat, 2015

While in 2005, Romania was placed on the second lowest in the region, beginning with 2012 it becomes the leader of the region in terms of real productivity of labor, followed by Bulgaria and Poland, while Greece, Slovenia, Hungary and Croatia had a fluctuating rate that decreased in the given period. Excepting the Czech Republic, Greece and Hungary, all other countries in the region registered values above the European average in 2014.

The country reports of the European Executive show that the unemployment rate, the deficit of the consolidated budget, the current account deficit and the net investment position are other indicators to be evaluated in order to formulate appropriate recommendations to fill the gaps. Data for these specific indicators are provided for the Central and Eastern Europe. (figure no. 3)

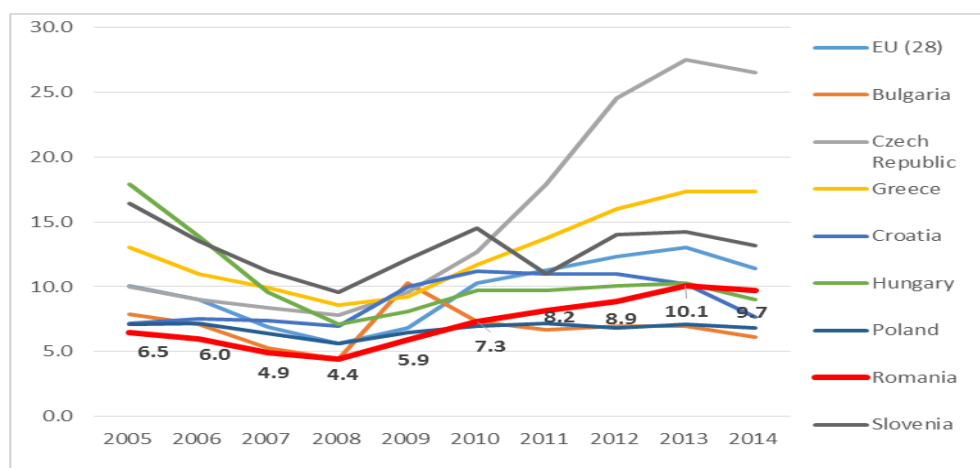


Figure no. 3. Unemployment rate, in euro

Source: based on processed data provided by Eurostat, 2015

Although the unemployment rate had an increasing trend over the past decade, except for Slovenia, Czech Republic and Greece, other Member States recorded improved levels below the average unemployment rate in the European Union. In Romania, the unemployment rate decreased from 2005 until 2008, when it reached 4.4%, after that, given the economic crisis, the unemployment rose by the end of 2013 when it reached 10.1%. The unemployment rate is inversely correlated with the active population indicator, compared to the total population. In the Solow – Swan model, the relative increases of the gross domestic product are directly correlated with growth potential of the active population. So, the rise of the unemployment is interpreted in the context of an economic recession. (table no. 4)

Table no. 4. Deficit of consolidated budget, as share in GDP

GEO/Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
EU (28)	-2.6	-1.6	-0.9	-2.5	-6.7	-6.4	-4.5	-4.3	-3.3	-3.0
Bulgaria	1.0	1.8	1.1	1.6	-4.1	-3.2	-2.0	-0.6	-0.8	-5.8
Czech Republic	-3.1	-2.3	-0.7	-2.1	-5.5	-4.4	-2.7	-4.0	-1.3	-1.9
Greece	-6.2	-5.9	-6.7	-10.2	-15.2	-11.2	-10.2	-8.8	-12.4	-3.6

GEO/Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Croatia	-3.7	-3.2	-2.4	-2.7	-5.8	-5.9	-7.8	-5.3	-5.4	-5.6
Hungary	-7.8	-9.3	-5.1	-3.6	-4.6	-4.5	-5.5	-2.3	-2.5	-2.5
Poland	-4.0	-3.6	-1.9	-3.6	-7.3	-7.5	-4.9	-3.7	-4.0	-3.3
Romania	-1.2	-2.2	-2.9	-5.6	-9.1	-6.9	-5.4	-3.2	-2.2	-1.4
Slovenia	-1.3	-1.2	-0.1	-1.4	-5.9	-5.6	-6.6	-4.1	-15.0	-5.0
Slovakia	-2.9	-3.6	-1.9	-2.3	-7.9	-7.5	-4.1	-4.2	-2.6	-2.8

Source: based on processed data provided by Eurostat, 2015

Maastricht criteria and the agreement on the necessity of setting up a single market for Euro determined continued efforts in terms of convergence to reach the required levels of the public debt and deficit of consolidated budget. If 2009 marked a maximum budget deficit for the most Member States, at the end of the reporting period it was below the average level in EU for countries like Romania, Czech Republic, Hungary and Slovakia. In 2014, Romania registered the lowest budget deficit in the region. (table no. 5)

Table no. 5. Deficit of current account, as share in GDP

GEO/Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Bulgaria	:	:	-24.3	-22.4	-8.6	-0.9	0.9	-0.3	1.9	1.2
Czech Republic	-0.9	-2.1	-4.3	-1.9	-2.3	-3.6	-2.1	-1.6	-0.5	0.6
Greece	-8.9	-11.6	-15.2	-15.1	-12.4	-11.4	-10	-3.8	-2	-2.1
Croatia	-5.3	-6.6	-7.2	-8.9	-5.1	-1.2	-0.8	-0.2	0.9	0.8
Hungary	-7	-7.1	-7.2	-7	-0.8	0.3	0.8	1.8	4	2.3
Poland	-2.6	-4	-6.3	-6.7	-4	-5.4	-5.2	-3.7	-1.3	-2
Romania	-8.6	-10.3	-13.8	-11.8	-4.8	-5.1	-4.9	-4.8	-1.1	-0.5
Slovenia	-1.8	-1.8	-4.1	-5.3	-0.6	-0.1	0.2	2.6	5.6	7
Slovakia	-10.6	-9.5	-5.9	-6.5	-3.5	-4.7	-5	0.9	2	0.1

Source: based on processed data provided by Eurostat, 2015

Data on the current account deficit reflects a worrying situation for Romania, given that imports far exceed exports and determines an increase of the long-term foreign debt. Excessive increase in consumption assumes an increase of demand and therefore of prices, under equilibrium conditions. In the absence of prudent fiscal and monetary policies, an inflationary increase represents a real threat for the sustainable economic growth.

From the perspective of the deficit structure, it derives from the low level of domestic production in some industries or sectors, such as transport, chemicals, pharmaceuticals, manufacturing equipment and mechanical and electrical technology imports. Imports of technology, although may worsen the deficit of the current account, have a positive impact on the long-term productivity and ultimately on the economic growth. However, Romania is positioned on the outskirts ranking of the countries of Central and Eastern Europe. The corrective measures should be targeted to encourage domestic production by supporting small and medium enterprises that invest in these branches of activity. (table no. 6)

Table no. 6. Net investment position, in million Euro

GEO/Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Euro area	-840	-697	-978	-1,216	-1,563	-1,467	-1,248	-1,416	-1,237	-1,136
Bulgaria	-6	-10	-15	-25	-35	-36	-34	-33	-31	-31
Czech Republic	-27	-29	-39	-53	-57	-65	-73	-70	-75	-65
Greece	-124	-149	-178	-214	-179	-207	-219	-176	-211	-220
Croatia	-15	-20	-31	-40	-35	-39	-42	-40	-39	-38
Hungary	-72	-82	-97	-103	-106	-111	-108	-94	-99	-91
Poland	-94	-108	-126	-164	-173	-193	-233	-220	-261	-273
Romania	-17	-23	-37	-54	-68	-74	-78	-84	-89	-87
Slovenia	-2	-3	-5	-8	-13	-14	-15	-15	-16	-14
Slovakia	-14	-19	-26	-28	-38	-42	-42	-45	-46	-47

Source: based on processed data provided by Eurostat, 2015

The net investment position represents the difference between assets and liabilities of residents of a state at a time. Although it is negative for Romania, it is noted that countries like Poland and Greece have a deficit well below the EU average. The increase of the residents debts creates negative premises for economic stability in the region and acts contrary to the goal of economic growth.

Conclusions

The analysis of the National Bank of Romania presented in 2015 show that Romania meets all the nominal convergence criteria. However, the economic crisis has been the benchmark for changing the approach, the nominal convergence towards real convergence, to encourage prudent attitude and limit consumption and indebtedness. Therefore, Romania's integration into the European Union requires continued efforts following the date of accession. Under the scrutiny of the European Commission, the economies of Central and Eastern Europe are monitored in terms of sensitive areas that require improvements such as public finances, taxation, pensions and healthcare, access to financing and banking system, social inclusion and combating poverty, level of wages, education and public administration.

The recommendations of the Commission for countries that have adopted Euro and for those outside the Euro area are grounded based on the development of specific macroeconomic indicators presented for each EU member state. For some EU member states, the European Commission gave warning signals when results were not according to forecasts. The macroeconomic imbalance procedure was addressed to almost all countries in Central and Eastern Europe region, excepting the Czech Republic and Slovakia. In Romania, the concerns raised in the health sector, pension financing system, taxation, social inclusion, public finance and administration.

In addition, the convergence program undertaken by the Romania requires actions to improve the infrastructure by investments and structural reform measures, as grounding for sustainable economic growth. Similarly, the excessive taxation, the budgetary deficits of the pension and health system are specific to Bulgaria, Croatia and Slovenia. Difficult access to financing for SMEs is observed mainly in Bulgaria, Croatia, Hungary and Slovenia. Also, the level of labor taxation above the European average may be seen in

the Czech Republic and Hungary. However, the European Commission forecast report (2015) shows that in Slovenia, Hungary, Poland, Czech Republic and Romania growth rates have the potential to cover the gaps to catch up with the developed economies by making visible progress in the process of real convergence.

The Swan-Solow model assumes that the rate of growth is dependent on the rate of technological progress and productivity. Thus, the macro-economic indicators, presented in the fourth Section of this paper, point out that capital flows converge to regions with demand and low costs of investment and inputs. Like any estimated model, the assumptions simplify the economic reality. The hypothesis of closed economy, for example, was turned into an open economy in the economic growth model by Barro and Sala-i-Martin in 1992. Similarly, the capital employed is represented by the investment in assets, without to take into account human factors, innovation and research.

Beyond these issues raised by European institutions and international organizations in periodic reports, the Solow-Swan growth model applied to Romania, for the period 2005-2014, determines correlations between macro-economic indicators and facilitates comparative analysis of emerging economies in the Central and Eastern Europe. The observations of real data lead to dimensioning of the effects generated in the process of real convergence.

Given that the calculation of macroeconomic indicators used in the regression analysis covered a period of ten years, the main limitation of this research is given by the 10 years period used for the database in the factor analysis. It would be recommendable for the future research to resort on a longer period of time which may provide a more accurate picture of the Solow-Swan model, applied to macroeconomic indicators related to Romania.

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