Estimation of Economic Growth Potential in Romania in Medium and Long Term

Constantin Duguleana, Liliana Duguleana[1]

Abstract:

Economic growth, as an economic process on long term, is influenced by economic, social and politic factors. The objective of this paper is to create a new perspective over the economic growth in Romania from the last twenty years. For this, the determinants of economic growth are analyzed, by emphasizing the existing correlations between the macroeconomic variables which determined the Romanian economic growth in the last twenty years. To substantiate the conclusions, there were used data from Eurostat databases, about the evolution of European Union in its whole, and for Romanian economy, especially, for the period 1995-2014. The evolution of some macroeconomic indicators is studied, as: the value added, income of different categories of workers, production costs of different types of activities. The study emphasizes the changing of economic activity structure in Romania, which favored the economic growth. Also with the structure changing, is shown the impact of technical progress over the economic growth rate. The study can be considered as an applicative scientific paper in the field of research of causes and conditions which determine the economic growth.

Key Words: *economic growth, total factor productivity, steady-state growth path*

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[1] *Faculty of Economic Sciences and Business Administration, Transilvania University from Braşov, Romania*

1. Introduction

Over time, many studies have focused their attention on the relationship between the economic growth rate and investments. The link between economic growth and investments has been an essential component of economic growth theory, especially when Harrod (1939) had formalized a relationship between capital accumulation and the labor productivity, in a dynamic model of growth and development. A whole class of models inspired by the works of Solow (1956), have at base the idea that stable economic growth rate depends on the rate of technical progress, which in turn it depends on exogenous factors. Investment rate along with other variables that may be affected by government policies significantly affect the ability of an economy to maintain a stable economic growth path (Thalassinos *et al.,* 2012; 2014 and 2015). Kaldor (1961) revealed that for a number of countries, income per capita in the long term is a major feature of them (major stylized facts).

Endogenous economic growth models differ of neoclassical models through the fact that the growth rate is determined by forces that are formalized within models, and not let outside of them, as is the case of exogenous growth models. Many of these models imply that the growth rate of investment in physical capital, but also the investment in human capital or in knowledge development have a positive effect on the growth rate, seen as a long-term phenomenon. The capital is defined broadly to include physical capital, human capital and information capital. Models of this type are those of Romer (1986), Baro (1990) or Magazzino (2012).

A popular approach is to use cross-country regressions. Using this approach, Romer (1987), Baro (1991), and Dinopoulos and Thompson (1997) showed the correlation between the investment rate, measured in fixed capital investment and economic growth rate. Such correlations are possible if the sample includes economies found on the stable economic growth path. If the same sample contains a combination of stable economies with some economies in transition, estimators of parameters have a displacement, thereby causing the approach of regression cross-country to be limited.

The theoretical and applied development of time series analysis has led to the emergence of models that can be applied to the analysis of the correlation between economic growth and investment. The dynamic models, in which the values of a variable are explained by its past values and the values, possibly taken by other variables, are among the most used. The models of type ECM (Error Correction Models) allow the short-term analysis of the influence of an explanatory variable on the endogenous variable, but also the adjustment rate of endogenous variable on long-term, when recovering after a shock to the stable growth path.

This paper will use an ECM to estimate the rate of stable growth and the time needed by the Romanian economy to achieve it. In Romania, other concerns for the

study of the relationship between economic growth and investment are those of Albu L. (2006), E. Dobrescu (2006), Ghizdeanu I. (2003).

2. Data

The data used in this study are quarterly, the analysis period being 1995Q2 - 2015Q1 (80 observations). These data are taken from the Eurostat, and correspond to the databases of the National Institute of Statistics (INS) in Romania. In terms of this study, the changes which occurred in the growth rates of investment are interesting and how these changes have been reflected on the rates of economic growth in Romania. The data are seasonally adjusted according to the number of days worked. The main descriptive characteristics of the data are given in Table 1.

Table 1. *Descriptive statistics of GDP rate and investment rates over 1995Q2 – 2015Q1 period*

Period	GDP rate (GR series)				Investments rate (IR series)			
	Mean	SD	Min	Max	Mean	SD	Min	Max
1995Q2 – 2000Q1	0.0	2.2649	-5.5	5.4	-0.4	16.2087	-24.3	41.7
2000Q2 – 2005Q1	1.3	1.2030	-1.3	3.3	2.7	0.6800	-5.7	15.4
2005Q2 – 2010Q1	0.9	2.1988	-6.2	3.9	2.3	10.6066	-25.5	25.9
2010Q2 – 2015Q1	0.5	0.8030	-1.1	1.5	-0.4	4.2728	-9.1	10.7

Source: *Eurostat*

Figure 1. *The fluctuations of GDP rate and Investment rate, over 1995Q2 – 2015Q1 period*
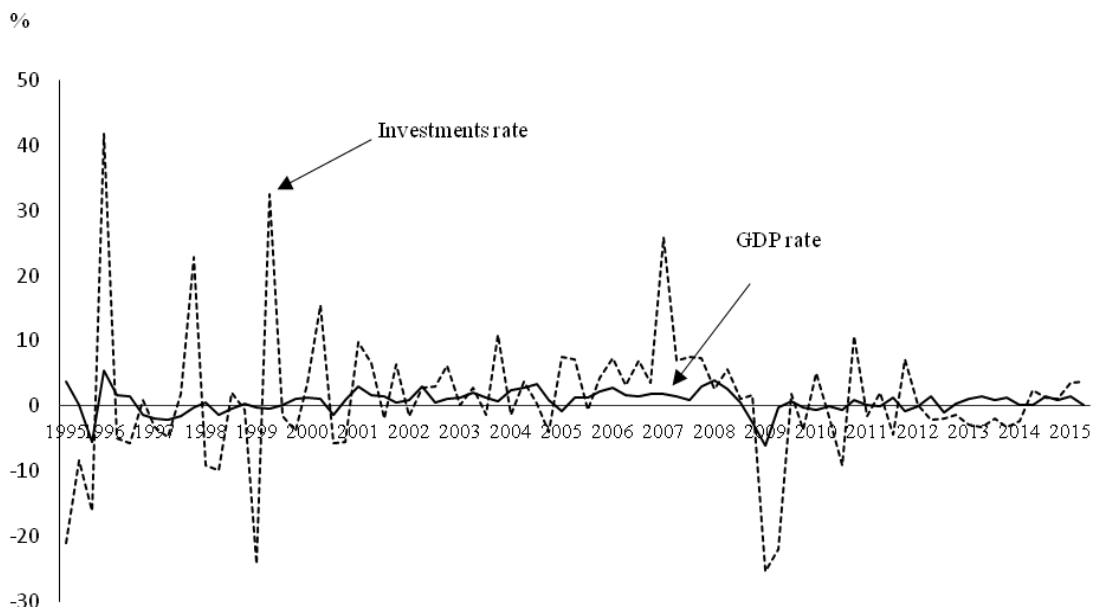
Figure 1 illustrates the developments in the economic growth rate and investment rate for the period 1995Q2 - 2015Q1. In some cases, investment growth rates have strayed significantly from the growth rates of GDP. When positive deviations have been followed by the negative ones, the GDP growth rates have not amply fluctuated. This is the case of increased investment in 2007Q1, with 25.9%, followed by 25.5% decline in 2009Q1. In those periods, the GDP growth rates were + 1.9% and -6.2%. In the first period, 1995Q2 - 2000Q1, investment growth rates had larger and more frequent fluctuations compared to other periods. During 2010Q2 - 2015Q1, the GDP growth rates were in the range [-1.1; +1.5], and those of the investment, in the range [-9.1%, 10.7%].

3. Methodology

First, was conducted a test ADF (Augmented Dickey-Fuller) on IR and GR series. ADF is a test based on residuals being used to test the existence of a unit root process, in which the null hypothesis supposes that the variable contains a unit root, and the alternative hypothesis assumes that the variable is generated by a stationary process. Atât pentru variabila GR și variabila IR, testul ADF duce la respingerea ipotezei nule, în imposibilitatea de a spune cu suficientă precizie că au o rădăcină unitate.

As a result, there is no need to make a co-integration test. However, co-integration can be tested using the model:

$$GR_t = \beta_0 + \beta_1 \cdot IR_t + \varepsilon_t$$

where GR is the economic growth rate, and IR represents the investment rate.

Error term, ε follows a normal distribution law with average 0 and constant variance, σ. In order to decide that the series are cointegrated, it is sufficient that ε_t to be stationary, and β_1 to be statistically significant and in the expected direction, that is to be positive. The cointegration highlights the existence of a stable relationship on long-term between GR and IR.

The LMSC test (Lagrange Multiplier Serial Corelation), applied on GR's regression on IR, does not reveal the existence of serial correlation.

To determine a possible regime change, Dickey-Fuller test was applied min-t, which minimizes the t-statistic for intercept break coefficients.

For *GR* series representing GDP growth rates, it was revealed a regime change since Q1 2009. The result is illustrated in Figure 2.

For the series representing investment rates, *IR*, the regime change highlighted by this test, starts with the second quarter of 2009, as illustrated in Figure 3.
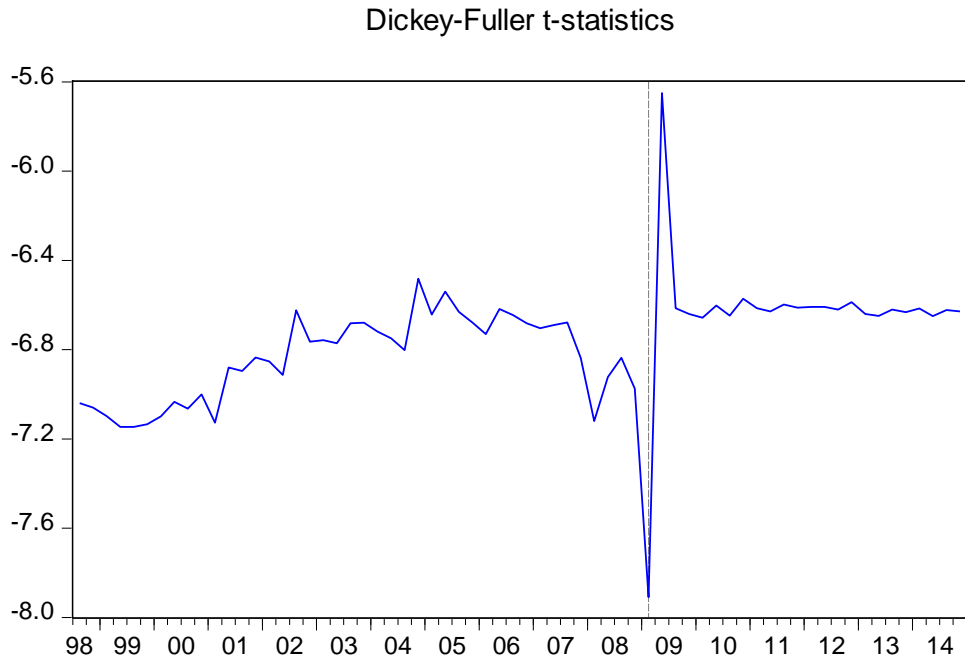
Dickey-Fuller t-statistics

Figure 2. *Break Date for GR Series: 2009Q1*
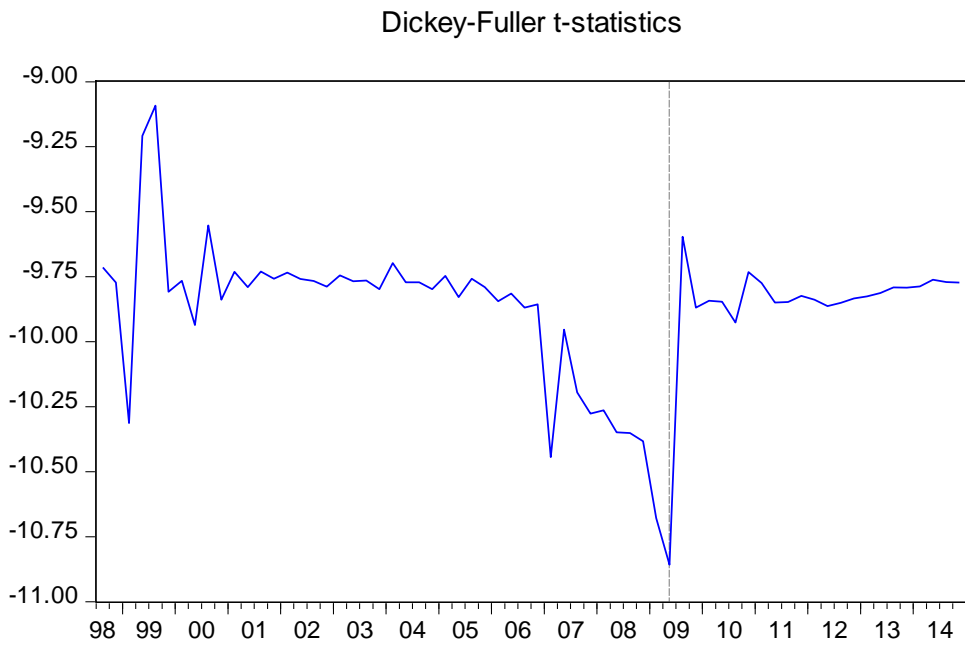
Dickey-Fuller t-statistics

Figure 3. *Break Date for IR Series: 2009Q2*

Secondly, was identified the model to determine the effects of short-term and long-term before and after the relevant change of regime, of the rate of investment on the economic growth rate. The ECM model used is as follows:

$$\Delta GR_t = \alpha + \beta_0 \cdot \Delta IR_t - \beta_1 (GR_{t-1} - \beta_2 IR_{t-1}) + \varepsilon_t$$

where:
the portion of the equation, $GR_{t-1} - \beta_2 IR_{t-1}$, is the error correction mechanism;
β_0 estimates the short term effect of an increase in IR on GR;
β_1 estimates the speed of return to equilibrium after a deviation.

The trend was not included in the equation, clearly not having such a component data.

If the ECM approach is appropriate then $-1 < \beta_1 < 0$, and β_2 estimates the effect of increasing with one unit (one percentage point) of *IR* on *GR*. The long term effect will be distributed during successive periods, consistent with the β_1 rate of term *error corection*.

4. Causality analysis

To make the analysis more robust, it will proceed to investigate the causal direction. For this, a Granger test will be used. Although it is a test that reflects the precedence, meaning that it tests whether the changing of a variable occurs regularly before the changing of another, it can be said that when this happens, the variable that is changing first is a Granger cause for that which is changing after.

Granger methodology was followed by the construction of VAR models using different lags of variables. According to Granger causality significance, the results confirm that the investment rate is a cause of economic growth rate. As can be seen in Table 2, with a high probability *IR* affects *GR* (probability is much lower in reverse).

Table 2. *Result of Granger causality test*

period	*GR* affects *IR*				*IR* affects *GR*			
1995Q2 – 2015Q1	Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
	GR	3.209999	2	0.2009	IR	23.09690	2	0.0000

5. Empirical evidence

In order to estimate, the equation ECM was formulated as follows:

$$\Delta GR_t = \alpha + \beta_0 \cdot \Delta IR_t + \beta_1 GR_{t-1} + \beta_2 IR_{t-1} + \varepsilon_t$$

The equation was estimated first, on period 1995Q2 – 2009Q1. The obtained results are:

$$\Delta GR_t = 0{,}06 + 0{,}10 \cdot \Delta IR_t - 0.62 GR_{t-1} + 0.13 IR_{t-1} + e_t$$
$$(0.019) \qquad (0.124) \qquad (0{,}031)$$
$$t = \quad 5.43 \qquad -4.97 \qquad 4.37$$

$$n = 55 \qquad R^2 = 0.54 \qquad \overline{R}^2 = 0.52 \qquad F = 20.59$$

These results can be written in ECM form as:

$$\Delta GR_t = 0{,}06 + 0{,}10 \cdot \Delta IR_t - 0.62(GR_{t-1} - 0.21 \cdot IR_{t-1}) + e_t$$

It is noted that $\beta_1 = -0{,}619882$, i.e. meets condition $-1 < \beta_1 < 0$ and is statistically significant. This means that the ECM approach is appropriate. All coefficients are also statistically significant.

A change in the rate of investment has effects on the rate of economic growth both on the short and long term. According to the obtained results, we can say that an increase in the investment rate by one percentage point causes on short-term, an increase of economic growth rate with 0.10 percentage points. *GR* and *IR* are in their state of long-term equilibrium when:

$$GR_t = 0{,}104 + 0.21 \cdot IR_t$$

An increase of *IR* with one percentage point causes a deviation from equilibrium, *GR* appears as too low to maintain balance. Restoring balance is done by increasing *GR* with 0.21 percentage points. The increase of 0.21 percentage points is distributed to the following periods at a rate of 62% per time unit: 0.13 percentage points at time t, 0.05 percentage points at time t + 1, 0.02 percentage points at time t + 2, and 0.01 percentage points at the time t + 3. The results of the long-term distribution of the effects of increasing investment rate by one percentage point on economic growth are illustrated in Figure 4.

The estimation results for the second period, 2009Q2 – 2015Q1, are as follows:

$$\Delta GR_t = 0.40 + 0.002 \cdot \Delta IR_t - 0.92 \cdot GR_{t-1} + 0.002 \cdot IR_{t-1} + e_t$$
$$(0.036) \qquad (0.166) \qquad (0{,}047)$$
$$t = \quad 0.05 \qquad -5.56 \qquad 0.06$$

$$n = 24 \qquad R^2 = 0.76 \qquad \overline{R}^2 = 0.72 \qquad F = 21.41$$
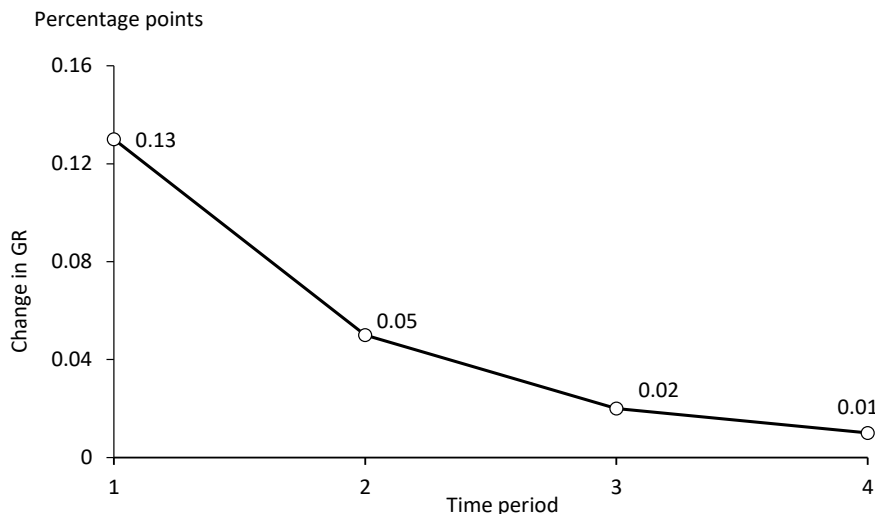
Percentage points

Figure 4. *Distribution in time of the effects of investment increasing on the economic growth rate*

Written in the form of ECM, the results are:

$$\Delta GR_t = 0.40 + 0.002 \cdot \Delta IR_t - 0.92(GR_{t-1} - 0.0021 \cdot IR_{t-1}) + e_t$$

It is noted that $\beta_1 = -0{,}924535$, i.e. meets condition $-1 < \beta_1 < 0$ and is statistically significant.

This means that the ECM approach is appropriate. Not all coefficients are statistically significant, but on the whole model is significant, $F = 21.41$ exceeding the critical value.

In this case, the changing of investment rate has effects on the rate of economic growth, both short and long term. Thus, an increase in the investment rate by one percentage point, causes an immediate increase in the rate of economic growth (in the same year) with 0.002 percentage points. Starting with 2009Q1, short-term impact of the increasing of investment rate over the economic growth rate has become lower. The long-term equilibrium relationship between *GR* and *IR*, after 2009Q1 is:

$$GR_t = 0.43 + 0.0021 \cdot IR_t$$

After an increase of *IR* by one percentage point, the returning to the balance between *GR* and *IR* is done by increasing *GR* with 0.0021 percentage points. The increase of 0.0021 percentage points is distributed over the following periods with a rate of 92% per unit time, i.e. almost entirely in the near future. This fact reflects obviously, the

targeting of investments due to the manifestation of economic crisis from long-term investments towards speculative investments. Given the relatively small number of observations after 2009Q1, only 24, these results should be viewed with caution. Figure 5 shows the regime change produced in 2009Q1.
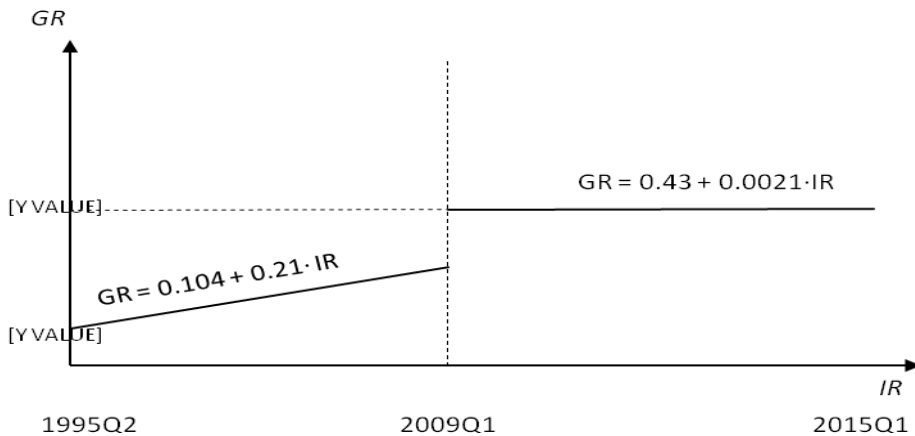

Figure 5. Regime change produced in 2009Q1

If parameters are estimated for the entire period, without taking into account the change of regime in 2009Q1, the long-term relationship between *GR* and *IR* is:

$$GR_t = 0{,}46 + 0.17 \cdot IR_t$$

An increase of the investment rate by one percentage point increases the economic growth rate by 0.17 percentage point; the growth which is distributed in subsequent periods at a rate of 76%. Thus, in year t, GR will increase by 0.13 percentage points, in year t + 1 the increase will be with 0.03 percentage points, while in year t + 2 it will be of 0.01 percentage points. If envisages an increase in the investment rate equal to the average of the last quarters, of 2.4%, it results that the annual economic growth rate can not be higher than 3.5%. Any economic growth rate above this level is not sustainable, not being the result of a real process of increasing the investment rate. An economic policy which not envisages the increasing of investment but stimulating consumption, to ensure an economic growth beyond the limit of 3.5% will require further adjustments that will bring again the growth rate to a level that will be in long term balance with the growth rate of investment.

6. Conclusions

In this paper it was assessed the link between economic growth rate and the investment rate. A particular attention was paid to the separation of the influence of increasing in the investment rate on the economic growth rate in: long-term influence and short-term influence. Special attention was paid to the regime change,

i.e. the change of the long-term relationship between the investment rate and economic growth rate. The intuited relations are empirically satisfied. The serial correlation is avoided and Granger causality highlights the direction of causality: from the rate of investment to the economic growth rate. The analysis may be useful to estimate the stable growth rate, in view of investment volume. On the basis of precise estimation of the balance between economic growth rate and the investment rate can be designed policies for sustainable economic growth.

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