# 1 TRENDS IN THE INTEREST RATE – INVESTMENT – GDP GROWTH RELATIONSHIP

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## Abstract

*In the last years it seemed that the Romanian economy leading up to access to the EU was going to enter a new stage, evolving more and more in line with the standard theory. Based on more accurate statistical data for the last years, we try to verify some hypotheses used in the standard economic literature. Also, applying few simple models derived from the standard ones in our experiment we estimated their parameters in the case of Romania in order to obtain an image of the trends in the next period. The two main partial models are referring to the impact of investment on GDP growth rate and to the relation between the interest rate and investment, respectively. Moreover, an equation including inflation dynamics was taken into account. Beginning in 1998, the behaviour of the national economic system and the interest rate – investment – economic growth relationship tend to converge to those demonstrated in a normal market economy and presented in the specialised literature.*

**Keywords:** Investment Rate, GDP Growth Rate, Interest rate, Depreciation Rate, Contour Plot.

**JEL Classification:** C51, E22, E27, P24

## The Model

Coming from standard literature, we used the following three basic equations:

$$r(\alpha) = a^*\alpha + b \quad (1)$$

$$\alpha(i) = c / (d + i) \quad (2)$$

$$i(p) = e^*p + f \quad (3)$$

where r - GDP growth rate, $\alpha$ – investment rate (in GDP), i – interest rate, p – inflation, a, b, c, d, e, and f – parameters (estimated econometrically).

The first equation tries to capture the impact of investment on GDP growth, the second equation demonstrates an inverse relation between interest rate and investment, while the third equation takes into account a direct relation between

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inflation and interest rate. Using some simple algebraic operations, based on the above equations we can obtain also some other useful derivate equations, as follows:

$$r(i) = b + a*c / (d + i) \quad (4)$$

$$\alpha(p) = c / [d + (e*p + f)] \quad (5)$$

$$i(\alpha) = (c / \alpha) - d \quad (6)$$

Moreover, we can express the empirical inflation–GDP growth rate relation in case of the Romanian economy:

$$r(p) = b + a*c / (d + e*p + f) \quad (7)$$

**Estimations**

We tried to estimate the parameters of equations in the case of the Romanian economy on the basis of the whole period after 1989, but the results were very poor because of the quality of statistical data (for instance, in 1992 average inflation was 210.4% and average active interest rate was 49.6%, in 1993 they were 256.1% and 58.9%, respectively, etc.). Only since 1998 the statistical data have become more relevant. The output of our experiment in the period 2000-2005 is shown in Figures 1-3, where: variables on ordinate axis and inflation are per cent; years are denoted from 1=2000 to 6=2005; E attached to the name of variable means estimated; r_L and r_U (represented as black dashed lines) mean the lower limit and upper limit, respectively (95% confidence intervals).

**Figure 1**

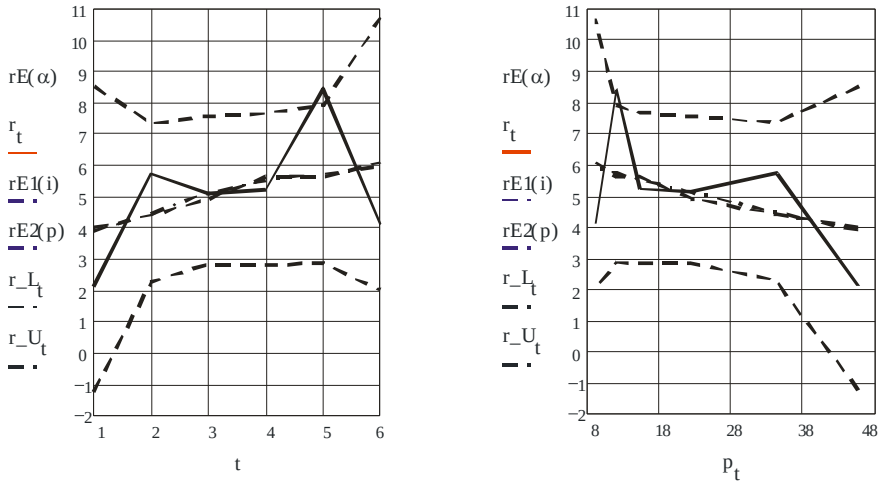


Figure 2

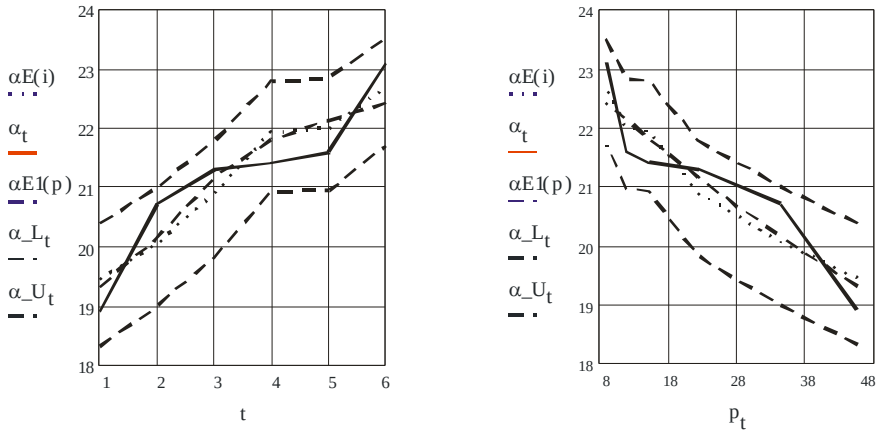
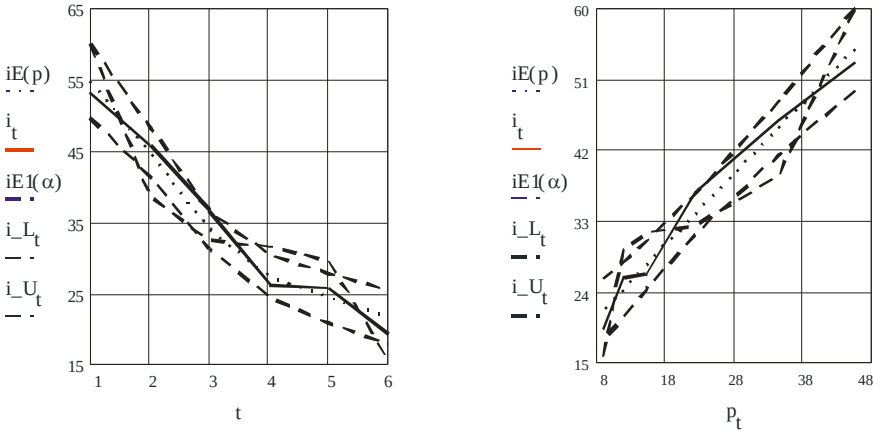



Figure 3




Also, Annex presents some 3D graphic representations for variables and their attached Contour Plots corresponding to real annual registered data over the period 2000-2005. Based on historical data, among other conclusions, we may see that a GDP growth rate of about 7% could be obtained for an investment rate of around 22% and an interest rate of about 10% (it is represented by peak 7 on the map denoted ($\alpha$, i, r). From the contour map (p, i, r) we can see the line 5 (5% GDP growth rate) that follow very closed the diagonal line of plan p-i, which can be interpreted as a natural rate of GDP growth rate. A similar conclusion, but for investment rate, could be derived from contour map (p, i, $\alpha$), where the trajectory of its natural rate could be considered the top line following very close the diagonal line of plan p-i. Contour map (p, $\alpha$, r) demonstrates the negative impact of inflation on the GDP growth.

**Simulation**

Based on relation (1) the simulation of the model demonstrated a critical value of 13.2% for investment rate ($\alpha$cr1). For $\alpha$<13.2% the GDP growth rate will be negative. Moreover, in the extreme case of no investment ($\alpha$=0) GDP will decrease by 8.6% per year (estimated value of coefficient b is around -8.6%). Accepting the hypothesis of a constant level of the so-called capital coefficient (computed as Stock of Fixed Capital/GDP) the value 8.6% could be used as a first estimate for the annual rate of capital depreciation in case of Romania which means in case of no investment that the whole stock of fixed capital will be consumed in only 12 years (to note that this shows a special situation for the capital stock in Romania: many productive capacities are still obsolete, physically and/or morally depreciated, more of them being underused or in conservation). Simulation of equation (2) shows a strong inverse correlation (hyperbolic correlation) between investment and interest rate: Coefficient of Multiple Determination R^2=0.845443; Adjusted coefficient of multiple determination Ra^2=0.806804; Durbin-Watson statistic=2.032844; Variable c – t-ratio=4.56026, Prob(t)=0.01034; Variable d – t-ratio=3.87819, Prob(t)=0.01787). It also allowed us to compute the potential level of GDP growth rate of 7.62% – a theoretical level computed as a value of GDP growth rate at the point $\alpha$cr2=c/d=25.1%, corresponding to an hypothetical interest rate tending to be equal to zero. Based on the simultaneous simulation of the two equations we computed a more realistic maximum for GDP growth rate, namely equal to 7.02% – also a theoretical level computed as a value of GDP growth rate at the point $\alpha$2=24.1%, corresponding to the situation in which GDP growth rate tends to equal interest rate. To note that in this situation we could suppose the stability of the whole economic system, like in case of studying the sustainability of public debt and deficits (Albu and Pelinescu, 2000). Some results of the simulation of the two partial models represented by equations (1) and (2) are shown in Figure 4.

**Figure 4**

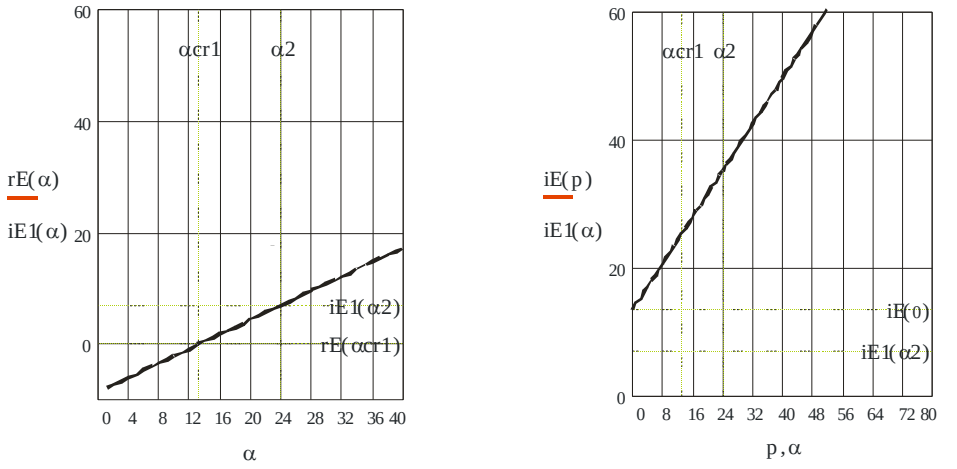
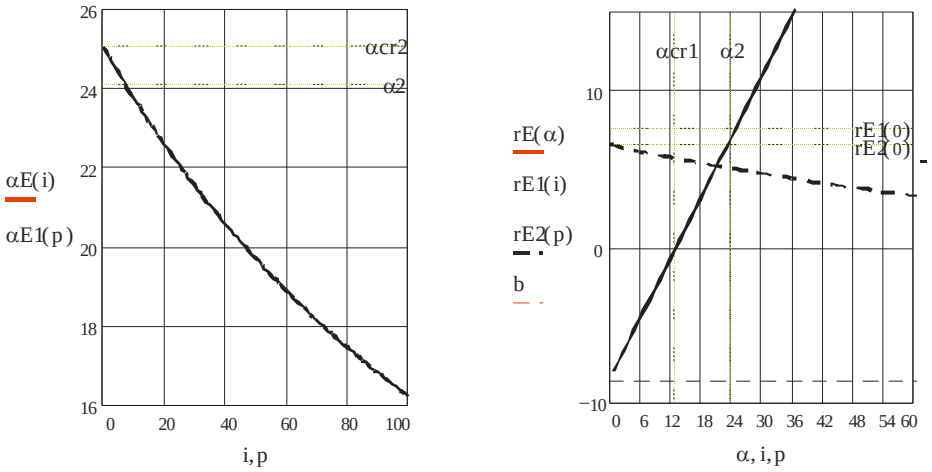


Figure 5

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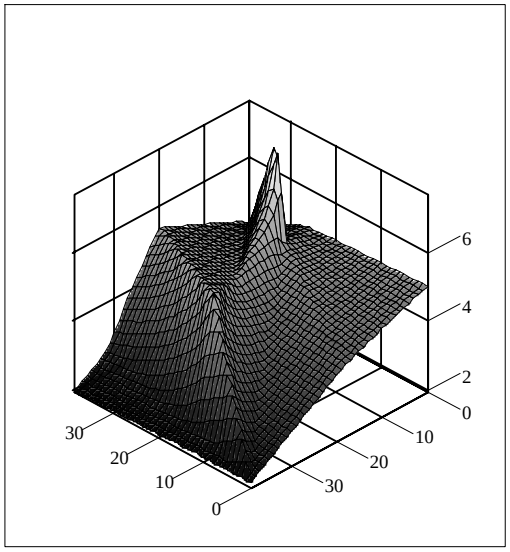
## Annex

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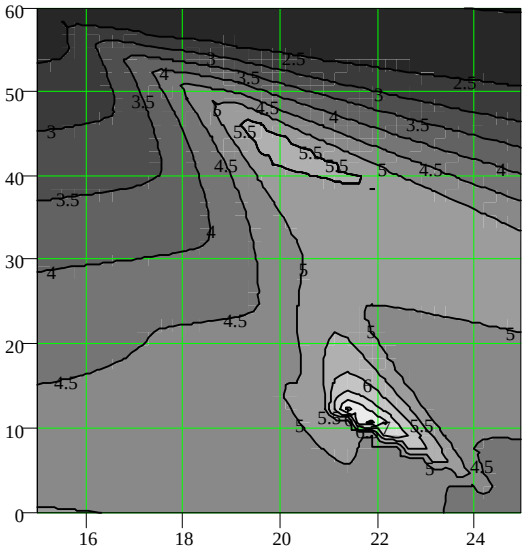


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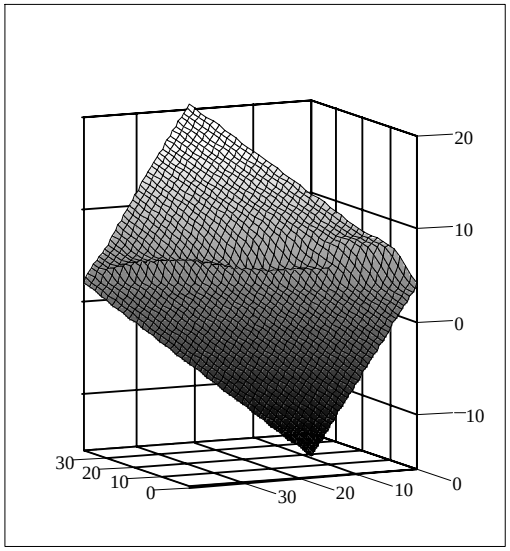
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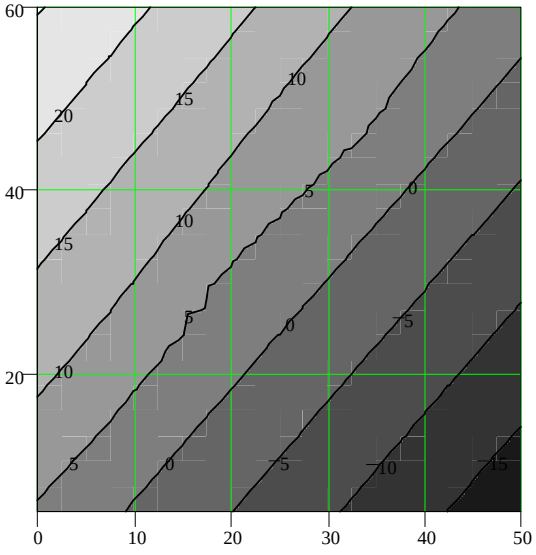
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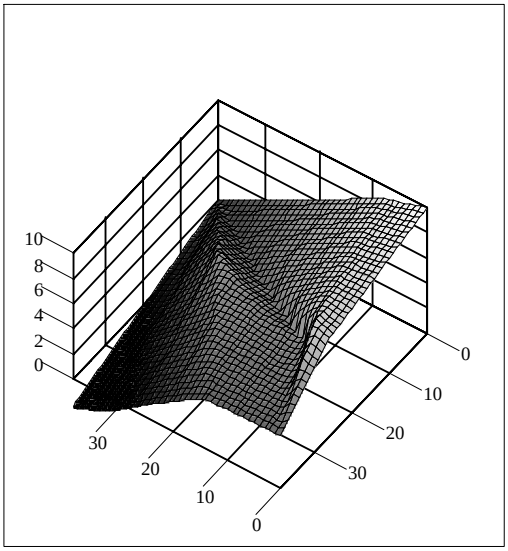


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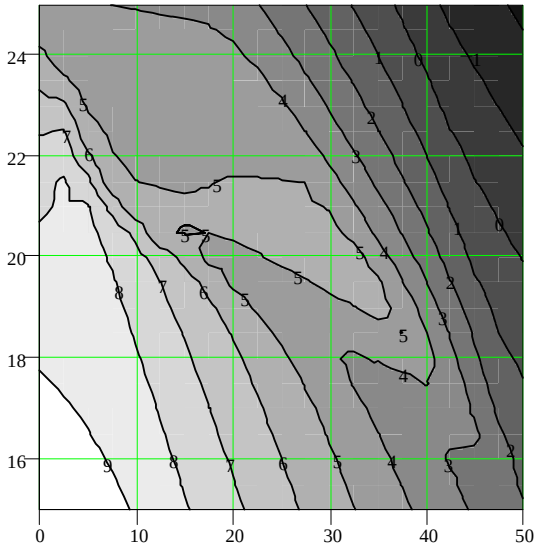


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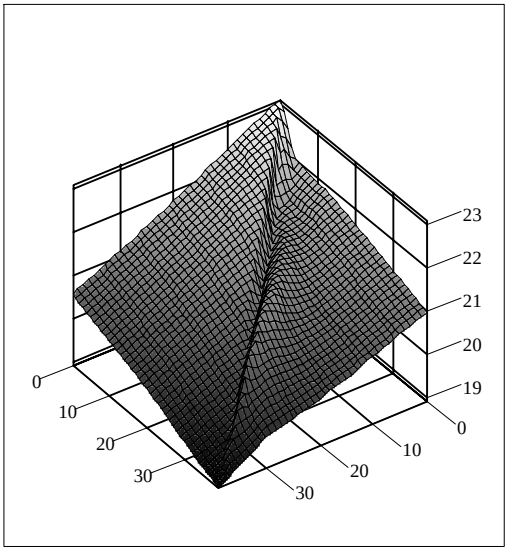
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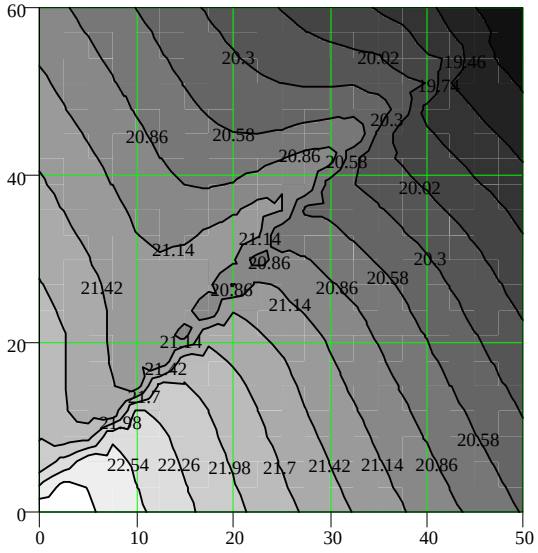
p , i , α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p , i , α