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INVESTMENTS' EVOLUTION REGARDED THROUGH AN ECONOMETRIC MODEL

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Abstract. This study intends to study the investments' evolution depending on the real interest rate of the economy. The simple scheme that we will develop in this study starts from the following idea: an increase of the interest rate will lead towards a decrease of the sells' volume, and also the decrease of the investments' level, especially the ones regarding the assets and buildings. On the contrary if the interest rate is decreasing than the sells volume increases, and there are increasing the investments (fixed assets and buildings).

The study will present realistic data and will try to find the appropriate explanation for the investments' evolution and its dependence related to interest rate level.

Considering the legal settlements in the present for Romania, a foreign direct investment refers to:

a) Constituting commercial companies, subsidiaries or filial, with foreign capital or associated with Romanian individuals or juridical persons, according to the Law nr. 31/1990 regarding the commercial companies;

b) Participating in increasing the capital of an existing company or inquiring social parts or shares of these companies, as well as convertible bonds or other effects;

c) Concession, rent or administrating location, according to the law, of some economic activities, public services, production units of some autonomic companies or commercial companies;

d) Achieving property right regarding some mobile or immobile goods, other real rights, excepting the possession right regarding the land;

e) Achieving property rights regarding the industrial and intellectual goods;

f) Achieving rights of generating a debt or other rights referring to the services execution with economic value associated to an investment;

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g) Achieving spaces for production or other buildings, excepting the houses, other than the auxiliaries of the investment, as well as their building;

h) Realizing the contract regarding the exploration projects, exploitation and splitting the production in the natural resources area.

The study approaches the issue of the direct foreign investment, in the way of that as the foreign direct investment shows an investment relation on long term, between a residential entity and a non-resident entity; usually, it involves the exercitation from the investor of a significant managerial influence in the enterprise in which he has invested.

The Romanian economy from the '90 years was characterized through the majority of state companies. The possibility of building private capital companies has lead to the increase of the investors' interest, including the non-resident persons, regarding the Romanian business medium. The empirical data are based on the foreign investments recorded in Romania in the period of 1991 – 2005.

The economic and social indicators calculated for 2005 shows, for Romania case, generally, a positive situation. The indicators are displaying an ascendant tendency compared with anterior periods. The Gross Internal Product was stabilized and it recorded an increase of 4.9% compared with the 2002 level, but it could not influence in a positive way the budget deficit, which continued to float round 2.7% at the end of the year.

During the year 2005, the national currency depreciation phenomenon, expressed through the continuous raise of the Leu / Euro and Leu / USD exchange rates, has continued in a predictable rhythm and in temperate way.

The foreign currency reserves of the Romanian National Bank has recorded a slightly increase, being reasonable at the end of the year 2003. The evolution the exchange rate had its contribution in increasing these reserves, through attracting the foreign currency from the population.

A simple calculus leads to the idea that, presently, the population has approximately eight or nine milliard US dollars, none deposed at the banks.

Considering the situation that the exports won't be at a high level, keeping the tendency shown during the year 2002, and the balance of trade continuous to remain negative and it won't be purchased measures to attract the foreign currency from the population, realizing the return of the credits in 2005 will be much difficult.

So, attracting local and foreign investments appears as being the only so-

lution for the Romanian economy's evolution, as for the entire world and, especially, Europe.

The foreign investments will have as effects: replacing the loans that Romania has to contract; modernizing the private and public companies; introducing a new management model; high qualification and specialization of the staff; using the external market segments, eliminating external competition; raising production's quality and developing also the market economy.

In studying the foreign direct investment, the econometric models found in the specialty literature, are describing the dependence between foreign investments and interest rate. We want to study this dependence in this paper work.

Because the investments are depending on the interest rate and of the investments from the previous year, we will build the following econometric model:

$$Y_t = a_0 + a_1 x_{1t} + a_2 x_{2t} + \varepsilon_t$$

where the signification is:

Y_t – investments at the t moment;

x_1 – interest rate at the t moment;

x_2 – investments at the $t-1$ moment.

It is about a particular case of the generally linear model with free term:

$$y_t = a_1 x_{1t} + ... + a_p x_{pt} + \varepsilon_t \qquad (t = 1, 2, \ldots, T) \qquad (1)$$

in which:

Y – is the endogen variable;

$x_1, x_2, \ldots, x_p$ – are exogenous variables;

$a_1, a_2, \ldots, a_p$ – are the unknown parameters that will be estimated, supposing that $x_{pt} = 1$, no matter what will be $t = 1, 2, \ldots, T$ and as a consequence Xp is considered an auxiliary variable.

In metrical shape we have:

$$Y = Xa + \varepsilon \qquad (2)$$

with:

$$Y = \begin{bmatrix} y_1 \\ \cdots \\ y_T \end{bmatrix}, \quad X = \begin{bmatrix} x_{11} & \cdots & x_{p1} \\ \cdots & \cdots & \cdots \\ x_{1T} & \cdots & x_{pT} \end{bmatrix}$$

$$a = \begin{bmatrix} a_1 \\ \cdots \\ a_p \end{bmatrix}, \varepsilon = \begin{bmatrix} \varepsilon_1 \\ \cdots \\ \varepsilon_T \end{bmatrix} \tag{3}$$

From $Y = X_a + \varepsilon$, results:

$$Y = X_a + \varepsilon,$$

from where:

$$\sum_{t=1}^{T} \varepsilon_t^2 = \varepsilon'\varepsilon = (Y - X_a)'(Y - X_a) = u$$

Let's consider $\hat{a}$ the value of the a vector, for which $u =$minimum, respectively,

$$\frac{d_u}{d_a}\Big|_{a=\hat{a}} = 0$$

or

$$(Y - X\hat{a})'\frac{d(Y - X\hat{a})}{d\hat{a}} + \frac{d(Y - X\hat{a})}{d\hat{a}}(Y - X\hat{a}) = 0$$

or

$$(Y - X\hat{a})'(-X) + \left(\frac{d(Y - X\hat{a})}{d\hat{a}}\right)'(Y - X\hat{a}) = 0$$
$$-Y'X + \hat{a}X'X - X'Y + X'X\hat{a} = 0.$$

But $Y'X = X'Y$ so that,

$$-Y'X = -X'Y \text{ and } \hat{a}X'X = X'X\hat{a}$$

So,

$$-2X'Y + 2X'X\hat{a} = 0,$$

or

$$X'X\hat{a} = Y'Y,$$

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from where the estimated vector:

$$\hat{a} = (X'X)^{-1}(X'Y) \tag{4}$$

Database for our study will be the interest rate during the period 1991 – 2005 and the foreign direct investment in that period (National Institut of Statistiques, Romania, 1990-2005).

Companies with foreign capital recorded in Romania during the period 1991 – 2005

Year	Companies number		Foreign capital expressed in currency					
			National currency		Foreign currency			
	Number	- % -	- Mil. RON -	- % -	- thousands USD -	- % -	- thousands EUR -	- % -
Total	97,203	100	175,981,801.00	100	10,365,684.00	100	8,217,269.30	100
1991	5,486	5.7	1,258,493.00	0.7	879,712.10	8.5	697,381.00	8.5
1992	11,790	12.1	584,646.00	0.3	545,050.60	5.3	432,082.20	5.3
1993	10,602	10.9	918,657.90	0.5	416,913.80	4.0	330,503.30	4.0
1994	11,075	11.4	2,347,968.00	1.3	910,646.30	8.8	721,903.70	8.8
1995	3,393	3.5	730,852.60	0.4	282,960.20	2.7	224,313.30	2.7
1996	3,617	3.7	2,277,224.90	1.3	586,911.60	5.7	465,267.00	5.7
1997	5,252	5.4	2,411,211.80	1.4	373,638.50	3.6	296,197.40	3.6
1998	8,836	9.1	7,372,695.10	4.2	732,216.10	7.1	580,455.40	7.1
1999	7,377	7.6	12,304,780.40	7.0	948,086.90	9.1	751,584.30	9.1
2000	8,568	8.8	18,353,548.50	10.4	826,039.20	8.0	654,832.50	8.0
2001	7,130	7.3	48,290,928.60	27.5	1,527,111.10	14.7	1,210,598.70	14.7
2002	7,483	7.7	35,650,884.00	20.3	1,081,563.30	10.4	857,396.10	10.4
2003	6,594	6.8	43,479,918.20	24.7	1,254,834.00	12.1	994,754.40	12.1
2004	8,679	6.9	47,579,498.30	25.8	1,329,459.00	13.5	1,075,256.60	14.2
2005	8,923	7.2	49,258,267.80	26.9	1,496,583.20	14.9	1,195,248.60	15.4

We will consider the investments evaluated in milliard USD and the interest rate during this period, as it follows:

Year	Investments in current year	Interest rate	Investments in Previous year
1991	8.8	26.8	7.7
1992	5.5	24.6	8.8
1993	4.2	24.0	5.5
1994	9.1	22.5	4.2
1995	2.9	19.0	9.1
1996	5.9	17.6	2.9
1997	3.7	13.7	5.9
1998	7.3	13.3	3.7
1999	9.5	15.5	7.3
2000	8.3	14.5	9.5
2001	15.3	13.9	8.3
2002	10.8	12.5	15.3
2003	12.5	12.0	10.8
2004	13.3	11.8	12.5

Having as a base the model:

$$Y_t = a_0 + a_1 x_{1t} + a_2 x_{2t} + \varepsilon_t,$$

We will determine the estimator values of a.

$$X = \begin{bmatrix} 8.8 & 26.8 & 1 \\ 5.5 & 24.6 & 1 \\ 4.2 & 24 & 1 \\ 9.1 & 22.5 & 1 \\ 2.9 & 19 & 1 \\ 5.9 & 17.6 & 1 \\ 3.7 & 13.7 & 1 \\ 7.3 & 13.3 & 1 \\ 9.5 & 15.5 & 1 \\ 8.3 & 14.5 & 1 \\ 15.3 & 13.9 & 1 \\ 10.8 & 12.5 & 1 \\ 12.5 & 12 & 1 \\ 13.3 & 11.8 & 1 \\ 14.9 & 9.5 & 1 \end{bmatrix} \quad Y = \begin{bmatrix} 8.8 \\ 5.5 \\ 4.2 \\ 9.1 \\ 2.9 \\ 5.9 \\ 3.7 \\ 7.3 \\ 9.5 \\ 8.3 \\ 15.3 \\ 10.8 \\ 12.5 \\ 13.3 \\ 14.9 \end{bmatrix}$$

In this way it results the model parameters estimators' matrices

$$\tilde{a} = \begin{bmatrix} 1 \\ 1.38778E - 15 \\ -4.11893E - 14 \end{bmatrix}$$

Because the solutions obtained for a_1 and a_2 are reaching 0, then the dependence between the foreign investments and the interest rate is not validated using this model. Normally, after obtaining the solutions for matrices of the parameters estimators, will be necessary a verification of the used model, by effecting a series of tests for validating the model, for the parameters and the residual variable. From the results obtained does not result any correlation between the foreign investments and the interest rate.

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