

## STATISTICAL MODELING OF THE VARIABLES FOR INVESTMENT ACTIVITY IN ROMANIA

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### ABSTRACT

*Techniques of regression and correlation were used to analyse the investment activity are very difficult to achieve. Numeric information regarding investment phenomenon's evolution in time is systematically recorded at national level. To understand as comprehensive as you can the informational message offered by the formed time series, these make the subject of a complex statistic analysis, ended with understanding the evolutionary regularities. In conclusion the overall analyze of the Romanian investment activity are the modest level of this in comparison with our country resources and with the future increasing reserves.*

**KEYWORDS** *investments, GDP, central tendency, asymmetry coefficient, regression*

**JEL CLASSIFICATION** *E22, E23, C15, B19, C02*

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### 1. INTRODUCTORY ASPECTS FOR CHARACTERIZING THE INVESTMENT ACTIVITY IN ROMANIAN

Evolution of the economy and particularly its efficiency depends on the size; structure and efficiency of expenditure are to acquire capital investments collectively. Romanian economy in the European market integration has increased the dependence of national goods and foreign capital, the major European industrial and financial centers, connecting to sources of external capital inputs<sup>i</sup>, while increasing the size flow internal and external material values. Service sector with investments contribute to a more efficient use of human, material and financial resources and needs of people and society as a whole. It also stimulates growth, renewal<sup>ii</sup> and diversification of production of material goods and provides conditions for facilitating the distribution and consumption. During 1996 - 2005 the FDI in Romania amounted to \$ 7.3 billion (of which about \$ 2 billion in privatization), located on the potential level of the economy, and with the situation in neighboring countries: Poland (39 billion), Hungary (\$ 21.5 billion), Czech Republic (\$ 12.5 billion). This differentiation can be explained by the position makers from foreign direct investment in the countries mentioned that was different both in content as well as in consistency. It is noteworthy the fact that large foreign capital inflows in these neighboring countries were determined mainly by partial privatization of public utilities, some airlines or some state banks.

From this point of view, Romania's position was much different. In essence, in Romania until 1996 there was a stable regulatory framework and attractive even in foreign investment, but privatization offer was very low and did not include virtually all public utilities or banks, that from 1997 to 2005 to assist a reversal of the situation that the legal<sup>iii</sup> and institutional became extremely unstable and privatization offer increased considerably. After the elections in November 2005, activities promoting FDI was broadcast across multiple institutions without an adequate budget, a situation

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completely different from that of other countries in transition. According to the National Institute of Statistics Publication economic and social status of Romania-Romania-INS statistics 2008 and 2009 in 2011, the impact of financial crisis on the economy manifested through 5 channels: channel-by restricting foreign trade export markets Romanians products, financial channel by reducing external private credit lines from banks mother, channel-confidence by increasing risk aversion of foreign investors in emerging markets, exchange rate channel, due to depreciation pressures on the exchange rate; wealth effect channel and balance, by increasing the share of non-performing loans and substantial reduction in the value of various asset classes.

An important source of vulnerability of the Romanian economy in 2008 and 2009 was represented by the perception of foreign investors who were dissatisfied with the relatively large short-term external debt of 20.6 billion as at end of 2008. But in 2009 foreign direct investments have been an important factor mitigating the effects of the crisis on the corporate sector compared to the rest of the economy, according to data published by the National Institute of Statistics in 2008-2009. Criza global economic and accelerated in 2009 was dominant negative context in which they operated real and the financial sector in Romania. Also in 2009 compared to 1998 was an increase in the share of private sector net investment of structure about 20 percentage points while state ownership decreased by the same percentage points in 2009 compared with 1998. In conclusion features include predominance market economy private property, economic autonomy, their activity in a competitive environment and limiting state intervention.<sup>iv</sup>

Currently (2012), private property holds an absolute majority in this field, the role of state ownership is also lower. Romanian economy is mainly aim active participation in the global economy by providing sustainable links between sectors and through better cooperation between consumers and service providers. Just a smooth and flexible fiscal policy, to encourage investment in all sectors can support these objectives.

Regarding financing sources net investment during 1998-2009 is observed that the most significant is the own sources, with weights ranging from 77% in 2000 and 68% in 1999, 2004 and 2009. Second in the sources of funding are the state and local budgets that helped finance net investment percentages from 3% in 2000 and 9% and 10% respectively in 2009 and 1998. Foreign loans decreased with EU accession in 2007 especially with percentages ranging între 3-5% (2007-2009), while domestic credit growth during the same period with percentages between (7% -10%) and other sources from 3% in 2000 to 9% in 2009. Foreign capital registered an insignificant percentage of 1% constant throughout the analysis. Foreign businessmen, especially European ones, have been attracted to invest in the Romanian economy due to political instability; economic and social persist in our country.

"Distrust in the Romanian economy and the integration of the Romanian economy continental European market has led to increased dependence on foreign national and capital goods, the major industrial centers of European financial linkage to sources of external capital inputs and increased also internal dimensions of material flows-foreign."<sup>v</sup>"We can conclude that despite the fact that the service sector (tertiary) has made significant contributions in the structure of net investments during 1995-2009, by increasing net investments in industries such as: construction, public administration and defense; trade, hotels and restaurants, transport, storage and communications, general structure of production in Romania remain fragile, the growing importance of the service sector in GDP in Romania as a decline in industrial volumes, especially heavy industry and not the result of structural policy reforms our country.

## **2. ANALYSIS OF STATISTICAL DISTRIBUTIONS TO CHARACTERIZE THE EVOLUTION OF INVESTMENT ACTIVITY IN ROMANIAN DURING 1990-2010**

As a result of systematic statistical data on investment activity in Romania during 1990-2010 in the first stage of statistical approach for characterizing the investment activity in Romania were

determined indicators derived, which enable a first form of macroeconomic indicators characterizing investment activity.

- **Real GDP national economy**

Average annual real GDP in the economy during 1990-2010 was 253,008.44 million comparable prices with very low representation namely 88.15%, due to a high degree of dispersion led to a standard deviation of 223,047.44 millions comparable prices, which makes the asymmetry coefficient calculated from the median of 0.66 millions comparable prices to indicate that the average GDP exceeds median value of 234945.44 million comparable prices (see Table 1).

- **Actual final consumption real national economy**

Macroeconomic indicator follows the same distribution as the real economy with a GDP average prices comparable 144,314.86 million during 1990-2010, indicated by a very low level of significance (coefficient of variation 96.96% > 50%) as amplitude variation is comparable prices 395,096.47 million, the asymmetry is positive and the average value of 0.72 (see Table 1).

- **Net Investment real national economy**

Average real net investment in the economy is comparable prices 32227.96 million/year very un indicator representative confirmed the high value of the coefficient of uniformity of 91.57% which is remarkable and positive value and medium coefficient asymmetry calculated based on the median of 0.61 (see Table 1).

- **Sector investment rate of non-financial corporations and quasi-corporations**

Macroeconomic indicator dependent investment recorded an average of 31.24% during 1990-2010, as representative of homogeneity coefficient is below 35% (24.03%) between the period 1990-2010 because the value of investment rate registered increases and decreases approximately<sup>vi</sup>. This is confirmed by the low value and negative asymmetry coefficient (-0.24), median of 31.6% is lower than the mean value of 31.22% (see Table 1).

**Table 1. Determination of central tendency, variation and asymmetry  
 the main indicators characterizing investing activities (1990-2010)**

Indicators	$\bar{x}$	$\sigma$	v	Me	Cas
<b>Real GDP national economy</b> Millions lei –comparable prices	253008,44	223047,44	88,15%	234945,44	0,66
<b>Final consumption real national economy</b> Millions lei –comparable prices	144314,86	139931,99	6,96%	85800,54	0,72
<b>The investment rate of societies and nonfinancial societies %</b>	31,24	7,51	24,03%	31,6	-0,24
<b>Net investments national economy</b> Millions lei –comparable prices	32227,96	29511,59	91,57%	22182,44	0,61
<b>Tangible assets national economy</b> Millions lei –comparable prices	339965,95	99504,59	130,18 %	99504,5	1,29

Source of data: adapted from INS (2010, 2011)(chapter 11, p. 309, chapter 12, p. 373), Cristache (2003), p.80

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- **Tangible real economy**

Annual average real tangible economy was 339,965.95 million comparable prices with little significance since uniformity coefficient of variation exceeding 100% (coefficient of variation of 130.18%). The maximum range of variation with comparable prices 1,404,729.49 mil [166.72 millions in 1991 comparable prices comparable prices 1,404,896.21 million in 2009] is low, leading to a fairly high asymmetry and positive (Cas = 1.29). This is because 50% of tangible values are below the comparable prices 99504.59 million and 50% above this value, a value well below the average of comparable prices 339965.95 million (see Table 1). Perspectives on the evolution of net investments in Romania are moderated. Progress in efforts to join the European Union was a positive factor, but not enough for development. Also it is expected that FDI in Romania to experience a slow growth in the medium term, a change only real way it can be expected to achieve conditions of market economy status, or long-term resumption of economic growth, the realization of structural changes in the Romanian economy, strengthen the private sector in the economy and stabilize institutional and legislative framework. <sup>viii</sup>

### **3. 3.THE CORRELATION ANALYSIS BETWEEN THE INDICATORS CHARACTERIZING THE INVESTMENT ACTIVITY IN ROMANIA DURING 1990-2010**

In the second stage of the statistical approach are characterized quantitatively and qualitatively the main dependent variables mentioned above. So for more complex analysis of the link and interdependence of social and economic phenomena, elementary statistical methods are often inadequate. <sup>ix</sup>Therefore, analysis of the links between factors determining real GDP growth in the economy, actual net investment in the economy, real actual final consumption in the economy, net exports can be exemplified by use of correlation and regression. <sup>x</sup> Socio-economic phenomena are complex phenomena influenced by a large number of cases, acting in the same sense or in different directions. In this case the regression analysis covers the following stages: developing the regression model and estimating the model parameters, checking the accuracy of results <sup>xi</sup>. Analyzing actual net investment developments in the economy during 1990-2010, according to the causal variables: <sup>xii</sup> the evolution of real GDP economy, real actual final consumption trends national economy, the following results were obtained multiple regression function using linear multiple regression model using Excel software packages (see table 2).

#### **INVESTMENTS =GDP – CONSUMPTION – NET EXPORT (for a market economy) <sup>xiii</sup>**

$$\hat{y}_{x_1, x_2} = 4208,40 - 0,188x_1 + 0,003x_2 \quad (1)$$

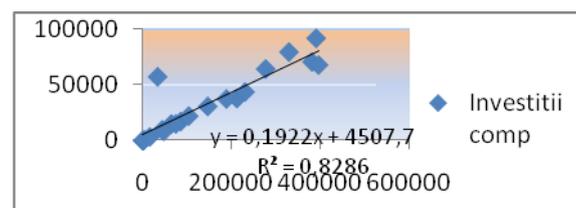
The link between the variables of this model is measured by the multiple correlation report of 0.90. We appreciate that the multiple relationship is in a linear form and very intense. The positive sign of the correlation indicates that our relationship is also direct (**Table 2**). The stochastic relation between variables is a high one. The coefficient of determination shows that 83% of the variation in actual net investment in the economy is explained by real GDP variables influence the economy, actual final consumption real economy, just looking and R adjusted, but given the number of degrees of freedom. The coefficient  $b_1$  is 0.188 which means that the actual final consumption real growth in the economy with a mil comparable prices, respectively with a unit of measurement,

actual net investment in the national economy will shrink 0.188 million comparable prices. Since  $p\text{-value} = 0.35 > \alpha$  means that this factor is not valid for a significance level of 0.05 (Table 2). The coefficient  $b_2$  is 0.003 which means that real GDP growth one million lei economy comparable prices in the national economy actual net investment will increase by 0.003 million comparable prices. Since  $p\text{-value} = 0.036 < \alpha$  means that this coefficient is valid for a significance level of 0.05. Verifying the Accuracy of multi-factorial regression model and the multiple correlation of the "Fisher" Criterion leads to the Following Conclusion: since the probability Sig. F is Less than 0.05, the multi-factorial regression model is valid with a significance level of 0.05 (Table 2).

**Table 2. Multiple correlations between actual net investment in the economy as a dependent variable, the evolution of real GDP real actual and the final consumption as factorial variables**

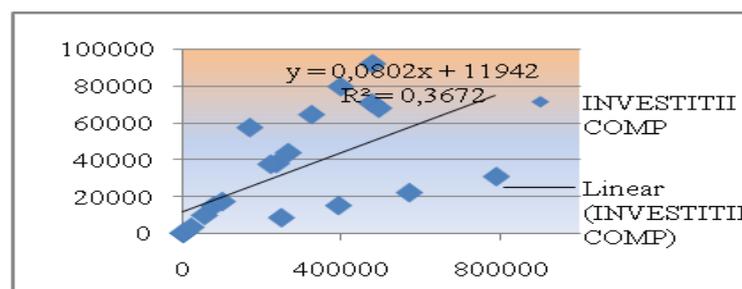
<i>Regression Statistics</i>				
Multiple R	0.91			
R Square	0.82			
Adjusted R Square	0.80			
	<i>Coeff.</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	4208.40	0.35	-5139.66	13556.48
Real final consumption	0.188	0.00	0.131	0.245
Real GDP economy	0.003	0.85	-0.032	0.038

Source: adapted from Cristache (2009), p. 81-114



**Figure 1.a.- Correlation between the real investments in economy and the final consumption**

Source: adapted from Cristache (2003, p. 90)



**Figure 1.b.- Correlation between real GDP and the real investments in economy**

Source: adapted from Cristache (2003, p. 94)

Observing the graphical representation (Figure 1.a. and Figure 1.b.) of the relationship between GDP and net investment and the real economy link between real actual final consumption economy can advance the hypothesis that the two variables are directly related: while the independent variables shows an increasing evolution (real GDP economy real and actual final consumption) and dependent (net investment real economy) registered a growth trend. Points are distributed relatively evenly along the regression especially in figure 1 a.

#### 4. CONCLUSIONS. IMPROVEMENT DIRECTIONS

For the next few years to give greater importance of investment necessary to continue the process of privatization of the priority areas of the economy (industry, agriculture, transport, tourism, etc.). To

this should be exempt from taxes for foreign investors important in parallel with the appropriate legal framework and it has left to be desired in the period analyzed and not at all encouraged foreign investors and neither the Romanians.

Thus the set of macroeconomic policies to avoid returning to areas unsustainable macroeconomic imbalances and to support their gradual attenuation is still based on agreements between Romania and the European Union, the International Monetary Fund and World Bank. As a consequence of the above is the fact that the evolution of the exchange rate of the national currency has significant implications for monetary policy of the central bank both in terms of maintaining price stability and financial system stability Romania. For volume increase investments in the country Our need to increase labor productivity, the level of GDP / capita, a higher degree of openness of the economy in order to increase the integration of foreign trade, etc. Also internally Romanian investors should be oriented towards productive sectors, to regain some traditional markets and providing such jobs leading to lower unemployment and inflation. In terms of industry Romanian investors should bear in mind diversification indigenous products, in accordance with the growing demands of consumers and on the other hand eliminate budget subsidies for unprofitable products thus enabling domestic and foreign investors to invest in such capital order to achieve full privatization of state-owned companies along with external balance of payments.

#### REFERENCES:

- Andrei, T., Bourbonnais, R., (2008) *Econometrie*, Bucharest, Economica publishing house,  
Abdi, H., (1987): *Introduction à un traitement statistique des données expérimentales*, Grenoble,  
Amstrong, H. W., (1995): *Convergence among regions of European Union, 1950-1990*, in The Journal of RSAI, 74,  
Bartholew, D. J., (1986): *The foundations of factorial analysis*, Biometrika, 71,  
Boudon, R., Lazarfled, P., (1969): *L'Analyse empiriques de la causalité*, Mouton, Paris,  
Cristache, S., (2009): *Introducere in econometria activitatii turistice*, Editura ASE, Bucuresti,  
Cristache S.(2003) :-*Metode statistice de calcul și analiză a eficienței economice în comerț*, 2003, Editura ASE, București,  
Harman, H. H., (1967): *Modern factorial Analysis*, University of Chicago Press, Chicago,  
Jollife, I. T., (1986): *Principal component analyses*, Springer, Berlin,  
Mitrut, C., Serban, D., Mitrut, A.C., (2003): *Statistics for Business Administration*, ASE, Bucuresti  
\*\*\* *ANUARUL STATISTIC AL ROMÂNIEI, INS 2010, 2011*

<sup>i</sup> Andrei, T., Bourbonnais, R., (2008) *Econometrie*, Bucharest, Economica publishing house;

<sup>ii</sup> Abdi, H., (1987): *Introduction à un traitement statistique des données expérimentales*, Grenoble,

<sup>iii</sup> Amstrong, H. W., (1995): *Convergence among regions of European Union, 1950-1990*, in The Journal of RSAI, 74;

<sup>iv</sup> Jollife, I. T., (1986): *Principal component analyses*, Springer, Berlin,

<sup>v</sup> Cristache S.E.-*Metode statistice de calcul și analiză a eficienței economice în comerț*, 2003, Publishing House ASE, Bucharest, 2003 ;

<sup>vi</sup> \*\*\* *ANUARUL STATISTIC AL ROMÂNIEI, INS 2010, 2011*;

<sup>vii</sup> Mitrut, C., Serban, D., Mitrut, A.C., (2003): *Statistics for Business Administration*, ASE, Bucuresti,

<sup>viii</sup> Harman, H. H., (1967): *Modern factorial Analysis*, University of Chicago Press, Chicago;

<sup>ix</sup> Bartholew, D. J., (1986): *The foundations of factorial analysis*, Biometrika, 71;

<sup>x</sup> Cristache, S., (2009): *Introducere in econometria activitatii turistice*, Editura ASE, Bucuresti,

<sup>xi</sup> Boudon, R., Lazarfled, P., (1969): *L'Analyse empiriques de la causalité*, Mouton, Paris,

<sup>xii</sup> Cristache S.(2003) :-*Metode statistice de calcul și analiză a eficienței economice în comerț*, 2003, Editura ASE, București,

<sup>xiii</sup> Because of net exports are not yet published data: Exports FOB and CIF imports in millions U.S. \$ 1990 for comparability, we introduced the variable factorial model.