ECONOMETRIC METHODS USED IN INVESTMENTS ANALYSIS

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Abstract

This paper describes a set of methods applied in investment analysis. In the first part, there are reviewed the theoretical bases of the studied analysis methodology. In the second part, there are presented the possibilities that linear and non-linear models provide as macro-economic analysis instruments. The final part emphasizes a series of macroeconomic correlations regarding foreign direct investments.

Key words: *investments, application, regression, sector, model*

General notions

There are many transformations which can be considered but we shall focus on a specific class characterized by the relation:

$$\lambda = \int g(z)\, w(z)\, dz.$$

In this formula , $g(z) = E(\tilde{y} \mid \tilde{z} = z)$, and $\mathbf{w(z)}$ is a weight function which is either scalar, or vectorial and satisfies $\mathbf{w(z)} = 0$ if $f_{m\arg}(z) = 0$, which is natural since $\mathbf{g(z)}$ is defined only if $f_{m\arg}(z) > 0$. The parameter of interest $\mathbf{l}$ is scalar or vectorial.

This class of transformation is justified by the properties of the resulting estimator $\mathbf{l}$ and, meantime, by its relevance as regards many issues of applied econometrics, which are special situations of these analyses.

Before entering into details, we notice the fact that this transformation does not insert the over-determination of the conditions on the variables distribution.

We shall[1] estimate the mean of the regression differentials. We have seen that the parametrical estimation of a regression erroneously specified does not allow us to consistently estimate the differentials of this function in a

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certain point. In many econometrical issues, the differentials are parameters of interest. The estimation is possible but its rate of convergence is very slow and, consequently, requires a large sample. Nevertheless, in many applications it is enough to estimate the mean of the regression differentials, namely:

$$\lambda = \int \partial^{\alpha} g(z)\, \nu(z)\, dz$$

where α is a multiple index of the derivation and ∂^a is the derivation defined by this multiple index. The function v(z) is a density on the explanatory variable which can be equal to $f_m(z)$, the density of the actual explanatory variable being studied. We shall analyze the under-additively test.

In order to illustrate this situation, let's assume that the function C is the function cost which associates an expected cost with the quantities of the different products z. The economic theory is interested in the under-additively C, namely it is:

$$C\left(\sum_{j=1}^{p} z_j\right) \leq \sum_{j=1}^{p} C(z_j)$$

Which means that, the cost of a company producing $\sum_{j=1}^{p} z_j$ **, is lower than the cost of several companies each producing** z_j. The above property must be true for each p and each sequence $(z_1,...,z_p)$. It is easy to show that this property is equivalent to the property which will be explicitly shown by the content. If f is the density $(z_1,...,z_p)$, $\tilde{\varphi}$ the density of the sum $z_1 + ... + z_p$ and f_j the density z_j, than, it is equivalent with the fact that for each f, we have:

$$\int C(u)\,\tilde{\varphi}(u)du \leq \sum_{j=1}^{p} \int C(z_j)\,\varphi_j(z_j)\,dz_j.$$

The reciprocal is resulting by taking into account the distribution on $(z_1,...,z_p)$ focused in one point. Now, we shall approach the under-additively test. The previous relation suggests that there is a l defined, namely:

$$w(z) = \tilde{\varphi}(z) - \sum_{j=1}^{p} \varphi_j(z),$$

the sign of this parameter having to be tested.

The estimation of l defined can be made in two modes.

The first variant consists of the estimation of g followed by the calculation.

The second approach avoids the estimation g and is based on the particularity given by the utilized (final) function:

$$\frac{1}{n}\sum_{i=1}^{n} y_i \frac{w(z_i)}{f_{marg}(z_i)}.$$

This condition is seldom satisfied. We can replace $f_{m\arg}$ with a parametrical or non-parametrical estimation.

Using Linear and Non-linear Models in Macroeconomic Analysis

The semi-logarithmic[1] and the double logarithmic models are the two models which can be linearized:

– The logarithmic model can be either without free term or with free term.

– The free term model (log-log) is of the dependence form, respectively:

$$y_i = ax_i^b \varepsilon_i$$

In this model a $\in R_+^*$ and $b \in R$. Depending of the sign of the parameter b the properties of the resulting characteristic are set up.

If this parameter is positive, the resulting characteristic has an up warding trajectory. The down warding trajectory of the resulting characteristic is emphasized, in the case of the regression non-linear model, by the negative value of the resulting characteristic exponent.

Applying the logarithms the double logarithmic model results

$\log y_i = \log a + b\log x_i + \log \varepsilon_i$

Using the substitutions

$y_i^* = k = \log y_i, x_i^* = \log x_i a^* = \log \varepsilon_i$,, the regression linear model becomes:

$$y_i^* = a^* + bx_i^* + \varepsilon_i^*$$

We estimate the two parameters of the regression linear model and establish the parameter a which appears in the regression linear model:

$$\hat{a} = 10^{\hat{a}^*}$$

• The free term model (log-log) holds, in addition, a free term and shows under the following form:

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$$y_i = a_0 + ax_i^b \varepsilon_i$$

In the case of this model applying the previous procedure of linearization is no more possible. In order to estimate the parameters, one of the following two methods applies:

- when a value of the free term of the model is specified, then, using the notations $v_i = y_i - a_0$ and $u_i = x_i$, we get the regression model $y_i = ax_i^b \varepsilon_i$. In this respect, parameters are estimated according to the case of the double logarithmic model;
- then we estimate the three parameters of the model through numerical models. It is possible to transform the model into a linear one using the development of the Taylor series.

We submit a number of properties of the parameters which are needed for interpreting the model parameters and the characteristics of the factorial variable in connection with the parameters values. The interpretations are achieved in the context of using the model $y_i = ax_i^b \varepsilon_i$. For this model we underline that:

- if b < 0, the function log-log is down warding as against the factorial characteristic. In this case, $\lim_{x\to\infty} y_i(x_i) = 0$. In the situation of the free term model r, $\lim_{x\to\infty} y_i(x_i) = a_0$;
- if b > 0, the non-linear function is up warding and $\lim_{x\to\infty} y_i(x_i) = \infty$;
- irrespectively of the sign of the parameter b, this is equal with the elasticity of the resulting variable, calculated in connection with the factorial variable, namely:

$$b = \frac{\partial y_i}{\partial x_i} : \frac{y_i}{x_i};$$

- when the differential of second order is $\frac{\partial^2 y_i}{\partial x_i^2} = ab(b-1)x_i^{b-2}$, is results that: $b \in (0,1)$, the analytic function is up warding and concave ; b = 1, the regression model gets reduced to the simple linear model, without free term ; b > 1, the function is up warding and convex .

• The exponential model is used in the case when the points cloud resulting from the graphical representation of the series of values $(x_i, y_i)_{i=\overline{1,n}}$ is directed along the curve of an exponential function.

The exponential model, with the parameters a and b, is defined through the relation

$$y_i = a \cdot b^{x_i} \mathsf{e}_i, a, b \in R_+^*$$

The estimation of the parameters of the exponential model is made through data transformations by logarithms, following the stages:

- by logarithms applied to the equality terms we get the regression linear model:

$$\ln y_i = \ln a + \ln b \cdot x_i + \ln \varepsilon_i$$

The model[1] becomes a linear by the substitution of $u_i = \ln y_i, \eta_i = \ln x_i, a^* = \ln a$ and $b^* = b$;

- we estimate the parameters of the regression linear model , $u_i = a^* + b^* x_i + \mathsf{h}_i$ using the smallest squares method; we get the estimators $\hat{a}^*$ and $\hat{b}^*$;

- the estimators of the parameters of the regression non-linear model are established:

$$\hat{a} = e^{\hat{a}^*} \text{ and } \hat{b} = e^{\hat{b}^*}$$

Finally, we calculate the values adjusted on the basis of the estimates regression non-linear model:

$$\hat{y}_i = \hat{a}\left(\hat{b}\right)^{x_i}, i = \overline{1,n}$$

The exponential model is used when the values of the resulting variable increase in an arithmetic progression while the values of the factorial variable increase in a geometrical progression.

In order to interpret the meaning of the parameter b we take into account that

$$b = \frac{1}{y} \cdot \frac{\partial y}{\partial x}$$

It is to notice that the parameter b defines the increase rate of the resulting characteristic depending on the factorial variable X.

In the case of the exponential model we distinguish the following situations:

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- b is the rate of increasing or decreasing of the characteristic Y as against X;

- if b > 1, he evolution of the characteristic Y is up warding

- if $b \in (0,1)$, the characteristic Y records a decrease as against the variable X;

- the values of the characteristic Y are positive only and the parameter a satisfies the positivity property.

Models used to analyze foreign investments

General aspects

A crucial issue for the economies in transition tending to consolidate their presence on the market consists of the drawing foreign capital.

Since 1990 up to date, leave apart slight exceptions, the direct investment with foreign capital participation in our country was recording a positive rhythm. This development has been influenced and sustained by several factors such as: the existence of an investment market in our country, the industrial restructuration, the development of the multiple services industry, the legislative framework attractiveness offering warranties to the foreign investors and many other factors.

It may be that, if comparing it with the situation recorded by other countries, our country is not recording an overall evolution particularly stimulating or significant.

The basic element at the basis of this temperate development of certain foreign investment is given by the fact that the legislation was not clear and encouraging enough for all those wishing to come and invest in our country.

This is a specific feature of the entire period as from 1990 until now.

The foreign investment in Romania recorded a particular diminishing for the period 2008-2009, mainly because the way the crisis affected the economy of our country and the lack of confidence from the investors as regards the anti-crisis program considered by the Executive.

Entries of commercial companies with foreign participation to the subscribed social capital

Mil. euro

1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
817,9	443,1	322,9	681,4	183,7	443,3	278,1	583,9	729,9
2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
648,6	1190,9	833,8	996,2	2343,7	2434,5	2417,2	2389,3	3984,4
2009	**2010**	**2011**	**2012**	**2013**	**2014**			
3512,6	3914,4	3329,4	2856,4	2918,2	2764,5			

The years 2010-2012 were in fact insignificant at this chapter. The figures are modest and refer, mainly, to completions or increases of capital, required by the crisis effects.

Until the year 2008, 0ne of the encouraging factors of the increase of the direct foreign investment in our country has been given by the privatization of certain sectors of the national economy, the drawing of the foreign capital by already existing commercial companies as well as the setting up of new companies with foreign capital (which, unfortunately is not valid for the period 2009-2013).

In 2013 the foreign capital contributed to the setting up of a number of 6624 companies, the subscribed value as contribution amounting 2,355,803.7 thousand euro.

Nevertheless, the years when the foreign capital investment recorded higher increases are the years when important sectors of the national economy have been privatized.

However, the process of analysis as to the efficiency of all those privatizations with foreign capital should focus on detecting whether the normal procedures meant to protect the national interest and to get a maximum of profitableness out of these privatizations.

The flow of the direct foreign investment

The ISD net flow for the year 2012 recorded the level of 2,138 million euro and is structured as follows:

- Net participations of the direct foreign investors to the capital of direct foreign investment from Romania, amounting 795 million euro (37.2% out of the IDS net flow). The net participations to capital are resulting from the diminishing of the capital participations, amounting 2,676 million euro, by the net loss, amounting 1, 881 million euro.
- The net loss resulted by deducting, out of the ISD companies profit recorded in 2012, amounting 4, 691 million euro, the dividends distributed for the year 2012, counting for 2,212 million euro, followed by diminishing this value with the losses recorded by the ISD companies in 2012, amounting 4,360 million euro.
- The net credit received by the companies with direct foreign investment directly from the direct foreign investors, including within the group, amounted 1,343 million euro, counting for 62.8% from the ISD net flow.

Out of the data concerning the ISD net flow and its components (participations to capital, reinvested profit/net loss and the net credit from the

investors), distributed on activity domains, there are relevant conclusions to underline.

For the majority of the economic activity domains, where the ISD hold a significant weight, there are increases of the participation to capital as to the ISD companies, which means a continuation of the investment process during the year 2012.

The domains recording the most significant increases of capital have been the industry (1, 072 million euro), in which frame, the manufacturing industry (529 million euro) and the energy (497 million euro) are leaders; other domains recording significant capital investment have been financial intermediations and insurances (646 million euro), as well as constructions and real estate transactions (295 million euro).

The main economic domains where the losses exceeded the profits have been financial intermediations and insurances (376 million euro profit, 1, 015 million euro loss) and constructions and real estate transactions (255 million euro profit, 747 million euro loss).

Through the distribution for the year 2012 of significant amounts as dividends within the above mentioned domains, the net loss gets deeper (profit minus distributed dividends, minus losses). Thus, dividends amounting 134 million euro have been distributed in the domain of financial intermediations and insurances and 158 million euro in constructions and real estate transactions.

A number of domains have taken the advantage of important financings, through net credits mother-daughter, respectively: the manufacturing (606 million euro), energy (173 million euro), trade (423 million euro), constructions and real estate transactions (213 million euro).

As far as the industry is concerned, although significant losses have been recorded (1,491 million euro) and dividends amounting 960 million euro have been distributed, by the recorded capital participations level (1,072 million euro), the net credits (862 million euro) received and the achieved profit (2,345 million euro), it benefited of a net flow if ISD amounting 1,828 million euro, representing 85.5 % from the ISD net flow for the year 2012.

The distribution of the direct foreign investment by branches, in 2013

From the point of view of the distribution of the ISD by economic branches, according to CAEN Rev. 2), they have been concentrated mainly in the manufacturing industry (31.1% of total). In the frame of this industry, the best represented branches are the crude processing, manufacturing of chemicals, rubber and plastics (5.9% of the total FDI), the transportation

means (5.7%), metallurgy (4.1%), foodstuff, beverage and tobacco (4.0%) and cement, glass and ceramics (2.7 %).

Out of the above situation we can conclude that the direct foreign investment in the production activity are not counting for too much within this structure, which would be vital and imply further consolidations if considering the integration with the European Union.

Anyhow, the development such as is a positive fact.

Besides industry, the other activities which have drawn significant ISD are the financial intermediations and insurance (representing 14.2 % of the total ISD), the trade (11.2%), constructions and real estate transactions (9.8%), information technology and communications (6.9%).

Repartition on main economic activities of FDI balance in 2013

	Value (mil euro)	Weight in total FDI
TOTAL, of which	**59.958**	**100,0**
Industry	28.810	48,1
Extractive industry	3.519	5,9
Processing industry, of which	18.648	31,1
- Food,beverages and tobacco	2.373	4,0
- Cement, glass, ceramics	1 619	2,7
- Manufacture of wood products, including furniture	1 255	2,1
- Manufacture of computers, other electronic, optical and electrical products	1 250	2,1
- Machineries, tools and equipments	1 309	2,2
- Metallurgy	2 481	4,1
- Transportation means	3.439	5,7
- Processing of oil, chemical products, rubber and plastic materials	3.533	5,9
- Textiles, confections and leather	891	1,5
- Other branches of processing industry	498	0,8
Electrical energy, gases and water	6.643	11,1
Professional, scientific, technical and administrative activities, support services	3.034	5,0
Agriculture, silviculture and fishing	1.278	2,1
Trade	6.723	11,2
Constructions and real estate transactions	5.887	9,8
Hotels and restaurants	370	0,6
Financial intermediaries and insurance	8.496	14,2
Information & communications technology	4.129	6,9
Transportation	944	1,6
Other activities	287	0,5

Data source: National Bank of Romania, NSI, *Foreign Direct Investments in Romania in 2013*

To note that the corporal and non-corporal immobilizations, recording a sold of 29,431 million euro by the end of the year 2012, are representing 49.0 % of the total sold od ISD which leads to a significant degree of stability of the foreign investment.

The economic activities where the ISD are found as corporal and non-corporal immobilizations at a significant level are the following:

- industry (29.4% of the total ISD, while in this frame the manufacturing industry counts for 18.7 % of the total ISD);
- trade (5.7%) as well as
- constructions and real estate transactions (5.9%).

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