EVALUATION METHODS OF THE IMPACT OF STRUCTURAL AND COHESION FUNDS ON ECONOMIC AND SOCIAL DEVELOPMENT AT REGIONAL AND NATIONAL LEVEL

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Abstract: Analysis of the role and implications of the funds coming from the European Union have on the national economy is very complex and complicated at the same time, because of the multitude of issues and indicators that this process shapes and drives, depending on the source of funding, the modality of funding and on the destination for which it has been allocated. Using mathematical models to assess the impact of European funding on the national economy is paramount valuable as it brings important information that can be used by policy makers in decision making sewage inputs and financial resources, in view of adopting optimal economic policy.

Keywords: mathematical models, European funds, economic development

1. Mathematical models used to assess the impact of European funding on the economy of the beneficiary state

In the economic literature there are known and applied various mathematical models that determine the impact of structural funds on economic and social development such as regression models [1] and simulation models [2]. The European Commission uses in order to analyze the impact of structural and cohesion funds three mathematical tools, referring to three different models: the Hermin, Quest and EcoMod Model. HERMIN model uses mathematical relationships which assemble about 240 neo-classical elements and Keynesian elements to analyze both the short and long term effects of cohesion policy. It is a multi-sectoral design and it is designed as a macro-econometric model composed of four sectors: manufacturing (sector producing tradable goods), the service sector of the market (sector

producing non-tradable goods), agriculture and government services sector (or non-market). In applying this model to study the impact of structural funds on the economy of the recipient State, it was taken into account its specific economic analysis and the availability of data on the concerned indicators, therefore the HERMIN model knows specific modifications and adaptations according to the country for which the study is made.

Its version for Romania case is called HEROM model and was implemented by the National Prognosis Commission, to analyze the impact of structural funds in Romania for the period 2007-2013. Being able to customize this model on the Romanian economy, it brought some advantages represented by the fact it has enabled to detect changes caused by sectoral economic policies, to surprise specific characteristics of Romanian economy and to consider the behavior

towards which the national economy heads. So, by applying this version of the model on Romanian economy it can be obtained a quantitative estimation of the macroeconomic impact of European funding for the period 2007-2013 program, not by the mere sum of the effects, but by incorporating multiplier effects and externalities. However, the authors of the study that has been developed for Romania draw attention to the limits of the model, determined mainly by the small size and lack of time series data for important variables related to capital investments. In applying the HEROM Model [3] it was taken into account the period of 2007-2020, which encompasses two stages, namely: 2007-2013 the period for allocation of funds to Romania and the period of 2014-2020 during which the transfer of funds becomes measurable and produces the first effects. In order to measure the effect of the capital injection for the structural and cohesion funds it was considered two scenarios, one in which the absorption rate is 100% and one in which financial assistance do not exist and the Community assistance is related to absorption pre-accession funds recorded at the end of 2006. The main results generated by running the two scenarios, were in favor of EU funds absorption rate of 100% for the 2007-2013 period, and they refer to [4]:

- GDP growth by almost 15% in 2014-2020, so around 2020, this represents 75% -80% of the EU27 average;
- annual growth rates of employment are estimated at 0.31%;
- inflation would remain high but below 5%;
- real wages will increase during the forecast period until 2014;
- budget deficit will increase in the analyzed period, being in the area of non-compliance to stability criteria (below 3%);
- imports are higher than exports until 2012, following the same trend, but at a slower pace after 2014.

Given the complex and macroeconomic phenomena that it captures, the results obtained from the simulation of various scenarios through the model can be used by policy makers in decision making sewage inputs and financial resources, and to the adoption of optimal economic policy measures. However, it must not forget that the reminded mathematical model assumes that investment follows closely the financial allocation established, but reality shows that often there are major gaps between the actually expenditure incurred in the implementation phase and the planned expenditure to be made.

The QUEST Model is a global macro-economic model, offering conclusions about the effects of cohesion policy on the entire European Union and consider the consequences for the economies of donor cohesion policy. It is a uni-sectoral model that models only the output of the private sector. It is based on Keynesian-neoclassical synthesis, comprising less detail sector, but has the largest geographical coverage, including all EU economies. The limits of this model refer to the fact that public investments are considered as productive as private ones, a fact that reality does not endorse it, and the use of European funding is based on the premise of sound financial management and optimal investment choices. According to the Quest model, the gains on long term on the supply side are similar to those of the Hermin model and the differences between countries regarding the extent of the effect of cohesion policy is determined by both the size of the assistance funds relative to GDP and monetary policy. The effect on net contributing countries to cohesion policy is negative but relatively small compared to the positive effect on GDP in the Cohesion countries. In other words, Quest model indicates that the cohesion policy supports long-term growth of the EU as a whole, contributing to the achievement of the convergence process.

The EcoMode (The Econometric Modeling)

was founded in 2007 with the fundamental contribution of Professor of Economics at the University of Ali Bayar, Bruxelles. This model quantifies the influence of European funds invested in human capital, improving the quality of human resources and assesses their productivity and growth. It was applied to a sample of 15 European Union member states, including Romania. The main objective of the study [5] was to quantify the economic impact generated by the convergence policy in 2007-2013. It is a comprehensive work, which analyzes five scenarios from the perspective of how European funding influences the economic development of the beneficiary state through the use of Community assistance in three main areas: infrastructure, human resources and business. The study results revealed that in the countries that have received substantial EU funding were expected positive effects. Thus, it is expected to increase GDP by around 15% by 2020 in countries such as Bulgaria, Lithuania, Latvia and Slovakia. Given the effects on productivity growth generated inputs, improving the quality of human resources and infrastructure development, the positive impact of capital injection will be felt after the next programming period 2007-2020. The positive effects on countries such as Germany, Italy, Greece and Slovenia are somewhat limited because of the fact that the amounts allocated to those countries are much smaller relative to GDP.

Increasing employment is projected to achieve a share of 40-50% GDP growth as a result of job growth, with significant effects on reducing the unemployment rate to more than 5%. Following the long-term impact of cohesion policy, the positive effect on human resource generated by investment in human capital, will also continue after funding cessation. The study also mentions that the most powerful effects of the Community assistance will begin to be noted since 2015, which confirms the premise from which the study started when applying the model, namely, the

Community intervention contributes to high sustainable growth, being the engine of convergence policy. The results obtained by running different scenarios using EcoMod model shows that the prerequisites for sustainable economic growth are supported by investments in physical and human capital. It has been observed a significant contribution from the investment projects in infrastructure and in the activities fields using high technology due to the use of a more efficient and qualified labor force.

A feature of the EcoMod model warns obtaining different results from one state to another. Thus, the differential impact of cohesion policy is attributed to differences in the structure of the economies, but also to the volume of funding and to implementation of national complementary policies in order to harness the potential of supply and the elasticity level associated to increasing productivity towards social capital growth.

All the three previously mentioned mathematical models have been developed as a tool to assess the impact of cohesion policy for the 2007-2013 programming period has on the economies of the beneficiary states, assuming 100% absorption of Community assistance. By applying these models in studies, it was also aimed to create an instrument of substantiation and verification of finance allocation directions, following the characteristics of each economy and serving to the common objective of achieving a competitive European space. However, the three mathematical models: HERMIN, QUEST and EcoMod are very complex macroeconomic models and comparing the appropriateness of using a model over another is very difficult to establish, given the different and particular results achieved by each model.

Given the particularities of each model, a study [6] conducted in 2007 by researchers: Bradley J., G. Untiedt presents a comparative analyze of expected effects of the cohesion policy for the period 2007-

2013 through the three macroeconomic models, namely: Hermin, Quest and EcoMod.

The main contribution of the quoted study is that it highlights the important differences between the mentioned models based on the economical approach from the side of the beneficiary of Community assistance. What have most drawn the attention were the significant differences which subsequently led to different conclusions on the impact of cohesion policy at EU level and on employment growth.

Possible explanations that have been found and that can be considered possible causes of obtaining different results are related to:

- the complexity of cohesion policy assessment as a result of various public instruments used, individual projects, extended measures, operational programs, investment packages;
- the technical aspects of analyzing the impact of cohesion policy differs from state to state depending on the manner of approach to the functioning of various economies and how they respond to specific policy interventions;
- the techniques of micro-evaluation of cohesion policy used, which differ from state to state;
- identifying the main categories of investments which are expected to achieve the policy directions of convergence;
- how investments in physical infrastructure, human capital and research and development will accelerate economic growth;
- the use of empirical studies to represent as accurately how certain variables increases the output and productivity;
- perfect economic models can not represent economic reality.

An important component of the results obtained by using the mentioned

mathematical models refers to the degree of subjectivity of the researchers. So, applying the models must be accompanied by full transparency as on the basis of the results will be performed other analyzes and forecasts, so they have to be reliable and comparable. Beyond the detailed results obtained by applying the 3 different models used to study the impact of cohesion policy for the period 2007-2013, a general conclusion drawn in all models refers to the fact that overall, the Community assistance has a great impact of increasing GDP for countries that are less economically developed in the EU, not just in the programming period but thereafter too.

2. The use of mathematical regression to study the impact of Structural Funds on economic development

The successful implementation of the programs financed by the cohesion policy promoted at European Union level, has a lot to do with the absorption capacity of the receiver State and with the involvement of the parties concerned in achieving the community's objectives in terms of employment, investment and economic growth.

The literature provides models for the quantification of the impact or effects of the injection of foreign capital on the recipient State's economy (for example, QUEST model, HEROM ECOMOD) that evaluates the possible results, carried out under the conditions of a rate of 100% European financing. These models are particularly useful in the decision-making process regarding investment priorities specific to each State, given the fact that they allow to be customized in order to obtain a result as close as possible to reality.

The application of these models can be interesting, especially when studying the various scenarios that can be made in making forecasts, but what we propose in this paper is to analyze, by using multiple linear regression, the existence and the type of correlation between the effective

absorption of European funds and its effect on the economy. Starting from the assumption that competitiveness within a country is an essential condition of the efficiency with which the structural and cohesion funds can be deployed at the regional level, we sought to examine whether regional GDP may be influenced by the extent of foreign capital injection. So, we used for the case study, the values obtained for the indicator of regional GDP registered by the 8 development regions of Romania, the population of these regions, the volume of foreign direct investment and the amount of funds being acquired at each region level related to the programming period of 2007-2013 framework of the Regional Operational Program. The information regarding these indicators was taken or calculated according to the data provided by the National Institute of Statistics. The main obstacle that we encountered at the time of the selection of the variables to be analyzed was the lack of availability of the data, and time series, which is why we choose the linear regression model that even though it is simple, it is representative for the purpose of research that refers to study the existence of cause-effect links between how European financial assistance is used and its role on the economic development and the opportunity to invest in Romania.

In this respect, the proposed model comprises the following variables:

- the dependent variable: GDP of the region;
- the factorial variables that are represented by population, the volume of foreign direct investment and the amount of funds being acquired at the region level related to the programming period of 2007-2013 framework of the Regional Operational Programme.

The following additional information regarding the selected variables refer to:

- the value of GDP is the one registered in 2013, according to the information provided on the website of the National Institute of Statistics: www.insse.ro, and it is expressed in euro at the annual average value for 2013, published on the official website of the National Bank: www.bnr.ro - 4.4190 lei per euro.
- the volume of direct foreign investments at the regional level, and the amount of funds being acquired at region level related to the programming period of 2007-2013 framework of the Regional Operational Programme expressed in euro in accordance with the methods of calculation referred to above;

The formula of calculation using the regression model is presented as follows:

$$Y = a_0 + \sum_i a_i X_i$$

Where: a_0 - represents the origin ordinate;

a_i - represent regression coefficients that show the level of dependency between variables (the average change in Y to an increase or decrease with one unit of variable X_i).

The table below lists the values of the coefficients of the regression on which may be established the correlation between the studied variables and setting the regression equation for regional GDP.

Table 1 - Multiple linear regression coefficients, displayed by SPSS 17 Software

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	5279,917	2835,903		1,862	,136
The occupied population corresponding to the year of 2013 (thousand persons)	9,859	3,245	,222	3,038	,038
The volume of direct foreign investments made in 2013 (million EUR)	,550	,048	,862	11,447	,000
Absolute value of EU funds related ROP (Regional Operational Program) (million EUR)	-2,368	3,986	-,043	-,594	,584

The regression equation that resulted is as follows:

$$\text{PIB}_i = 5279,917 + 9,859 \times \text{Pop}_{\text{occupied}} + 0,550 \times \text{Vol}_{\text{investments}} - 2,368 \times \text{Fund}_{\text{ROP}}$$

The interpretation of the obtained correlation coefficients can be summarized as follows:

- the correlation coefficient recorded for the factoriale variable "population" shows a strong and direct link between it and GDP value recorded at the level of a region, which confirms the hypothesis that labour productivity contributes significantly to the development and economic progress of a region;
- the correlation coefficient recorded for the factoriale variable "volume of foreign direct investment" shows a relatively strong connection between it and the value of GDP at regional level, meaning that the socio-economic progress of a region is largely provided by a substantial amount of foreign capital injection;
- the correlation coefficient recorded for the factoriale variable "absolute value of EU funds related to POR" show a close and reverse connection between it and the GDP registered at the level of a

region, which mathematically would be translated as the regional GDP grows as the funds absorbed decrease. From the economic point of view, this allegation can not be confirmed and can be explained as follows:

- ✓ the volume of attracted funds related to POR at the level of the eight regions analyzed is not significant, and as a result is unable to finance the multiple and specific needs of regional development of each of the regions that these funds are financing;
- ✓ to quantify the effect that european funds have on the growth of regional GDP, the analyze should address to all seven Operational Programs (this was not possible due to the lack of availability of the data on the volume of financial assistance that are attracted by each region within the framework of the programming period 2007-2013);
- ✓ the effect that the funds related to Regional Operational Program have on economic and social progress is an indirectone, since it ensures the infrastructure development which supports and encourages the national production and consumption.

The regression analysis allows conclusions to be drawn and forecasts to be made [7].

Thus, using the multiple linear regression models has enabled us to reach the following conclusions regarding the complexity of the studied phenomenon:

- quantifying the effects already produced in the economy by attracting Community assistance must be addressed over time, evolving, and not at some point, as it has a pro-cyclical influence on medium and long term, and keeping these benefits brought to economy is the responsibility of the quality management of the recipient State and the way the Government intends to capitalize and exploit the opportunities that European funds bring;
- the high value of the correlation coefficient obtained in the case of "population" variable compared to that obtained for the "volume of foreign direct investments", can be explained by the fact that human resources is the main factor by which investment strategy can be applied effectively in order to achieve the expected results on the development of the economy;
- registering a negative value of the correlation coefficient for "the absolute value of the EU funds related to POR" brings in the issue of disparities in development among the eight development regions analyzed and the fact that this mathematic model does not take into account the specifics of each region (essential elements such as: size, demographic

characteristics, the structure of economic activities, the skill level of the workforce, capital equipment, consumption profile, export potential, developed infrastructure, the degree of autonomy in making decisions in relation to Central Administration, etc.) and hence it can not study the different reactions that are generated with regard to employment and income at the time of the injection of funds, both on short-term and in dynamic.

Conclusions

The use of mathematical models in the assessment of the impact of structural and cohesion funds upon economic and social development at regional and national level are particularly complex given the macroeconomic aspects of the studied phenomena, especially as the results of these simulations can be used for informing policy decision makers regarding production and financial resources and for the adoption of measures of economic policy. However, attention should be drawn to the fact that these models start from the premise that investment follows closely the set out financial allocation, but the reality shows us that there are often gaps between effective expenditures made in the implementation phase and the ones planned to be carried out.

Their use and effects that they produce on the economy, given the small number of variables and their non-predictable approach of a such complex and dynamic phenomenon.

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