Methods of Quantifying the Impact of Structural Funds Absorption on Regional Development

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Abstract. *More than one third of the total EU budget is spent on the so-called Cohesion Policy through the Structural Funds. Its main purpose is to reduce disparities between EU regions and promote economic growth and convergence. Consequently, the process of convergence of regions and, implicitly, the need to assess the impact of absorption of structural funds on the economy is a matter of great importance. Absorption of structural and cohesion funds is one of the zero-degree priorities of public administration, business, farmers and non-governmental organizations.*

Keywords: regional development, structural funds, absorption rate, SPSS.

JEL classification: E01, O11, O47.

1. Introduction

According to the KPMG survey in 2015, Romania is in a critical position in the context of attracting European funds as the penultimate country in the Central and Eastern European countries (after Croatia, see table 1) in terms of payments to the beneficiaries.

Table no.1 State of contracting European funds in Central and Eastern Europe, 2015

Perioada 2007-2015			
Țara	Rata de contractare	Rata de plata	Diferența între rata de contractareși rata de plată (în pp)
	%	%	
Lituania	99%	99%	0
Polonia	100%	92%	8
Estonia	100%	95%	5
Cehia	103%	89%	14
Lituania	104%	97%	7
Bulgaria	105%	95%	10
Slovenia	107%	105%	2
România	116%	73%	43
Croația	117%	57%	60
Ungaria	117%	111%	6
Slovacia	122%	97%	25

Source: KPMG study, 2015, EU fund in Central and Eastern Europe, www.kmng.com/cee

Some scientific research papers highlight the direct link between low absorption of European funds and uneven development of EU regions. Šumíková (2003), Horvat (2005), Zaman & Cristea (2011), Zaman & Georgescu (2014) have associated the low absorption rate of EU funds with managerial and administrative deficiencies such as the ability to prepare eligible projects of applicants, implementation and monitoring of projects, corruption, politicization of public institutions, etc. Šumpíková points out that the absorption rate of EU funds is linked to three main factors:

- macroeconomic capacity: cohesion policy rules limit the transfer of European Union funds to a percentage of the country's gross domestic product (GDP);
- financial capacity: ability to co-finance EU-supported programs and projects;
- administrative capacity: the ability of central and local authorities to manage EU programs and projects.

Achim and Borlea (2015), Bachtler and Ferry (2013), Dellmuth and Stoffel (2012), Grecu (2009), Tomova et al. (2013), Tosun (2014), Zaman and Georgescu (2009) are other authors that have identified as factors influencing the absorption rate of EU funds the following: capacity of institutions and administrative structures, bureaucracy, coordination between public institutions, public-private partnership, the long-term coherent vision of the authorities, the social and economic development of the member countries, the availability of national resources for project financing, the qualification level of the staff, etc.

2. Methodology and interpretation of indicators

According to the Romanian economist Liviu Albu (2007) in his paper "The Sustainable Development Economy - Analyzes and Economic Forecasts", the construction of macroeconomic models started from the aggregate relations established at the level of national economies between GDP or GNP and other exogenous factors and in time there has been an increase in the number of applied models but also an increase in the number of variables analyzed. Considering that established models assessing the impact of European funds on economic growth such as the HERMIN model and the QUEST model take into account a rate of absorption of European funds of 100%, we considered it necessary to achieve econometric regressions. Moreover there was also implicitly, the need to establish correlations between certain macroeconomic indicators among which the absorption of European funds and economic growth. Starting from the assumption that the most used indicator for the measure of economic growth is the Gross Domestic Product (GDP), the econometric correlation was made by referring to it.

The analysis of this correlation was made with the SPSS 17 statistical program. The SPSS (Statistical Package for Social Sciences) is one of the most used statistical data analysis programs. The first step was to collect input data and define work objectives. The AMECO database - an annual macroeconomic database of the European Commission's Directorate-General for Economic and Financial Affairs - was used to collect data. As a working methodology, we worked out the selected macroeconomic indicators using Excel and then imported the SPSS spreadsheet to analyze the required statistical data. Taking into account that the period of European funds allocation was 2007-2013 with the possibility to implement them until 2015 and even 2016 for projects of major interest, the period we analyzed is 2007-2016.

We started our study by analyzing the correlations between the GDP indicator and the other selected indicators (European Funds Absorption Rate, Minimum Wage, Import, Export, Consumption, Investments, Inflation) to highlight the links between them and how they influence each other, the intensity of the link between these indicators being the one that justifies the importance of creating a regression function. The index used to analyze the correlations created is the Pearson index.

The Pearson correlation coefficient indicates the strength of the link between the independent variables and the dependent variable. A +/- 1 value of the coefficient reveals a perfect correlation. The higher the Pearson coefficient is closer to "0", the situation reveals a weak correlation between the variables. When the Pearson coefficient is close to "-1", it shows an inverse correlation (the variable x increases while the y variable decreases). When the Pearson coefficient approaches the value "+1", it reveals a positive correlation (both x and y variables increase).

Using the Sig (2-tailed) coefficient, the SPSS program signals whether the result of the correlation is statistically negative. If this coefficient is less than 0.05, the correlation is significant, and if Sig (2-tailed) is within the relevant range, SPSS helps us by signaling with the asterisk * and **.

The values obtained at the level of the Pearson index analyzed indicators are as follows (Figure no. 1):

Correlations

		PIB (mld. EUR)	Grad de aborbtie fonduri	Salariu min-medie (EUR)	Import (mld. EUR)	Export (mld. EUR)	Consum total (mld. EUR)	Investitii (mld EUR)	Inflatia medie anuala
PIB (mld. EUR)	Pearson Correlation	1	,915**	,904**	,910**	,858**	,975**	,473	-,804**
	Sig. (2-tailed)		,000	,000	,000	,001	,000	,167	,005
	N	10	10	10	10	10	10	10	10
Grad de aborbtie fonduri	Pearson Correlation	,915**	1	,945**	,839**	,914**	,835**	,111	-,944**
	Sig. (2-tailed)	,000		,000	,002	,000	,003	,760	,000
	N	10	10	10	10	10	10	10	10
Salariu min- medie (EUR)	Pearson Correlation	,904**	,945**	1	,816**	,837**	,857**	,143	-,892**
	Sig. (2-tailed)	,000	,000		,004	,003	,002	,693	,001
	N	10	10	10	10	10	10	10	10
Import (mld. EUR)	Pearson Correlation	,910**	,839**	,816**	1	,885**	,897**	,443	-,807**
	Sig. (2-tailed)	,000	,002	,004		,001	,000	,199	,005
	N	10	10	10	10	10	10	10	10
Export (mld. EUR)	Pearson Correlation	,858**	,914**	,837**	,885**	1	,745*	,121	-,824**
	Sig. (2-tailed)	,001	,000	,003	,001		,013	,739	,003
	N	10	10	10	10	10	10	10	10
Consum total (mld. EUR)	Pearson Correlation	,975**	,835**	,857**	,897**	,745*	1	,594	-,752*
	Sig. (2-tailed)	,000	,003	,002	,000	,013		,070	,012
	N	10	10	10	10	10	10	10	10
Investitii (mld EUR)	Pearson Correlation	,473	,111	,143	,443	,121	,594	1	-,027
	Sig. (2-tailed)	,167	,760	,693	,199	,739	,070		,941
	N	10	10	10	10	10	10	10	10
Inflatia medie anuala	Pearson Correlation	-,804**	-,944**	-,892**	-,807**	-,824**	-,752*	-,027	1
	Sig. (2-tailed)	,005	,000	,001	,005	,003	,012	,941	
	N	10	10	10	10	10	10	10	10

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Figure no.1 Correlation level determined by the Pearson index

Source: information obtained through SPSS program

The very high correlation between economic growth and the absorption rate (p = 0.915) is due to the fact that, until 2013, a very low absorption rate (below 40%) was recorded, the effects of the injection of European funds the Romanian economy felt strongly after 2014. However, the attracted volume of European funds is far below the needs for regional development and the recovery of the gap with the European Union. It is important to note that this phenomenon of attracting European funds coincided with that of the economic and financial crisis which has made the absorption process slower and slower.

From the point of view of the correlation between the economic growth and the minimum wage, the data clearly indicates that there is a strong positive correlation (p = 0.904), the GDP being considered a standard of human welfare.

Starting from the premise that the Gross Domestic Product, one of the main macroeconomic aggregates, can be determined by summing up the components expressing the use of goods and services that form the final output, namely: consumption (private and public), investments and the difference between the value of exports and that of imports, the analysis shows that there are strong positive correlations between GDP and those indicators, i.e. high rates of economic growth are accompanied by high rates of consumption, export and import (import: p = 0,910, export: p = 0,858, consumption: p = 0.975). We can also say that there is a strong interdependence

between the value of the gross domestic product and that of the indicators mentioned (Sig almost zero, Sig <0.05), the correlation being almost perfect. In terms of investments, they recorded an insignificant correlation (p = 0.473 and sig = 0.167).

The correlation between economic growth and inflation is strongly negative, that is high rates of economic growth are accompanied by low inflation rates (p = -0,804). In the past years (1995-1996), high inflation rates have been recorded and economic growth, which has generated inflationary pressures, has also been recorded, and in the years to come, attention has been paid to the fight against inflation, which has led to a decrease in inflation of gross domestic product. We are currently facing GDP growth accompanied by a low inflation rate.

The econometric modeling of the correlation between the selected indicators in order to establish the regression model had as a first step the selection of the dependent and the independent variables. GDP level was established as a dependent variable, and the other indicators were independent variables. The next step was to test the intensity of the link between the independent and the dependent variables. As a way of introducing variables into regression, the Backward method was used, which involves the step-by-step elimination of insignificant variables. As can be seen in Table 2, the insignificant variables were gradually excluded from the regression calculation as follows: import (model 2), import and minimum wage (model 3) and import, minimum wage and investments (model 3).

Table no.2 Variables excluded from regression calculation

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Inflatia medie anuala, Investitii (mld EUR), Export (mld. EUR), Salariu min- medie (EUR), Import (mld. EUR), Consum total (mld. EUR), Grad de aborbtie fonduri [a]	.	Enter
2	.	Import (mld. EUR)	Backward (criterion: Probability of F-to-remove >= .100).
3	.	Salariu min- medie (EUR)	Backward (criterion: Probability of F-to-remove >= .100).
4	.	Investitii (mld EUR)	Backward (criterion: Probability of F-to-remove >= .100).

a. All requested variables entered.

b. Dependent Variable: PIB (mld. EUR)

Source: Table obtained through SPSS program

The probability that the final model (model 4) is correctly defined is very high - 99.9%, this conclusion being based on the values determined using SPSS 17 for R Squared (0.998) and Adjusted R Squared (0.996) they have maximum possible values, which justifies the existence of the regression model (table no.3).

Table no.3 Summary SPSS Model

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,999[a]	,999	,995	1,1115	,999	260,320	7	2	,004
2	,999[b]	,999	,996	,9402	,000	,147	1	2	,739
3	,999[c]	,999	,997	,8850	,000	,544	1	3	,514
4	,999[d]	,998	,996	1,0436	-,001	2,953	1	4	,161

a. Predictors: (Constant), Inflatia medie anuala, Investitii (mld EUR), Export (mld. EUR), Salariu min- medie (EUR), Import (mld. EUR), Consum total (mld. EUR), Grad de aborbtie fonduri

b. Predictors: (Constant), Inflatia medie anuala, Investitii (mld EUR), Export (mld. EUR), Salariu min- medie (EUR), Consum total (mld. EUR), Grad de aborbtie fonduri

c. Predictors: (Constant), Inflatia medie anuala, Investitii (mld EUR), Export (mld. EUR), Consum total (mld. EUR), Grad de aborbtie fonduri

d. Predictors: (Constant), Inflatia medie anuala, Export (mld. EUR), Consum total (mld. EUR), Grad de aborbtie fonduri

Source: Table obtained through SPSS program

The same verification was performed by the ANOVA test, the validity of model 4 being confirmed by the F test values (516.094 - a value much higher than the level considered to be the benchmark in the analyzes made for the validity of the econometric models), as well as the Sig index. This is below the threshold of 0.05 confirming the significance and relevance of the econometric model at global economic level (table no.4).

Table no. 4 ANOVA Test from SPSS program

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2251,134	7	321,591	260,320	,004[a]
	Residual	2,471	2	1,235		
	Total	2253,605	9			
2	Regression	2250,953	6	375,159	424,408	,000[b]
	Residual	2,652	3	,884		
	Total	2253,605	9			
3	Regression	2250,472	5	450,094	574,709	,000[c]
	Residual	3,133	4	,783		
	Total	2253,605	9			
4	Regression	2248,160	4	562,040	516,094	,000[d]
	Residual	5,445	5	1,089		
	Total	2253,605	9			

a. Predictors: (Constant), Inflatia medie anuala, Investitii (mld EUR), Export (mld. EUR), Salariu min- medie (EUR), Import (mld. EUR), Consum total (mld. EUR), Grad de aborbtie fonduri

b. Predictors: (Constant), Inflatia medie anuala, Investitii (mld EUR), Export (mld. EUR), Salariu min- medie (EUR), Consum total (mld. EUR), Grad de aborbtie fonduri

c. Predictors: (Constant), Inflatia medie anuala, Investitii (mld EUR), Export (mld. EUR), Consum total (mld. EUR), Grad de aborbtie fonduri

d. Predictors: (Constant), Inflatia medie anuala, Export (mld. EUR), Consum total (mld. EUR), Grad de aborbtie fonduri

e. Dependent Variable: PIB (mld. EUR)

Source: Table obtained through SPSS program

On the basis of the above mentioned elements, but also of the information presented in Table no. 5, the final step for establishing the regression model is the estimation of the regression equation parameters describing the correlation between the value of the gross domestic product and that of the non-eliminated selected indicators (the degree of European funds absorption, exports, consumption and inflation), which faithfully reflects the real evolution of macroeconomic indicators.

Starting from the data presented in Table 5, it is possible to transcribe the linear regression model in the following form:

$$R\ (PIB) = 1{,}954 + 0{,}276 * GrAb + 0{,}219 * Export + 1{,}057 * Consumption + 1{,}385 * Average\ inflation + \varepsilon,$$

where ε – error of the regression equation.

Table no. 5 Coefficients of the regression model

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	11,568	22,541		,513	,659	-85,419	108,554
	Grad de aborbtie fonduri	,262	,218	,463	1,204	,352	-,674	1,198
	Salariu min- medie (EUR)	,013	,032	,045	,415	,719	-,125	,152
	Import (mld. EUR)	-,176	,460	-,089	-,383	,739	-2,157	1,804
	Export (mld. EUR)	,316	,367	,208	,861	,480	-1,263	1,894
	Consum total (mld. EUR)	,890	,471	,565	1,890	,199	-1,136	2,916
	Investitii (mld EUR)	,356	,308	,100	1,154	,368	-,971	1,682
	Inflatia medie anuala	1,027	,981	,199	1,046	,405	-3,195	5,248
2	(Constant)	18,493	11,382		1,625	,203	-17,731	54,716
	Grad de aborbtie fonduri	,338	,073	,598	4,607	,019	,105	,572
	Salariu min- medie (EUR)	,018	,025	,061	,738	,514	-,061	,098
	Export (mld. EUR)	,180	,082	,119	2,210	,114	-,079	,440
	Consum total (mld. EUR)	,735	,201	,466	3,656	,035	,095	1,374
	Investitii (mld EUR)	,407	,235	,114	1,736	,181	-,340	1,154
	Inflatia medie anuala	1,371	,333	,266	4,122	,026	,312	2,430
3	(Constant)	14,640	9,519		1,538	,199	-11,789	41,069
	Grad de aborbtie fonduri	,343	,069	,605	4,973	,008	,151	,534
	Export (mld. EUR)	,181	,077	,119	2,362	,077	-,032	,394
	Consum total (mld. EUR)	,833	,141	,529	5,888	,004	,440	1,226
	Investitii (mld EUR)	,303	,176	,085	1,718	,161	-,187	,793
	Inflatia medie anuala	1,367	,313	,265	4,366	,012	,498	2,236
4	(Constant)	1,954	7,085		,276	,794	-16,260	20,167
	Grad de aborbtie fonduri	,270	,064	,477	4,213	,008	,105	,435
	Export (mld. EUR)	,219	,087	,144	2,528	,053	-,004	,442
	Consum total (mld. EUR)	1,057	,065	,671	16,238	,000	,889	1,224
	Inflatia medie anuala	1,385	,369	,269	3,753	,013	,436	2,333

Dependent variable GDP (mld EUR)

Source: Table obtained through SPSS program

At the end of modeling of this correlation, using the SPSS 17 statistical model, the regression equation graph (Figure 2), reflecting a linear regression; as the dependent variable increases, the selected independent variables increase.

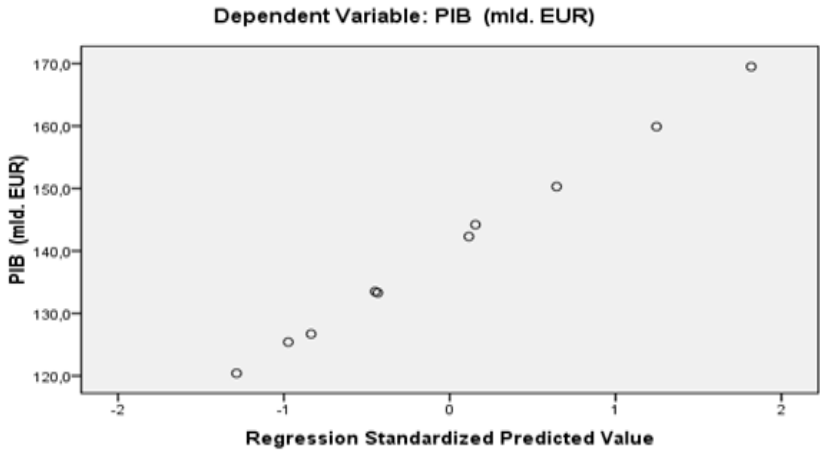

Figure no.2 The regression equation graph

Source: Figure obtained through SPSS program

3. Conclusions

The regression model analyzed allows us to establish a series of conclusions regarding the relationship between the variables considered:

- here is a direct, significant relationship between the value of gross domestic product and the degree of absorption of European funds, exports, final consumption and inflation;
- the other selected variables such as import, minimum wage and investments were excluded from the model.

The situation can be considered normal given that it is known that in recent years, in our country, economic growth was almost exclusively based on a policy of stimulating consumption, with European funds also having a rather insignificant impact on economic growth.

We also believe that quantitative assessment must always be accompanied by a qualitative assessment that surprises factors which cannot be measured by econometric modeling. As such, when using evaluation results with the help of econometric models, it is important to be aware that models are simplifications of reality, despite the impressive mathematical calculations they use.

Also, it should not be overlooked that Romania's major development needs and the current economic context make it imperative to achieve as high a level of absorption of the non-reimbursable funds as well as an efficient use thereof, generating a significant impact at national, regional and local level. However, when assessing the absorption capacity of a Member State, it is not only the percentage used by the funds allocated which is analyzed, but also the effects which they have generated in the economy of that State.

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