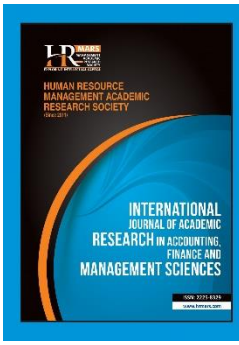
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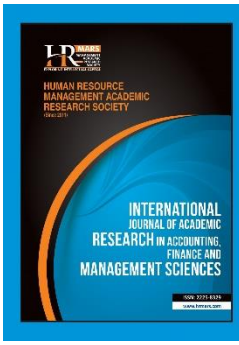
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Effects of European Economic and Monetary Integration on the Eurozone Economy – An Econometric View

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Abstract
Monetary integration, a good thing, or a necessary evil? This question looks for specialists of the world to respond, especially now in the current global crisis. With the help of econometric modeling, we tried to provide a partial answer to this question so important. Application of multiple regression method in which the main actors were the actual rate of increase in the GDP of the euro area, the rate of growth of foreign direct investment in the euro area, as well as the rate of employment growth in the euro area, we came to the conclusion that economic and monetary integration is a good thing in the economic conditions of normalcy but they show the weaknesses of a crisis more severe, so it must review the parameters of this type of integration.
Keywords: Monetary Integration, Econometric Modeling, Multiple Regression, Crisis, Effects

Introduction

Modeling is a method of research and knowledge of reality by means of representations called models; these are artificial systems with which to study the behavior of a real system (micro or macro economic level) that is by analogy, although this simplification to the essential characteristics of the denaturize phenomenon or process studied.

Within the framework of macroeconomic studies use data and methods of analysis of existing information is unavoidable. Economic-mathematical modeling is a method of research and knowledge of complex phenomena and processes in economics, analyzed in the abstract with the help of logical and mathematical formalizing this can be seen as an alternative to "experiment" used in the sciences.

The model, as an instrument of scientific knowledge, is used in numerous theoretical and practical subjects. In economics, particularly in the disciplines of management, models and are used for all types of diversity that exists. In recent decades, however, is increasingly taking shape more particularly, use trend in these disciplines, mathematical models of type, largely due to their ability to condense the essentials of rigorous and their ability to be programmed with the aid of electronic computers, together constituting a scientific investigation of an unknown so far, a prodigious

"extension" of human intelligence.

Modeling activity, in order to be effective, must be carried out in the framework of the system, namely as a point in the design phase of the new system. A series of operations that are carried out in the context of the analysis of the system before this time have a preparatory to perform modeling and others, later they are necessary for the practical application of the models developed.

The major phases of the development of a mathematical model in an issue of organization management socio-economic concerns: first phase of modeling, which as a preparatory, is knowledge of the reality in the studied, in order to improve the decision-making mechanism of the information. Descriptions of the logic of decision-making processes, along with consideration of the objectives of the future system, are the main elements of the knowledge necessary reality modeling; the second phase is the modeling of building your own model. This operation, in the vast majority of cases, the practice is to apply a classic tool of modeling extremely varied range that provides us a theory of operational research. In such situations, the ability is to establish correspondence between reality and simulation modeling tool known from literature. There are cases when you cannot set such a mail analyst being forced to develop new models. These can be of two kinds: classical models), combinations of field theory and b) new models themselves. In the first case, it all comes down to good knowledge of reality and theory, to which must be added a dose of skill in combining methods. In the second case, it is an original creation; the third phase of the modeling is dealing with reality and possibly model experimentation. This phase is carried out within the framework of the implementation of the system, which can be considered as the fourth and last phase of modeling.

One of the main characteristics of the methods of operational research is that some operational problems of the research can be viewed in purely theoretical perspective, as pure mathematics problems. No it will be the prospect that we will adopt the following, we will look at the methods of operational research closely linked to practical problems.

Literature Review

In the literature there are many studies on the determinants of economic growth of a region. For model I chose made a selection of studies which examines primarily the influence of foreign direct investment on economic growth. For example, Bosu, Chakraborty and Reagle, Upadhyaya and Trevino have concluded that this link is more likely to be found in open economies with greater degree, than in others. Also Borensztein, Gregorio and Leehave determined that foreign direct investments have a positive effect on economic growth when the country enjoys a workforce with a high level of education. In turn, Alfaro and others considered that such investment promotes economic growth in the countries or regions which have developed enough financial markets.

For the end of the period considered, it was seen that the Euro area is made up of countries which only have thought both are highly integrated economically, as well as some other currency, and there are major disparities in the area of financial markets, although they share the same currency.

Precisely why in the following analysis, I wanted to point out this aspect of the impact of economic and monetary integration on those 17 States of the Euro area, the impact of which was turned into a negative when they were hit by a shock of the scale of the global financial crisis.

So, we chose to analyze the correlation existing between the rate of real growth of gross domestic product in the Euro Zone, foreign direct investment in the Euro area, as well as the rate of growth of employment in the same space.

Econometric Model

The period chosen for this endeavor is located between 1996 and 2010. This includes both years before the introduction of the single currency, but also years during the current crisis facing the entire planet.

The method used in analysis was multifactorial regression, and the platforms used were Excel and Eviews. Thus, the structural form of the model in this case is:

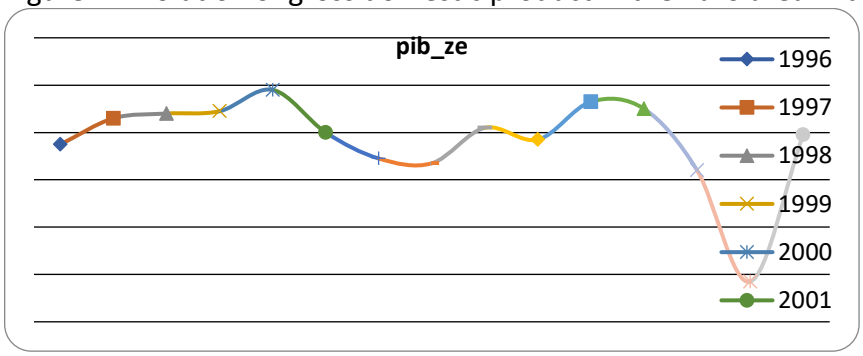
$pib\_ze=a_1+a_2*isd\_ze+a_3*pop\_ocup\_ze+\varepsilon_t$, where:

Symbol	Significance	The nature of variable
pib_ze	Real growth rate of gross domestic product in the Euro area (%)	Endogenous variable (criterion)
isd_ze	Rate of growth of foreign direct investment in the Euro area (%)	Exogenous variable (predictor)
pop_ocup_ze	The rate of employment growth in the Euro area (%)	Exogenous variable (predictor)
a_1,a_2,a_3	Econometrical determined coefficients	

Table 1. Evolution of indicators during the period 1996-2010 (%)

Year	**pib_ze**	**isd_ze**	**pop_ocup_ze**
1996	1,5	1,33	0,6
1997	2,6	1,42	0,9
1998	2,8	2,75	1,9
1999	2,9	6,72	1,9
2000	3,8	11,62	2,5
2001	2	5,75	1,4
2002	0,9	5,31	0,7
2003	0,7	3,59	0,5
2004	2,2	2,04	0,8
2005	1,7	4,35	1
2006	3,3	3,96	1,6
2007	3	6,62	1,7
2008	0,4	2,92	0,8
2009	-4,3	3,37	-1,8
2010	1,9	2,72	-0,5

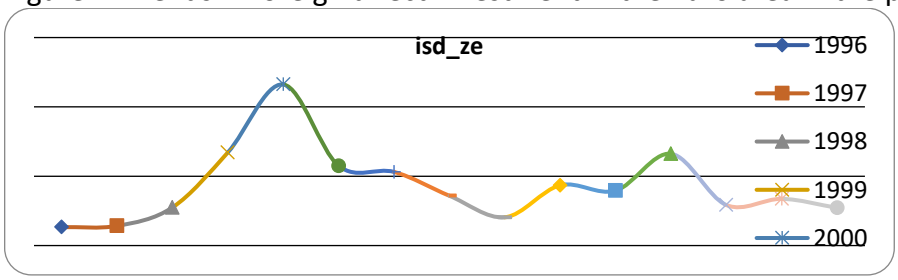
Figure 1. Evolution of gross domestic product in the Euro area in the period 1996-2010 (%)



Looking at the chart the evolution of gross domestic product in the Euro Zone during the period 1996-2010, it is noted that in 2000, it reached a peak, reaching a growth rate of 3.8%. A close increase was felt also in 2006, reaching a value of 3.3%. Perhaps this trend upward in 2006 would have continued if not break out in 2007 and began to propagate the global financial crisis. Note that these shocks on international markets have produced a major change of that trend, and the minimum point is recorded in 2009, when he had a value of-4.3%. Measures to combat the adverse effects of the crisis, has managed that in 2010, the rate of growth of real GDP in the Euro area should be more positive again, with 1.9%.

In terms of foreign direct investment in the Euro area during the analysis period, the evolution we presented in the chart below:

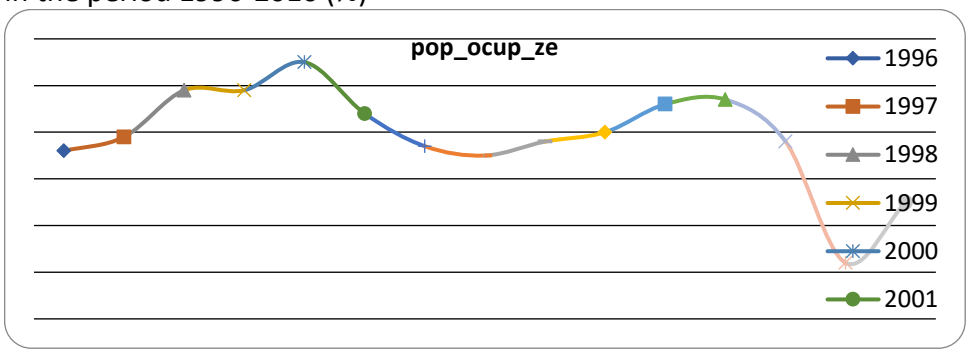
Figure 2. Trends in foreign direct investment in the Euro area in the period 1996-2010 (%)



Note that these were positive throughout the period of reference. The peak of these investments was reached in 2000 when the rate of growth of their nil 11.62%. After this year, this indicator has also experienced significant growth in 2007, exactly at the beginning of the crisis. Minimum point was in 1996, only 1.33%.

Another indicator taken into account and which has a major influence on the endogenous variable is the rate of increase in employment in the Euro area.

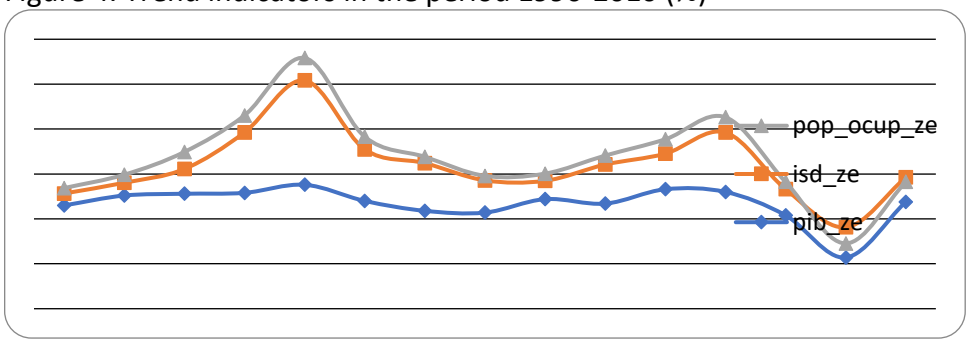
Figure 3. Evolution of the rate of increase in employment in the Euro area in the period 1996-2010 (%)



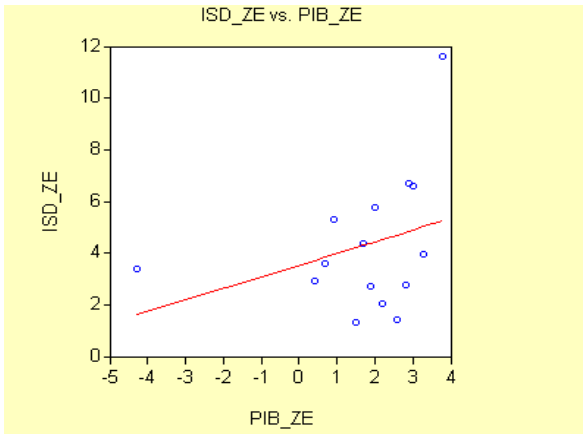
Note that for this indicator, the maximum was reached in 2000 when he recorded a value of 2.5%, and the minimum was reached in 2009, with a value of-1.8%.

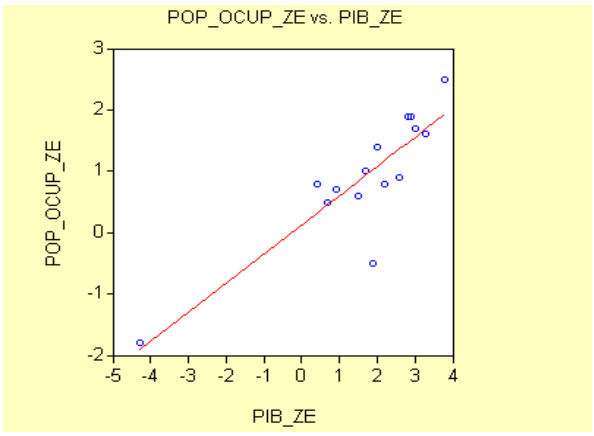
By overlaying the three graphs it appears that all three variables chosen had similar trends over the period considered.

Figure 4. Trend indicators in the period 1996-2010 (%)



Identification of regression function is carried out with the help of graphic of variable pib_ze depending on the other two variables, isd_ze, respectively pop_ocup_ze.





Analyzing the graphs above noted that the link between pib_ze and isd_ze, respectively pib_ze and pop_ocup_ze can be approximated by a straight line. Thus, the model chosen is a multifactorial, because being correlated with linear pib_ze isd_ze, the pop_ocup_ze is available, and it will be easily correlated linearly and in relation to both factors.

Further we realized the estimate model parameters. For this we turned to the least-squares Method applied in Eviews, which requires the following calculation: getting the system of equations by calculating the partial derivatives with respect to the parameters of the model.

$F(a_1,a_2,a_3)=\min\Sigma(pib\_ze - a_1 - a_2*isd\_ze - a_3*pop\_ocup\_ze)$

After estimating equation we obtained the following results:

Dependent Variable: PIB_ZE
Method: Least Squares
Date: 03/06/12 Time: 12:36
Sample: 1996 2010
Included observations: 15

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ISD_ZE	-0.142968	0.116482	-1.227383	0.2432
POP_OCUP_ZE	1.781048	0.293636	6.065503	0.0001
C	0.645497	0.491528	1.313246	0.2137

R-squared	0.780217	Mean dependent var	1.693333
Adjusted R-squared	0.743587	S.D. dependent var	1.924825
S.E. of regression	0.974678	Akaike info criterion	2.963438
Sum squared resid	11.39998	Schwarz criterion	3.105048
Log likelihood	-19.22579	F-statistic	21.29970
Durbin-Watson stat	1.863813	Prob(F-statistic)	0.000113

a_1=0,645497	σ_{a1}=0,491528	Prob.= 0,2137 > 0.05 => accept H_0
a_2=-0.142968	σ_{a2}=0.116482	Prob.=0.2432 > 0.05 => accept H_0
a_3=1.781048	σ_{a3}=0.293636	Prob.=0.0001 < 0.05 => accept H_1
$\sigma_{\varepsilon t}$=0.974678		

Estimators are significantly different from zero, with a threshold of significance α if it checks the following relationships:

$$\frac{\widehat{a_1}}{\sigma_{a1}} > t_{calc.}\ ;\ \frac{\widehat{a_2}}{\sigma_{a2}} > t_{calc.}\ ;\ \frac{\widehat{a_3}}{\sigma_{a2}} > t_{calc.}$$

Having all the data above and working at a threshold of significance α = 0.05, the t-student distribution value for t, n-k-1, meaning $t_{0,025;\,12}$ =2,179.

Thus, by comparing the results that we obtain for the a_1, $t_{calc.}$ = 1.3132, so it is smaller than the t_{tab}, from which it follows that the null hypothesis is accepted, so there is no free time estimator significantly different from zero.

We have that for a_2, $t_{calc.}$ =-1.227383, less than the value of the t_{tab}, so any estimator this parameter do not differ significantly from zero.

For a_3, its value $t_{calc.}$ = 6.065503, greater than the value of the t_{tab}'s estimator, so this parameter is significantly different from zero.

These considerations were the results of the analysis carried out on a number of 15 observations. Due to the fact that I am counting on the assumption that the normal distribution is estimation around the true value, the model obtained should be tested.

Test "t" has led to the conclusion that the a_2 is not significant, being very close to zero, so the "foreign direct investment" was not too well chosen as the factor of influence of gross domestic product, having an indirect influence on them, while the a_3 differ significantly from zero, so the population factor "occupied a determining influence on the gross domestic product.

To verify the model's verisimilitude we applied in Excel the ANOVAs and Regression tests, with the following results:

Regression Statistics	
Multiple R	0,88329915
R Square	0,78021738
Adjusted R Square	0,74358694
Standard Error	0,97467849
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	40,46935534	20,23467767	21,29970182	0,000112709
Residual	12	11,39997851	0,949998166		
Total	14	51,86933333			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0,64549713	0,491527851	1,313246301	0,213657056	-0,425450054	1,716444317
X Variable 1	-0,1429677	0,116481739	-1,227382866	0,243212884	-0,396759596	0,110824217
X Variable 2	1,78104786	0,293635662	6,065502537	5,62395E-05	1,141270708	2,420825003

It is noted that the report of multiple correlation (Multiple R) is 0.88329915 and show a very strong link between the variables. Determination coefficient R^2 (R-squared) has the value 0.78021738. It is expressed as a percentage (78%) and shows how dependent variable of the variance is explained by the estimated equation. The closer to 1 (100%), the proportion of the variation explained his pib_ze is higher and so the link between variable intensity is stronger.

To test the validity of the model took into account the two hypotheses:

H_0: the model is invalid

H_1: valid pattern

How we have $F_{calc.}$, i.e. $F_{statistic}$ =21.29, and $F_{tabelar}$, in our case $F_{05;\ 2;\ 12}$ = 3.885, so $F_{calc} > F_{tab.}$, it appears that the model chosen is a valid one, and parameters are relevant for the model, the function being well chosen.

In the analysis of autocorrelation of residual variables the most commonly used test is the Durbin-Watson. Assumptions of this test are:

H_0: p = 0, so there is no residue series-level autocorrelation

H_1: p ≠ 0, so there is the autocorrelation

Analyzing out-put of Eviews we noted that the DW statistic of the model chosen by us is 1.86. Critical values of statistics depends on the number of exogenous variables within the model (2), the number of observations (15) and the threshold of significance chosen (0.05). Breakpoints include tables for items specified as a pair of values d1 and d2, d1= 0.95 and d2 = 1.54. Note that DW belongs to the range (d2, 4-d2), which is why it can be asserted that there is no autocorrelation of error, so it is acceptable to the hypothesis H_0.

To test the heteroskedasticity test I applied White (cross terms), as can be seen in the figure below:

White Heteroskedasticity Test:

F-statistic	1.599546	Probability	0.254373
Obs*R-squared	7.057764	Probability	0.216380

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 03/06/12 Time: 12:43
Sample: 1996 2010
Included observations: 15

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.016804	1.832071	2.192494	0.0560
ISD_ZE	0.022519	0.553055	0.040718	0.9684
ISD_ZE^2	-0.210301	0.138511	-1.518297	0.1633
ISD_ZE*POP_OCUP...	1.309933	0.744812	1.758744	0.1125
POP_OCUP_ZE	-5.199660	2.498779	-2.080881	0.0672
POP_OCUP_ZE^2	-0.169761	0.365205	-0.464837	0.6531

R-squared	0.470518	Mean dependent var	0.759999
Adjusted R-squared	0.176361	S.D. dependent var	1.652047
S.E. of regression	1.499308	Akaike info criterion	3.937059
Sum squared resid	20.23133	Schwarz criterion	4.220279
Log likelihood	-23.52795	F-statistic	1.599546
Durbin-Watson stat	1.885073	Prob(F-statistic)	0.254373

It is defined for the following assumptions:

H_0: the model is homoskedastic

H_1: model is heteroskedastic

Test statistic: W = n * R-squared = 15 * 0.470518 = 7.05777

The critical value of statistics depends on the number of parameters that appear in the application of White test (6) and significance level chosen (0.05). So, we'll determine the χ^2 distribution for 6 degrees of freedom and α = 0.05, the critical value of 12.592. Note that comparing values we noted that W<12.592, which means that the null hypothesis is accepted, and the model chosen is homoskedastic.

To test for the existence of multicoliniarity we defined the assumptions:

H_0: $r^2_{x1/x2}$ < R-squared, model does not present the phenomenon of multicoliniarity

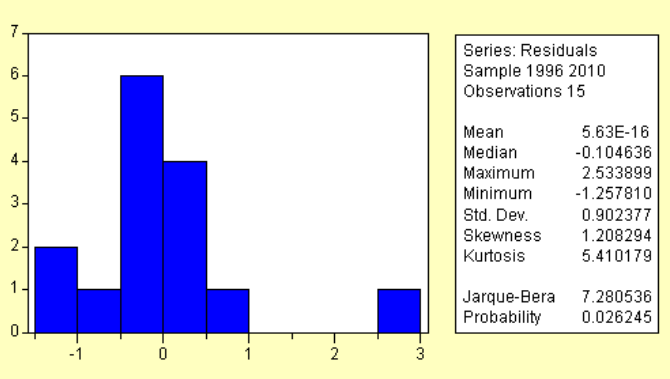
H_1: $r^2_{x1/x\,2}$ > R-squared, it is suspected the presence of multicoliniarity in the model

To verify the existence of the multicoliniarity we applied the Klein test. So, we calculated the matrix coefficients of the linear correlation as explanatory variables, which can be seen from the figure below, from which we extract the value $r_{x1/x2}$ = 0.537449.

Correlation Matrix					
	PIB_ZE	ISD_ZE	POP_OCU...		
PIB_ZE	1.000000	0.326182	0.867540		
ISD_ZE	0.326182	1.000000	0.537449		
POP_OCU...	0.867540	0.537449	1.000000		

Since $r_{2x1/x2}$ = 0.28885 < R-squared = 0.780217 one can say that the phenomenon of multicoliniarity is not present in the regression model.

Testing of the normality we did it with the help of histogram, obtaining the following test results:



We took into account the two hypotheses:

H_0: Skewness = 0, Kurtosis = 3, so the distribution is normal

H_1: the distribution is not normal

In the analysis we present that the distribution is asymmetrical, one oriented towards positive values (Skewness = 1.2), with a flattening of 5.4. Also, the Jarque-Bera shows a value of 7.28 > 0.05 therefore we accept the assumption that the errors are not normally distributed.

Results

Following this econometric tests it has been observed that the term has coefficient 0.645497 free. The term free means that point of explanatory variables are 0. Since t = 1, the probability is 0.21 and threshold of significance is 0.05, it means that the coefficient is insignificant. Moreover, the fact that the lower limit of the confidence interval (- 0.42545 ≤ a1 ≤ 1.716444) for this parameter is negative, and the upper limit is positive, show that the parameter is null.

Coefficient a_2 is - 0,142968, which means that an increase of foreign direct investments by 1%, the GDP will fall by 0.14%. Since t =-1.227, probability is 0.2432, and in particular the significance threshold is 0.05 it means that the coefficient is insignificant. Moreover, the fact that the lower limit of the confidence interval (- 0.396759 ≤ a1 ≤ 0.110824217) for this parameter is negative, while the upper limit is positive, we indicate that the candidate is approximately zero.

The a_3 being 1.781048, we show that the employment is in direct positive relationship with gross domestic product, i.e. an increase of 1% in the rate of employment in the Euro area, the gross domestic product of the region will increase by 1.78%. The fact that the candidate is significantly different from zero and is confirmed by the confidence interval (2.420825003 ≤ a1 ≤ 1.41270708) which has both the lower and upper limit, positive.

Overall, the period taken into account it is noted that between gross domestic product and foreign direct investment in the region considered there was a reverse negative relationship. As I mentioned at the beginning of this review, in economic theory is noted that foreign direct investment would have positive effects on the economy of the region. However, there are cases, like the one described above, in which foreign direct investment may have an opposite effect on the economy of the region. Although foreign direct investment raises the productivity of investment and consumption, they may also decrease the economy due to the improper allocation of prices or biases of resources. Another cause which could determine this relationship negative would be that the output of the Euro area investment exceeds the level entries. It should also be borne in mind that the analysis is composed of 17 different countries with economies. Another important factor is that in the Euro area employment growth rate of population is quite low (some Euro area countries confronted with high unemployment) so that there is a lack of human capital, so the effect of FDI on the gross domestic product is negative.

Conclusions

Should not be ignored nor that the Euro area is currently in a strong crisis, which made their presence felt since 2007 and has had significant negative effects on the less developed countries in this region.

All of these things above were reflected in an econometric model, more specifically in its results. We can thus preview that once its anti-crisis measures will also benefit the relationship between Member States will regain vigor, economic and monetary integration of these will return to the normal parameters, which will determine economic growth as good as before the crisis, if not even better.

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