ECONOMETRIC STUDY OF THE CORRELATION BETWEEN FOREIGN DIRECT INVESTMENTS AND GROSS DOMESTIC PRODUCT IN ROMANIA

Podaşcă Raluca[1]

Abstract

Economic freedom and friendly taxation are essential aspects of Romanian business environment for entrepreneurs and especially for foreign investors. There is a close competition among world's developed countries to create favorable conditions for attracting foreign direct investments. The global experience has shown that the main condition for attracting foreign investors is improving the investment climate. When referring to the dynamics of foreign direct investment in Romania, it is noticed that since 2003 until present they have recorded a positive trend. This is explained primarily due to increased foreign direct investment flow from the European Union to Romania (it is noticed that in 2006 which is the year that preceded Romania's integration in the European Union, the FDI registered the highest growth of 57.7%), but also due to economic performance of our country. This increase can be explained by the fact that foreign investors have viewed the profit opportunities, relatively high in the Romanian economy, either as Greenfield investments and either through buying, mergers and acquisitions.

Key Words*: foreign direct investments, gross domestic product, correlation, ANOVA method*

JEL Classification: C10, G00

1. Introduction

Foreign direct investment is a long term investment relationship between a resident entity and a non-resident entity. It usually implies that the investor exerts a significant influence in the company in which he invested. There are considered foreign direct investments (FDI) the registered capital and reserves related to a foreign investor who owns at least 10% of the votes or capital subscribed of a resident company, credits between the investor or the group to which it belongs and the resident company in which he invested and also the reinvested profit.

There are also considered FDI, the equity investments and loans from non-resident companies whose voting power or share is below 10%, but belong to a direct investor group of the resident company. Another FDI are considered the resident companies on which the non-resident investor has a significant influence on indirect route, namely certain subsidiaries and resident associations of the resident enterprise, where the non-resident investor holds at least 10% of the subscribed share capital (FDI enterprises grade II).

By the contribution of foreign equity holdings in foreign direct investment enterprises, there are the following types of FDI: greenfield (establishment of enterprises by or together with foreign investors), mergers and acquisitions (partial or full takeovers of enterprises by foreign investors from residents), development of enterprises (increase in the capital of foreign investors in direct investment enterprises), restructuring of enterprises (financing by foreign investors through intake equity and direct investment enterprises with losses to their cost effectiveness).

2. The econometric analysis

A large number of main and secondary factors, of essential and nonessential factors, act on socio-economic phenomena, which are found in connectivity. Econometrics, using a variety procedures and methods available can study the concrete manifestation of these connections, can express them quantitatively and measure the intensity with which they occur. Starting from the fact that statistics study mass phenomena within which act

[1] Assistant Ph.D at the Petroleum-Gas University of Ploiesti, Faculty of Economic Sciences, raluca.podasca@yahoo.com

statistical laws, whose main feature is the fact that they manifest as a tendency, it is required the interpretation of causal relationships still as a tendency. Meanwhile, statistical practice proves that in the process of producing mass socio- economic phenomena, not all phenomena manifest with the same intensity and in the same sense.

Table no.1. Calculation of FDI dynamic indicators in Romania between 2003-2014

Year	FDI (mil. Euro)	$\Delta_{t/0}$	$\Delta_{t/t-1}$	$I_{t/o}$ (%)	$I_{t/t-1}$ (%)	$R_{t/o}$ (%)	$R_{t/t-1}$ (%)
2003	9662	0	-	100.00	-	0.00	-
2004	15040	5378	5378	155.66	155.66	55.66	55.66
2005	21885	12223	6845	226.51	145.51	126.51	45.51
2006	34512	24850	12627	357.19	157.70	257.19	57.70
2007	42770	33108	8258	442.66	123.93	342.66	23.93
2008	48798	39136	6028	505.05	114.09	405.05	14.09
2009	49984	40322	1186	517.33	102.43	417.33	2.43
2010	52585	42923	2601	544.25	105.20	444.25	5.20
2011	55139	45477	2554	570.68	104.86	470.68	4.86
2012	59126	49464	3987	611.94	107.23	511.94	7.23
2013	59958	50296	832	620.55	101.41	520.55	1.41
2014	60198	50536	240	623.04	100.40	523.04	0.40

Source: own calculation based on official data available at http://www.bnr.ro/Publicatii-periodice-204.aspx

Throughout the analyzed period 2003-2014 there is a continuous increase in foreign direct investment balance, but since 2008, when the economic and financial crisis was felt on the Romanian economy, it is noticed cumulative balance of foreign direct investment with very small increases. Also, we can notice that the value of the credits grew during the whole period, indicating a negative situation, leading to the idea that foreign firms have significantly reduced or even suspended investments realized from net incomes, some of the companies being significantly impacted by losses.

Table no. 2. Distribution by region of development of Romanian FDI

Development region	2014		2013	
	FDI (mil euro)	Share (%)	FDI (mil.euro)	Share (%)
Bucharest-Ilfov	35665	59.2	36808	61.4
Center	5833	9.7	5179	8.6
West	4646	7.7	4599	7.7
South-Muntenia	4194	7	4581	7.6
North-West	3384	5.6	2665	4.5
South-East	2898	4.8	2529	4.2
South-West-Oltenia	1954	3.3	1912	3.2
North-East	1624	2.7	1685	2.8
Total	60198	100	59958	100

Source: own calculation based on official data

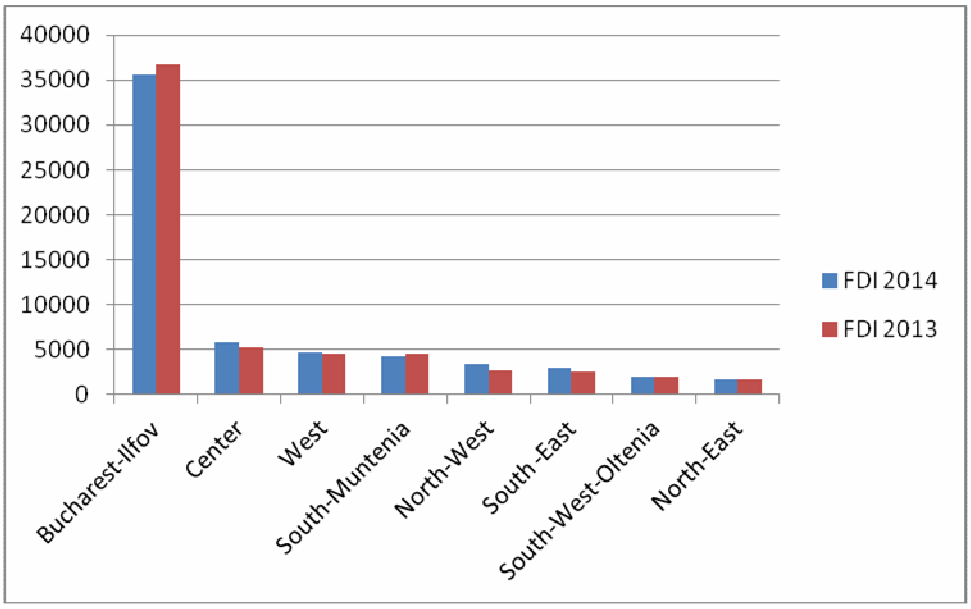

Figure no.1.The evolution of FDI by regions of development

From the territorial point of view, in 2014 compared to 2013 there aren't major changes in the share of FDI by regions of development. Bucharest-Ilfov has the largest share of FDI in 2014 (59.2%), followed by Center region (9.7%), West region (7.7%) and South-Muntenia (7%). It is important to specify that FDI were territorially located by registered office of enterprises, which does not always correspond to the place of business.

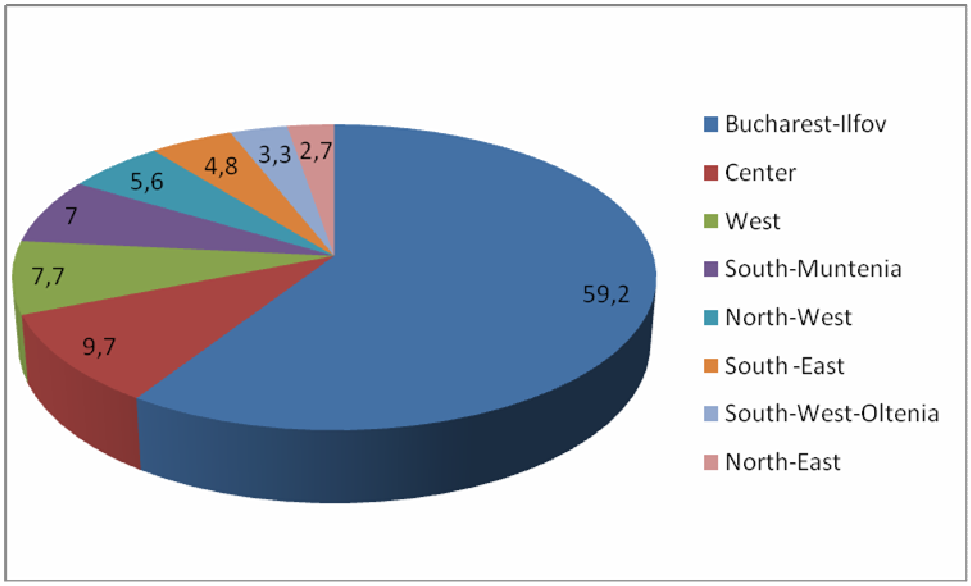

Figure no.2.The share of FDI by regions of development in 2014

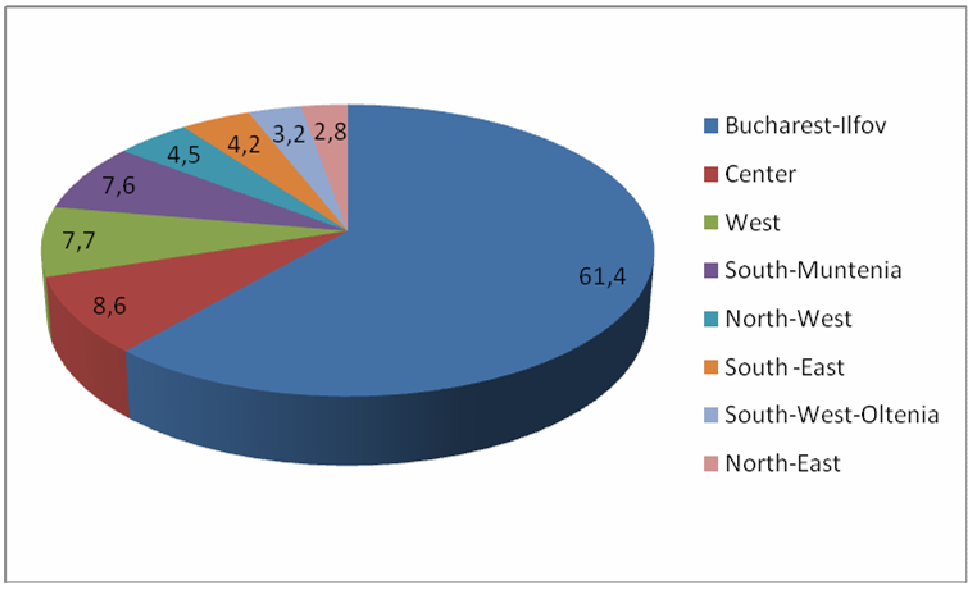

Figure no.3.The share of FDI by regions of development in 2013

Regarding the content of economic growth, there is a variety of reviews leading to a number of definitions. Economic growth expresses the changes that occur in a given time horizon and a certain space materialized in increasing dimensions of macroeconomic results, closely related to factors influencing its size, including economic and social environment in which occurs. These results can be measured through indices that are significant in assessing a country's economic dynamics. The best measure of economic growth is gross domestic product.

Table no.3. Calculation of GDP dynamic indicators in Romania between 2003-2014

Year	GDP (mil. Euro)	$\Delta_{t/0}$	$\Delta_{t/t-1}$	$I_{t/o}$ (%)	$I_{t/t-1}$ (%)	$R_{t/o}$ (%)	$R_{t/t-1}$ (%)
2003	52931	0	-	100.00	-	0.00	-
2004	61404	8473	8473	116.01	116.01	16.01	16.01
2005	80225	27294	18821	151.57	130.65	51.57	30.65
2006	98418	45487	18193	185.94	122.68	85.94	22.68
2007	125403	72472	26985	236.92	127.42	136.92	27.42
2008	142396	89465	16993	269.02	113.55	169.02	13.55
2009	120409	67478	-21987	227.48	84.56	127.48	-15.44
2010	126746	73815	6337	239.46	105.26	139.46	5.26
2011	133305	80374	6559	251.85	105.17	151.85	5.17
2012	133511	80580	206	252.24	100.15	152.24	0.15
2013	144253	91322	10742	272.53	108.05	172.53	8.05
2014	150018	97087	5765	283.42	104.00	183.42	4.00

Source: own calculation based on official data available at http://ec.europa.eu/eurostat

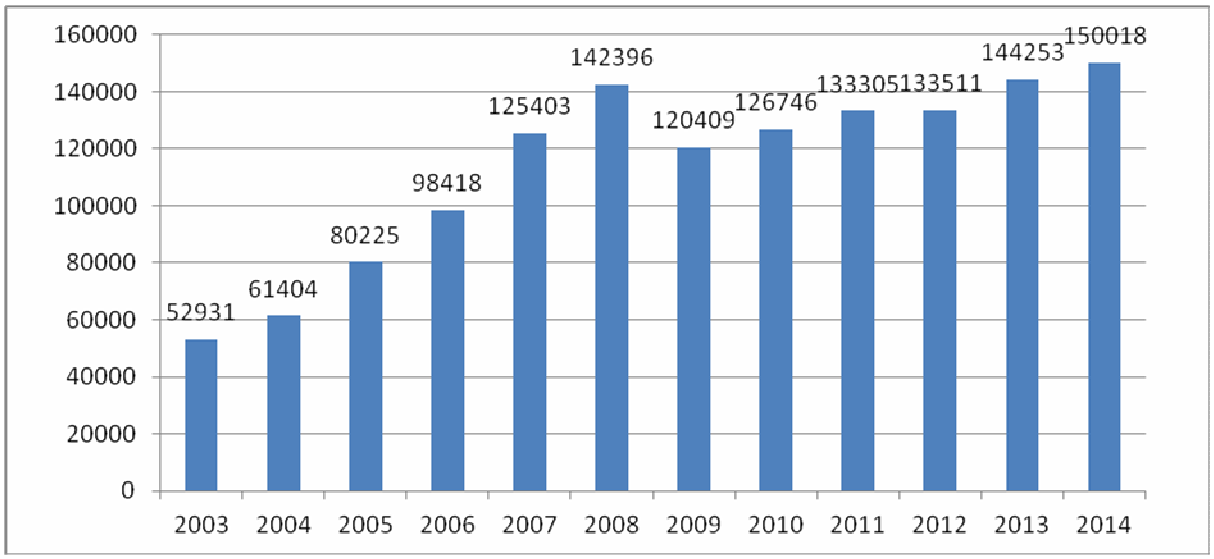

Figure no.4. The evolution of Romanian GDP between 2003 and 2014

Gross Domestic Product has seen an impressive growth during 2003-2008, in 2008 reaching a value of 142396 mil. euro, a period that coincided with increasing levels of foreign direct investment. Between 2009 and 2012, Gross Domestic product decreased significantly, due to the effects of the financial crisis that affected the entire world. Since 2013 it is noticed an ascendant trend of the indicator, which is mainly due to industry, exports and agriculture.

In order to analyze the influence of FDI on economic growth in the period 2003-2014, it is used the statistical method of linear regression. Thus, the FDI represents the independent variable and GDP the dependent variable.

Table no.4. Indicators used for the statistical correlation

Year	**x_i (FDI)**	**y_i (GDP)**	**x_i^2**	**xi*yi**
2003	9662	52931	93354244	511419322
2004	15040	61404	226201600	923516160
2005	21885	80225	478953225	1755724125
2006	34512	98418	1191078144	3396602016
2007	42770	125403	1829272900	5363486310
2008	48798	142396	2381244804	6948640008
2009	49984	120409	2498400256	6018523456
2010	52585	126746	2765182225	6664938410
2011	55139	133305	3040309321	7350304395
2012	59126	133511	3495883876	7893971386
2013	59958	144253	3594961764	8649121374
2014	60198	150018	3623799204	9030783564
Total	509657	1369019	25218641563	64507030526

Source: own calculation based on official data

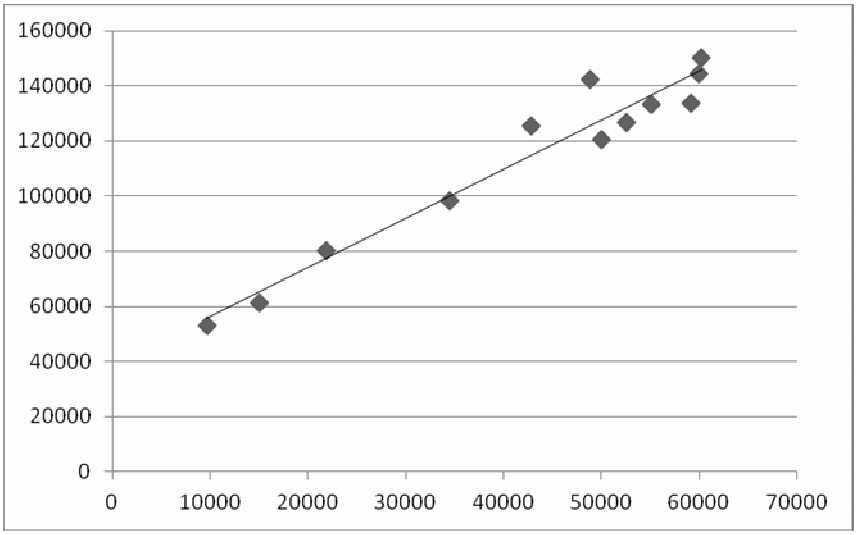

Figure no.5. The graphical representation of the connection between FDI and GDP

The equation characterizing the linear regression is:

$$\hat{y}_i = a + b \cdot x_i$$

The normal equation system is:

$$\begin{cases} n \cdot a + b \sum x_i = \sum y_i \\ a \cdot \sum x_i + b \cdot \sum x_i^2 = \sum x_i \cdot y_i \end{cases}$$

Considering the causal variable (X) as the foreign direct investments and the resultative variable (Y) as the gross domestic product, the graphical representation indicates a direct linear connection between these variables. This assumption will be demonstrated further through econometric methods (ANOVA method).

Variance analysis method, through its components enables determining the representativeness of a sample in the relation to the hypothesis that the average or dispersion does not differ significantly from one sample to another. Establishing the representativeness of the sample is actually the result of testing the significance of the difference between averages or dispersions of the groups and the general collectivity.

The coefficients estimation of a linear model by least squares method and calculating the required indicators associated with statistical tests are performed through Regression procedure, one of the most complex statistical processing of Excel package. The procedure allows the construction of graphs needed to assess visual matching linear model.

Applying this method to study the relationship between the population employed in agriculture, forestry, fishing and the agricultural production, there are obtained date presented in the following tables.

Table no.5. The variables' value synthesis

Regression Statistics	
Multiple R	0.972
R Square	0.945
Adjusted R Square	0.940
Standard Error	8082.561
Observations	12

Source: made by the author

The value of correlation coefficient (0.972) indicates a strong connection between the two variables. The determination coefficient (0.945) indicates the proportion of the dependent variable variance caused by the independent variable variance (94.5% of the variance of the GDP is caused FDI).

Adjusted R Square (0.94) represents the corrected value of the determination coefficient (it is introduced to counter the effect of the mechanical increase of the determination coefficient along with the number of independent variables). Standard error of the estimation is calculated as the standard deviation of residues (for the degrees of freedom used, refer to the following ANOVA table) and standard deviation estimation error ε (assuming their normality).

Table no.6.The ANOVA method

Source of variation	df	SS	MS	F	Significance F
Regression	1	11331746252	11331746252.105	173.46	0.00000012
Residual	10	653278044.8	65327804.48		
Total	11	11985024297			

Source: made by the author

Source of variation indicates the decomposing of total variation in variation caused by regression (explained) and residual variation (unexplained). The "df" column indicates the number of degrees of freedom, "SS" represents the sums of squares according the following decomposition: the global sum of squares=sum of squares caused by regression+the residual sum of squares. The "MS" column indicates the mean sums of squares (sum of squares divided to number of freedom degrees). The computed value of the F test is 173.46 and its theoretical value is 0.00000012 which is smaller than 0.05 (the materiality threshold) meaning that the linear model is valid.

The following panel contains the estimated values for the coefficients' model and statistics needed to verify the usual assumptions on coefficients. It is worth mentioning that, unlike F-test, the coefficients are tested individually.

Table no.7.The variables' value synthesis

Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
38446.640	6198.915	6.202	0.0001	24634.596	52258.685
1.780	0.135	13.170	0.0000001	1.479	2.082

Source: made by the author

Table lines refer to the variables of the model, including the constant term. The table columns are:

1) first column: the displaying names from the dashboard existing or automatically created for independent variables involved; intercept is the name for the free term (constant) model;

2) coefficients column contains the estimated values of coefficients.; the values show that the equation for the linear model is : $y_i=38446.64+1.78 \cdot x_i;$ in the distributional

assumption of the linear model, the calculated values of coefficients derived from normal distribution, making possible statistical verification of the coefficients;

3) standard error represents the standard deviation of the distribution coefficient;

4) t stat and p-value columns represents the statistic to verify the validity of "a" and "b" parameters; the hypothesis for testing their validity are:

The value 0.0001 is smaller than 0.05 which means that parameter "a" is statistically significant. The value 0.0000001 is also smaller than 0.05 which means that "b" parameter is statistically significant.

5) Lower 95% and upper 95% indicates the inferior and superior limits for "a" and "b" parameters. The limits of the 0.05 threshold are calculated automatically, regardless the initialization of Regression procedure. Therefore, it can be interpreted as the linear model parameters are included in the following intervals:

$$24637.596<a<52258.685$$

$$1.479<b<2.082$$

3. Conclusions

Given appropriate policies and a basic level of development, foreign direct investments have an important contribution on creating a better economic environment. There are also disadvantages created by the foreign direct investments such as the deterioration of the payments balance, as profits are repatriated, having a negative effect on national market competitiveness. However, it cannot be denied the positive association between foreign direct investments inflow and economic growth, provided that beneficiary countries have reached a minimum level of education, technological and/or infrastructure development.

References:

1. Eurostat- Statistics Explained http://ec.europa.eu/eurostat (accessed on 20.10.2016)
2. Matei M. ,2004. *Foreign direct investments. Functions and Evolutions*, Bucharest Expert Publishing House
3. National Bank of Romania- Periodic publications http://www.bnr.ro/Publicatii-periodice-204.aspx (accessed on 01.10.2016)
4. Zaman G., Vasile V., Matei M., Croitoru C., Enescu G., 2011. *Some challenging (macro)economic aspects of FDI in Romania*, Romanian Journal of Economics, Volume 2, Issue 42, pg. 21-58