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THE RELATIONSHIP BETWEEN FOREIGN DIRECT INVESTMENT AND THE HIGHER EDUCATION SYSTEM IN ROMANIA[*]

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Abstract

The relationship between the foreign direct investments received by a country and its system of higher education is not yet completely clarified. Also, due to the fact that aspects related to the system of higher education are not directly linked with the economical performance of a country, the linkages between variables from this domain and the level of foreign direct investments received by a country has not been a major topic in the scientific literature, neither at global nor national level. In this study we propose a quantitative approach destined to describe and quantify the connection between inflows of FDI and the number of students enrolled in the tertiary education level for the case of Romania. Based on yearly data for the period 1990 – 2012 the study uses a VAR approach in order to study the bidirectional linkage between the two variables. The study provides some evidence that the level of the FDI attracted in Romania can be regarded as having a short term influence on the number of students enrolled in tertiary education and also the fact that the reverse is not true.

Keywords: Foreign Direct Investments, Higher Education, Granger causality, VAR model.
JEL Classification: C01, C32, F62, I23, F21, O11

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1. Introduction

The last 20 years have brought for the ex communist countries, through the medium of the foreign direct investments, a new source of capital that is fueling their development. In the economy, in the political field and also among academicians, the foreign direct investments are regarded as having significant positive impact on the economical environment of a host country. However, lately, there is an increasing trend that argues that foreign direct investments have rather negative effects on the economical and also social environment of a developing country.

In these circumstances, the study of the foreign direct investments is proving to be a very effervescent field among the researchers. Most of the studies conducted both by academicians and practitioners are dealing with studying the determinants that are responsible for attracting foreign direct investments in a country. Among the main determinants identified in the literature is the human capital. The researchers have brought evidence supporting that the relationship between the human capital and the inflow of foreign direct investments is a bidirectional one, depending strongly on the host country and also on the type of the majority of the foreign direct investments attracted.

Since 1990, the Romanian economy has gone through significant changes, entering on a European route, and in 2004 Romania fulfilled the European requirements and was accepted as a future member. Thus, in 2007 it became a member state of the EU and, although it walked a long way since 1990, it still is the second poorest country in the Union.

In these circumstances the foreign direct investments should be regarded with great attention by the Romanian authorities and the relationship among them and other socio-economic aspects should be studied in detail.

2. Literature review

Foreign direct investments are considered to be one of the main benefits brought to developing countries in the recent years by globalization. There is a vast literature backing up the idea that economic growth is fueled by the inflow of foreign direct investments (Borensztein, E., DeGregorio, J. et al. 1988).

The literature identifies a large variety of determinants of foreign direct investments. One of the most important determinants is market size, as it is identified in studies conducted by Crozet, Mayer and Mucchielli (2004), Przybylska and Malina (2000) and Ghemawat and Kennedy (1999). Also of great importance is infrastructure, as it is stated in the studies of Wei et al. (1998), Mariotti and Pischitello (1995), Broadman and Sun (1997).

Labor market is identified in a large number of studies as being another important determinant of the foreign direct investment (Crozet, Mayer et al 2004, Lansbury et al.,

1996). The literature provides evidence that also the research and development level of a host country are significant determinants of foreign direct investments. In this respect, the studies conducted by Cantwell, J.A. and Iammarino S., 2001, Cantwell, J.A. and Piscitello, L 2005, and Chung together with Alcácer, 2002 shed light on the subject.

Another important direction followed by the researchers is the one describing the connection between foreign direct investment, human capital and economic growth. Borensztein et al. (1998) find in their study conducted on a sample of 69 developing countries that the benefits brought in a host country by the inflow of foreign direct investments are influenced by the potential of the country in absorbing the new technologies. Thus, it is obvious that the human capital is an important characteristic of a country when talking about the internalization of the benefits brought by foreign direct investment. Miyamoto claims in a study conducted in 2003 that developing countries under invest in their human capital remaining in this way unattractive for a significant part of the multinational companies that are considering foreign investments.

Beugelsdijk et al. have argued in their study from 2008 that the impact on economic growth depends on the FDI type and also that different types of foreign direct investments have different impacts on human capital accumulation and education. Thus, vertical foreign direct investment search for efficiency and therefore they are more inclined to locate in countries where they have access to cheap labor for their sweatshops. Therefore it is obvious that this type of investments do not contribute much to the development of the human capital from the host country. By providing low wages and low specialization, this type of investment does not provide any incentives to the population of the host country to enroll in tertiary education. On the other hand horizontal foreign direct investments are market oriented and therefore they compete on the host country's market with other foreign investors and also with local companies. Thus, this type of FDI contributes to the upgrading of the technological level of the host country and to the development of the local human capital. By doing so, this kind of foreign investment encourages the development of the R&D sector of the host country and also encourages the population to pursue tertiary education.

In a study, presented in 2002, Nunnenkamp performed a panel analysis on 38 countries (for the period 1975 - 2000) and found evidence of a relationship between foreign direct investments and the level of schooling as an indicator for the human capital. In 2006 Gittens argues that foreign direct investments impact positively the human capital proxied by the enrolment in the primary education level. He also finds evidence that in developing countries the level of the attracted foreign direct investments is not connected with the tertiary enrolment.

Egger et al. prove in a study presented in 2005, using a cross-country approach, for the period 1960 - 2000, that capital inflows have a positive impact in motivating individuals to pursue higher education. On the contrary Ram and Zhang obtain evidence, in a study

conducted in 2002, that the relationship between foreign direct investments and human capital is not important any more.

As already mentioned, it is obvious that the literature of the field brings evidence supporting the idea that foreign direct investments are brought into a country by the human capital available in that location and also for supporting the idea that through spillovers foreign direct investments improve the level of the human capital of a host country. More over there is a significant amount of studies that provide evidence supporting the hypothesis that there is no connection between foreign direct investment and the human capital.

Considering these directions followed by the researchers it becomes obvious that the relationship between foreign direct investments and the human capital depends strongly on the analyzed period and also on the sample of countries included in the research. Also noteworthy is the fact that the findings of the researchers are significantly influenced by the modeling technique employed and also by the availability and consistency of the required data.

3. Research goal

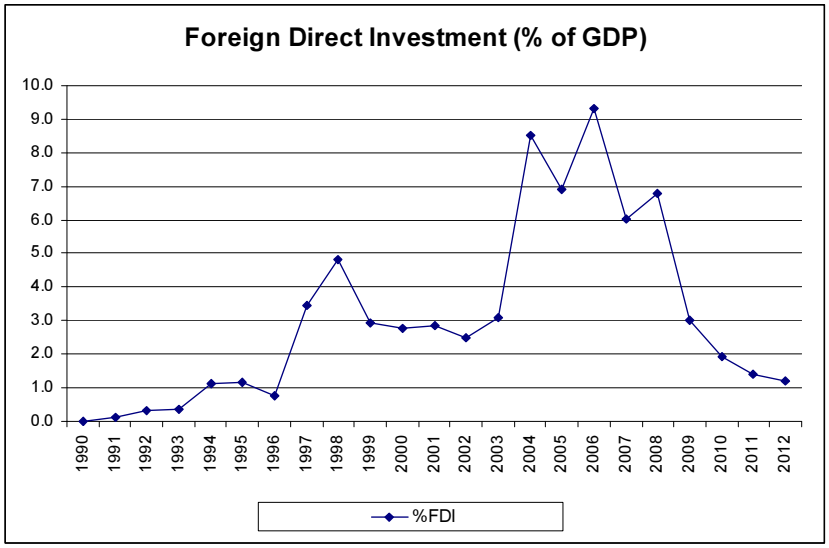
The main purpose of this research paper is to provide some form of evidence that there is a relationship between the higher education system in Romania and the capacity of the country in attracting foreign direct investments. Due to the fact that data for the expenditure with tertiary education are not reliable for the entire post communist period we have replaced this variable with a proxy. Therefore we have tried to prove that there exists a linkage between the number of students enrolled in tertiary education and the inflow of foreign direct investment for the period 1990 – 2012.

4. Description of the analyzed variables

Foreign direct investments can be viewed as an indicator of the viability of a national or of a regional economy. The inflow of foreign direct investments, for the period of 1990 – 2012, needs to be analyzed in connection with Romania's European route. Until 2003 Romania was struggling to create a stable business environment and therefore it was not considered as a viable option by foreign investors (this period can be characterized by low levels of attracted foreign direct investments). Starting with 2004, after being regarded as a functional market economy, the inflow of foreign direct investments has increased significantly (this period can be characterized by high levels of attracted foreign direct investments). The third period that can be identified, started in 2008, when the effects of the economical crisis became visible and the inflow of foreign direct investments suffered a

severe reduction. The data for this indicator were downloaded from the website of the World Bank (The used indicator is measured as percentage from GDP).

Figure no. 1 - The inflow of Foreign Direct Investments in Romania for the period 1990 – 2012



The system of higher education is a very important component of an economical environment at the level of a modern state, due to the fact that it needs to be regarded as the main "manufacturer" of the highly trained human capital. A very good indicator of the importance of the higher education system in a country is represented by the expenditure with tertiary education, expressed as a percentage from the GDP. Because data for this indicator were not available we tried to replace this indicator with a proxy. The two available variables that could replace the total expenditure with tertiary education that were identified are: the number of teaching staff employed in tertiary education and the number of students enrolled in tertiary education. Because data were available for a longer time period (1990 – 2012 versus 1995 – 2012) the number of students enrolled in tertiary education was selected. The data were downloaded from the Tempo database, available on the website of the National Institute of Statistics. When using this variable as a measurement unit for the development of the higher education system we need to admit the limitations imposed by the fact that the number of students is influenced by demographic trends and other external variables.

We can identify two different periods in the analyzed horizon: 1990 until 2008 and 2008 – 2012. The first period can be characterized by a growing trend which becomes steeper in the period 2004 – 2008. The second period can be easily characterized as a period of contraction when the number of enrolled students decreased continually.

Figure no. 2 - The number of students enrolled in tertiary education system in Romania for the period 1990 – 2012

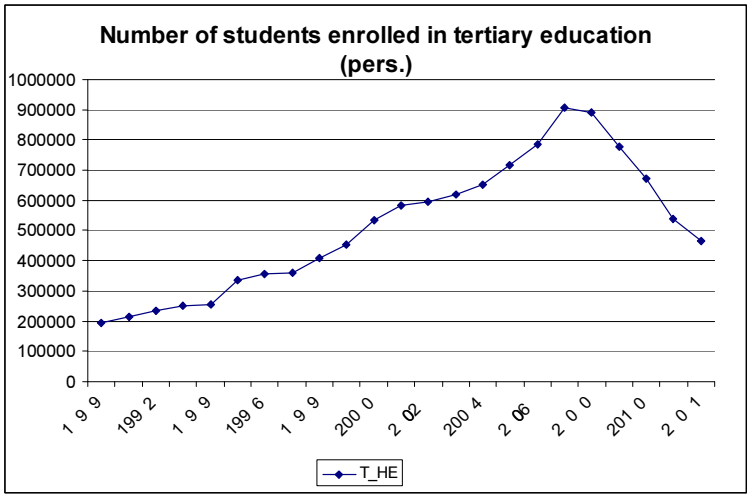
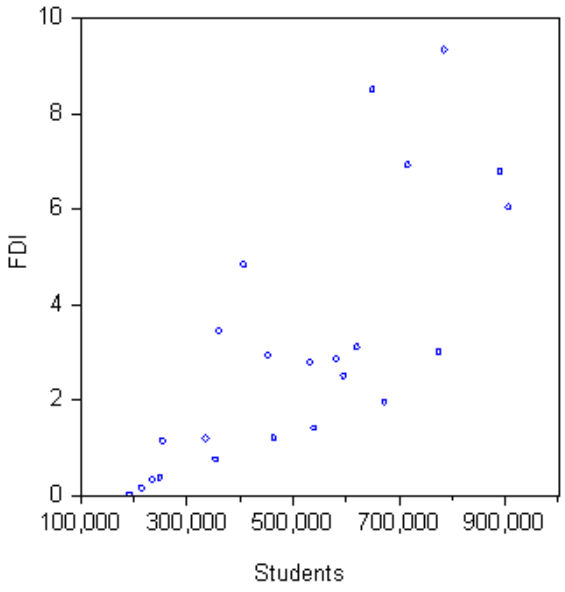


Figure no. 3 - The relationship between the inflow of FDI and the number of students enrolled in tertiary education system in Romania for the period 1990 – 2012



The chart displayed in figure no. 3 illustrates clearly that between the two variables there might be a positive interdependence sustaining the hypothesis which states that between foreign direct investments attracted by Romania and its higher education system there is a positive relationship.

5. Methodology

In order to analyze the potential relationship between the two variables we have decided to use a VAR model. Thereby we are able to investigate the bidirectional linkage between the two variables. Consequently, the methodology that was implied by this research can be stepwise described, as follows:

1) Applying unit root tests, to test if the time series are stationary.
2) Identifying the optimal lag for the VAR model.
3) Applying the Johansen Cointegration test.
4) Estimating the VAR model for the differentiated time series.
5) Performing a block exogeneity (Granger causality) Wald test.

We need to state clearly right from the beginning that the major weakness of this study is represented by the short time series available. Therefore the obtained empirical results need to be regarded with great caution and they should be interpreted more like exploratory research and not like indestructible evidence.

Important to mention is the fact that this weakness is common to a large variety of research conducted on ex communist countries from the eastern part of Europe, due to the fact that most of the available time series are starting, at earliest, from 1990.

Using quarterly data might have been an appropriate solution for exceeding this problem but it was not possible in this research due to the fact that they were not available. More over, we have to mention, that aspects regarding enrollment in the higher education system are in most of the cases presented on a yearly basis due to the specificities of the field.

6. Empirical results

As a first step we analyzed the presence of unit roots for both our time series. The Augmented Dickey-Fuller and the Phillips-Perron tests were used. The FDI and the number of Students time series are both not stationary, showing a unit root.

Therefore we proceeded at differentiating both series and performing the tests again. The differenced FDI series is stationary, therefore we can conclude that the FDI time series is integrated I (1). For the differentiated number of students series we can reject the null hypothesis only for a significance level of 10% (both tests indicate a Prob* value between 0.05 and 0.1). Bearing in mind this aspect we can conclude that both series are integrated of the same order I (1).

Figure no. 4 - The unit root test for the time series inflow of FDI

Null Hypothesis: FDI has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.046644	0.2569
Test critical values:	1% level	-2.674290	
	5% level	-1.957204	
	10% level	-1.608175	

Null Hypothesis: T_HE has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.702867	0.4001
Test critical values:	1% level	-2.679735	
	5% level	-1.958088	
	10% level	-1.607830	

Figure no. 5 - The unit root test for the time series number of students

Null Hypothesis: D(FDI) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.608454	0.0000
Test critical values:	1% level	-2.679735	
	5% level	-1.958088	
	10% level	-1.607830	

Null Hypothesis: D(T_HE) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=4)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.661307	0.0904
Test critical values:	1% level	-2.679735	
	5% level	-1.958088	
	10% level	-1.607830	

Going further we have decided to perform the Johansen Cointegration test. The first step was to estimate a VAR model necessary for choosing the optimal lag length. Due to the fact that we only have 23 observations we have decided for a VAR model with only two lags. We have analyzed the residuals checking for the presence of heteroskedasticity (using the White Heteroskedasticity test) and also for the presence of autocorrelation (using the LM test). The

normality was further checked using the Normality Jarque-Berra test. The obtained results have not confirmed the presence of heteroskedasticity or the presence of the autocorrelation. Also, the value obtained for the Jarque Berra test (8.883) with a Prob. value of 0.065 gave us sufficient evidence not to reject the null hypothesis which assumes that the residuals are normally distributed.

In the second phase we have used the Lag order selection criteria for the purpose of identifying the optimal lag. Two of the displayed criteria have indicated one lag (LR and SC) and the remaining three have indicated two lags (FPE, AIC and HQ).

Figure no. 6 - The VAR Lag selection criteria test

Sample: 1990 2012
Included observations: 21

VAR Lag Order Selection Criteria
Endogenous variables: FDI T_HE

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-328.6095	NA	1.62e+11	31.48662	31.58610	31.50821
1	-292.2983	62.24769*	7.50e+09	28.40936	28.70780*	28.47413
2	-287.2385	7.710251	6.88e+09*	28.30843*	28.80582	28.41637*

* indicates lag order selected by the criterion

Again, taking in account the short series we have at our disposal, we have decided for a model with only one lag (LR criterion and SC criterion). Therefore we have performed the Johansen Cointegration Test for a model with only one lag. The results indicate, both for the Trace test and for the Max-eigenvalue test that at a level of 0.05 we have no cointegration.

Figure no. 7 – The Johansen Cointegration test

Sample (adjusted): 1992 2012
Included observations: 21 after adjustments
Unrestricted Cointegration Rank Test (Trace)

Trend assumption: No deterministic trend
Series: FDI T_HE
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.233917	6.111534	12.32090	0.4225
At most 1	0.024261	0.515771	4.129906	0.5354

Trace test indicates no cointegration at the 0.05 level

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.233917	5.595763	11.22480	0.3980
At most 1	0.024261	0.515771	4.129906	0.5354

Max-eigenvalue test indicates no cointegration at the 0.05 level

After deciding that our time series are not cointegrated we have estimated the VAR model again for the differentiated series (using our VAR model we are able to analyze only the short term effects). The results obtained for the new VAR model are listed in the Figure no. 8.

As it is visible from the output, the coefficients for the first model have very low values for the t test and therefore we can conclude that we have no evidence in rejecting the null hypothesis. These results are further confirmed by the low value of the R square coefficient and also by the low value of the F statistics. Therefore, it is clear that we have strong evidences to support the idea that FDI can not be explained by the lagged values of the variable: number of students.

The second model is statistically valid due to the fact that the F statistics has a value of 13.35 which is higher than the critical value of the Fisher distribution. This assumption is further supported by the value of the R square statistics which proves that almost 60% of the variance of the dependent variable can be explained by the presented model. The two coefficients of the lagged variables included in the model are statistically significant, proving that the number of students from the current period is clearly influenced by the number of students from the previous period and by the foreign direct investment attracted in the previous period. The relationships between the endogenous variable of the second model and the lagged variables included are positive (the estimated values for both coefficients are higher than zero).

Figure no. 8 – The VAR model for the differenced time series

Sample (adjusted): 1992 2012

	D(FDI)	D(T_HE)
D(FDI(-1))	-0.248685	11326.34
	(0.22988)	(5150.51)
	[-1.08181]	[2.19907]
D(T_HE(-1))	4.79E-06	0.676589
	(7.1E-06)	(0.15857)
	[0.67654]	[4.26688]
C	-0.012250	-61.81550
	(0.45420)	(10176.5)
	[-0.02697]	[-0.00607]

R-squared	0.073656	0.597379
Adj. R-squared	-0.029271	0.552644
Sum sq. resids	72.93774	3.66E+10
S.E. equation	2.012982	45101.44
F-statistic	0.715616	13.35354
Log likelihood	-42.87109	-253.2292
Akaike AIC	4.368675	24.40278
Schwarz SC	4.517893	24.55200
Mean dependent	0.050294	11874.57
S.D. dependent	1.984153	67431.62

Determinant resid covariance (dof adj.)	7.67E+09
Determinant resid covariance	5.64E+09
Log likelihood	-295.3508
Akaike information criterion	28.70008
Schwarz criterion	28.99852

In order to further verify if the included lags are required in the model we have performed a VAR lag exclusion Wald test. The listed output supports the idea that the lagged values included in the second model are appropriate. The p-value for the lag 1 is smaller than the standard 0.05 significance level for both the second model and for the joint analysis.

Figure no. 9 – The lag exclusion test

Sample: 1990 2012
Included observations: 21

Chi-squared test statistics for lag exclusion:
Numbers in [ ] are p-values

	D(FDI)	D(T_HE)	Joint
Lag 1	1.431233	26.70709	30.21447
	[0.488891]	[1.59e-06]	[4.43e-06]
df	2	2	4

As a last step of our analysis we have performed a block exogeneity (Granger causality) Wald test. The results (the value for the Prob. from the lower table is smaller as the 0.05 significance level value) further confirm that the differenced FDI time series Granger causes the differenced values of the time series number of students.

Figure no. 10 – The Granger Causality/Block exogeneity Wald test

VAR Granger Causality/Block Exogeneity Wald Tests
Sample: 1990 2012
Included observations: 21

Dependent variable: D(FDI)

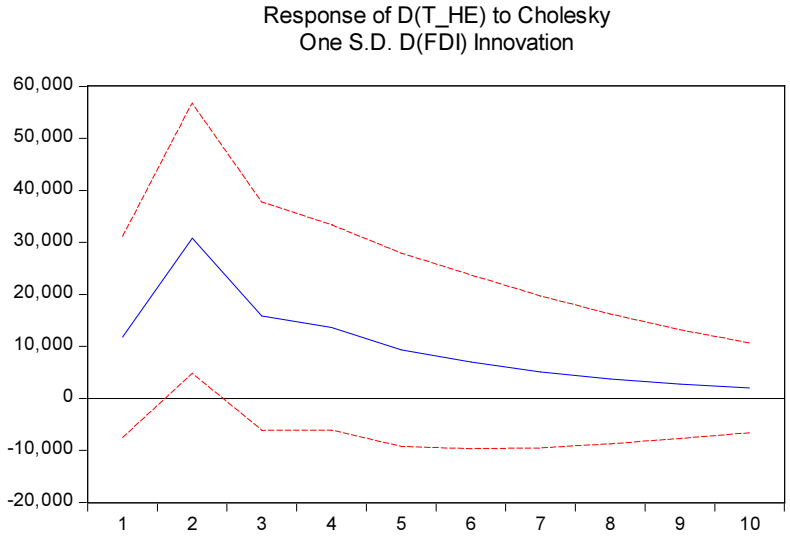
Excluded	Chi-sq	df	Prob.
D(T_HE)	0.457701	1	0.4987
All	0.457701	1	0.4987

Dependent variable: D(T_HE)

Excluded	Chi-sq	df	Prob.
D(FDI)	4.835915	1	0.0279
All	4.835915	1	0.0279

The chart of the impulse response function also indicates that a shock in the differenced FDI series generates a response in the differenced time series no. of students after one period. Afterwards the impulse is absorbed and the influence decreases constantly (the constant decrease of the impulse is clearly visible in the figure).

Figure no. 11 – The IRF of D(no. of students) to one SD D(FDI) innovation



7. Conclusion

Concluding we have to say that the paper should be included among works that provide evidences of the ever-changing linkages between foreign direct investments and major socio-economic aspects. By using the latest available data on the World Bank's website and on the website of the National Institute of Statistics from Romania, the paper contributes to the literature by providing some evidence that support the hypothesis that there might be a relationship between the inflow of foreign direct investments and the tertiary education system for the case of Romania.

The main finding of the paper is that there is a direct connection between the level of attracted foreign direct investments for the period 1990 – 2012 and the number of the students enrolled in tertiary education. Also we provide clear evidence that the causality relation is not bi-directional by showing that the VAR model with only one lag, where the differentiated time series number of students was the endogenous variable, is statistically valid (the other model, describing the reverse relationship is not statistically valid). Further evidence supporting this statement was provided by the Granger Causality/Block exogeneity Wald test.

The short term relationship between the analyzed variables is obvious because an impulse in the FDI time series impacts significantly the endogenous variable in the next period, diminishing afterwards its importance constantly.

The results obtained are in line with other results obtained in the literature, and thus they provide evidence that Romania was not a target only for vertical foreign direct investments.

By knowing that such a relationship exists between these two aspects, the decision makers should forge strategies to attract as much foreign investment as possible because it is obvious that the country's development is positively influenced by them.

Although the results are important they should be regarded with great caution because the relationship might not be a direct one and might rather be a mediated one. Most probably foreign direct investment have a positive influence on the economic growth and the economic growth has a significant impact on the tertiary education system, due to the fact that this education level is not mandatory and might fluctuate heavily depending on the economic level (of a country and its inhabitants).

The results should be regarded with great caution due to the fact that the time series that were used are rather short. However this weakness is very difficult to be exceeded due to the short period since Romania exited the communist era. Therefore, if possible, a future study should investigate the relationship using quarterly data (if they are available taking in consideration the specificities of the higher education system) or data regarding the expenditure with the tertiary education level.

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References

Beugelsdijk S., Smeets R. and Zwinkels R. (2008). The impact of horizontal and vertical FDI on host'scountry economic growth. *International Business Review*, **17**, pp. 452-472.

Borensztein, E., DeGregorio, J. and Lee, J. W. (1988). How does Foreign Investment Affect Growth?. *Journal of International Economics*.

Broadman, H. G. and Sun, X. (1997). The Distribution of Foreign Direct Investment in China. *The World Economy*, **20**(3), pp. 339–361.

Cantwell, J. A. and Iammarino, S. (2001). EU regions and multinational corporations: change, stability and strengthening of technological comparative advantages. *Industrial and Corporate Change*, **10**, pp. 1007–1037.

Cantwell, J. A. and Piscitello, L. (2005). Recent Location of Foreign-owned Research and Development Activities by Larger Multinational Corporations in the European Regions: The Role of Spillovers and Externalities. *Regional Studies*, **39**(1), pp. 1-16.

Crozet, M., Mayer, Th. And Mucchielli, J-L. (2004). How do firms agglomerate? A study of FDI in France. *Regional Science and Urban Economics*, **34**(1), pp. 27-54.

Ghemawat, P. and Kennedy, R. (1999). Competitive Shocks and Industrial Structure: The Case of Polish Manufacturing. *International Journal of Industrial Organization*, **17**(6), pp. 847-867.

Gittens D. (2006). *The Effects of Foreign Direct Investment on the Accumulation of Human Capital in Developing Countries: Are There Implications for future growth?*. Fordham Economics Dissertations, Number 3.

Mariotti, S. and Piscttello, L. (1995). Information cost and location of FDIs within the host country: empirical evidence from Italy, *Journal of International Business Studies*, **26**, pp. 815-40.

Miyamoto, K. (2008). *Human capital formation and foreign direct: Investment in developing countries*, Paris, OECD Publishing, 10.1787/gen_papers-v2008-art4-en

Nunnenkamp P. (2002). *Determinants of FDI in Developing Countries: Has Globalization Changed the Rules of the Game?*, Kiel Working Paper No. 1122, Kiel Institute for World Economics, 120

Przybylska, K. and Malina, A. (2000). The Determinants of Foreign Direct Investment in Transforming Economies: Empirical Evidence From Poland. *Statistics in Transition*, **4**(5), pp. 883-899.

Ram, R. and Zhang K. H. (2002). Foreign direct investment and economic growth: Evidence from cross-country data for the 1990. *Economic Development and Cultural Change*, **51**(1), pp. 205-15.

Wei, Y, Liu, X., Parker, D. and Vaidya, K. (1999). The regional distribution of Foreign Direct Investment in China. *Regional Studies*, **33**(9), pp. 857-867.