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The relation between economic growth and foreign direct investment during the economic crisis in the European Union*

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Abstract

The goal of this research is to investigate the relationship between economic growth and foreign direct investment inflows in the European Union (EU-28) in the period of the recent economic crisis. Panel data approach and Bayesian techniques are employed to solve the problem of a short set of data (2008–2014). The panel data approaches (panel vector-autoregressive model and Bayesian random effect models) identified a reciprocal and positive relationship between FDI and economic growth in EU-28 starting with 2008. The individual approach based on Bayesian linear regressions identified this tendency as being specific for most of the EU-28 countries. However, there are some countries for which higher FDI did not generate economic growth and some countries where higher GDP did not attract more FDI and FDI did not bring economic growth. According to cluster analysis, the disparities among countries regarding the FDI distribution according to GDP growth and GDP rate distribution according to FDI diminished in 2014 compared to 2008. The basic conclusion is that on overall in the European Union there was a reciprocal relationship between economic growth and FDI since the beginning of the crisis with a tendency of reducing disparities between countries in attracting FDI.

Key words: *economic growth, foreign direct investment, panel data, Bayesian model, crisis*

JEL classification: *C51, C53, F21*

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1. Introduction

The relationship between economic growth and foreign direct investment (FDI) has been a subject of discussion for many researchers, economists, and policy analysts in time mainly in Developing countries. It is important to know if FDI inflows really generate economic growth and if a country with higher GDP rate attracts more FDI inflows.

Foreign direct investment (FDI) represents a vehicle for transferring tangible assets, but also intangible assets like technology (for example, innovative product designs and managerial skill). The positive effect of FDI on economic growth is ensured by FDI transferring assets regarding FDI spillover effect and productivity improvement (Lechman and Kaur, 2015).

On the other hand, the empirical studies regarding the relationship between FDI and economic growth showed mixed influences. Few studies, like those of Chakraborty and Basu (2002) for India, found little or no evidence for FDI contributing to economic growth. Actually, a faster economic growth attracts more FDI inflows (Choi, 2004; Carkovic and Levine, 2002, Kherfi and Soliman, 2005, Fidrmuc and Kostagianni, 2015, Cichy and Gradoń, 2016).

Most studies were interested in the FDI influence on economic growth in Central and European countries, an overall image for EU-28 not being provided yet. None of the researches employed the Bayesian techniques that are very useful in the context of a short period corresponding to the economic crisis.

The empirical literature that studies the FDI in the context of the recent economic crisis is still young. It is clearly that an economic crisis has negative consequences on FDI increase (Clowes and Bilan, 2014), but a careful attention should be accorded to the relationship between growth and FDI in this unstable period. There are only few researches that focused on the impact of financial crisis on FDI level. In this context, Ucal et al. (2010) showed the high impact of economic crisis on FDI. In the year(s) before crisis, FDI registered a maximum level, but then FDI decreased fast. Some researchers analysed if the recent economic crisis affected more the FDI compared to the previous global economic crisis. Poulsen and Hufbauer (2011) compared the recent FDI recession with the response of FDI to the past financial crisis and they found that the financial crisis started in 2008 was the biggest one.

The hypothesis of this research refers to the identification of the relationship type between economic growth and FDI in the European Union countries (it could be a bidirectional relationship, a unidirectional relationship or no relation could be between GDP rate and FDI in the European Union).

In this paper, after the description of the methodological background (panel data models and Bayesian models), the bidirectional relationship between FDI inflows and economic growth is analysed. In the end, some conclusions are drawn.

2. Literature review

There are economic, social and political factors that affect FDI inflows. A considerable attention was accorded in literature to the relationship between FDI and economic growth.

The economic growth depends on sustained growth of productive capacity, consisting in investment and saving. The low levels in investment and saving implies low economic growth. Being a source of economic growth, the need of FDI inflows had increased in the last years. Several determinants of the linkage between FDI and economic growth were identified by Anwara and Nguyen (2010): learning by doing, exports, human capital, macroeconomic stability, public investment, level of financial development. Using these determinants, Neuhause (2006) showed that there are three principal channels through which FDI influences economic growth:

- direct transmission through Greenfield investments;
- indirect transmission trough ownership participation;
- second round transmission trough technology spillover.

The effect of FDI on GDP growth differs in conventional models and in actual growth models. In the case of the neo-classical approach, FDI influences only the output level, but FDI has no impact on long-run growth rate. The FDI exogenous increase would raise the capital quantity and per capita GDP only temporarily because diminishing returns would limit the growth on long-run. The labour growth and technological progress, as exogenous factors, determine the effects of FDI on long-term economic growth. The studies based on neoclassical model of Solow (1957) integrated investment as a fixed proportion of output. However, the determinants of technological progress were not included in the neoclassical models. On the other hand, the models based on new growth theory consider that FDI influences economic grow through human capital and research and development. The spillovers in technology from FDI ensure long-term economic growth.

The most part of empirical studies analysed FDI and trade interaction on economic growth (Karbasi et al., 2005) or the relationship between economic growth and FDI inflows (Lipsey, 2000). The results indicated that FDI inflows have a positive influence on economic growth. On the other hand, these studies did not provide an explanation regarding the general relationship and the causality sense for a large number of developing countries. The influence of FDI inflows on economic growth is variable from a country to another. For example, Xu (2000) showed that in the case of some countries FDI has a negative impact on GDP growth. Balasubramanyam et al. (1996) explained that FDI had a positive impact on growth in host countries with export promoting strategy, but not in states with import substitution strategy. Baliamoune-Lutz (2004) found a direct and bilateral relationship between FDI and

economic growth in Morocco. Alaya (2006) made the analysis for Morocco, Turkey and Tunisia, finding that economic growth is determined by exports and domestic investments, but there is a significant negative effect of FDI inflow on economic growth.

For Argentina, Brazil and Mexico, Hsiao T. and Hsiao M. (2006) built a panel vector autoregressive model to show a unidirectional relationship between GDP and exports, and a bidirectional relationship between exports and GDP. Panel vector autoregressive models were also estimated by Won et al. (2008) for Asian newly industrializing economies in order to show that inward FDI determined fast economic growth in these countries.

A dynamic panel was employed by Baharumshah and Thanoon (2006) to reflect a positive contribution of FDI on economic growth for East Asian countries. Bhandari et al. (2007) constructed panel GLS models and they explained that an increase in the inflow of FDI positively affects the economic growth in East European countries. For Gulf Cooperation Council (GCC) countries, Faras and Ghali (2009) proposed OLS panel models to justify the weak causal impact of FDI inflows on GDP growth. 45 countries were analyzed by Wijeweera et al. (2010) in the period 1997–2004. Only for highly skilled labour FDI inflows have a positive impact on economic growth.

The panel data approach was used by Darrat et al. (2005) to identify time and country specific effects when studying the relationship between FDI and economic growth in MENA regions and Central and Eastern Europe. In MENA and non-EU accession states the impact of FDI on economic growth is negative or in some cases it does not exist. On the other hand, in EU accession countries the imposed reforms are applied and FDI inflows positively influenced the GDP growth. The huge concentration of FDI in primary sector determined, in general, a negative impact of FDI on economic growth in 14 MENA countries over the period 1980–2003, as Meschi (2006) showed. Nicet-Chenaf and Rougier (2009) analysed the relationship between FDI and economic growth in some MENA countries using a panel data model. FDI did not directly influence economic growth, but they play an important role in economic growth having positive influence on the international integration and the formation of human capital. Tintin (2012) estimated a fixed effects model for 125 countries over 1980–2010 and showed that there are not uniform effects across groups of countries of FDI on economic growth.

A unidirectional causal effect from FDI to GDP rate was observed by Alalaya (2010) for Jordan over 1990–2008. The author applied an ARDL model for co-integration. A relatively high and significant speed of adjustment was computed. A negative impact of FDI on economic growth was obtained by Marc (2011) for seven south Mediterranean countries (Turkey, Jordan, Syria, Algeria, Egypt, Morocco, and Tunisia) in the period 1982–2009 by employing a structural model.

There are some studies that showed that the relationship between economic growth and FDI is conditioned by other factors like: small technological gap between local companies and foreign firms (Li and Li (2005)), education level (Lipsey (2000)), trade openness (Balasubramanyam et al., 1996, Fitzová and Žídek, 2015), financial development (Alfaro et al., 2004), export diversification (Nicet-Chenaf and Rougier, 2009) and a stable and efficient institutional and legal environment (Bengoa and Sanchez-Robles, 2003).

Some past researches that investigated the relationship between FDI inflows and GDP growth had some empirical limitations. Many econometric models were built in order to study the effects of FDI on economic growth in developing countries. On the other hand, there are only few researches that analyzed the causality relationship between these variables. Many of these studies employed cointegration techniques using Engle-Granger cointegration test or maximum likelihood test. These cointegration techniques are not suitable for small sets of data. Therefore, Odhiambo (2009) employed the bounds testing cointegration method of Pesaran et al. (2001) that is more robust in case of small sample. Country-specific issues are not revealed by using cross-sectional data (Casselli et al., 1996; Ghirmay et al., 2001). Most of the researches considered longer periods for analyzing the impact of FDI on economic growth in the EU (Angelopoulou and Liargovas, 2014; Blomkvist, 2011).

For the European Union, before the crisis (1989-2008), Angelopoulo and Liargovas (2014) did not find a robust relationship between GDP rate and FDI. On the other hand, the relation was studied after crisis beginning by Dornean and Oanea (2013) who used a regression with a dummy variable for crisis to show a positive influence of FDI on economic growth during 2008–2012. There are few studies in literature that focus on FDI and economic growth causality only after crisis start in the entire European Union.

3. Methodology

More types of econometric models are employed in this research in order to test the hypothesis regarding the relationship between economic growth and FDI in the EU:

- Bayesian random effects models;
- Bayesian linear regression models;
- Panel vector-autoregressive models (panel VAR models).

Bayesian random effects models and panel VAR models are built on panel data. Bayesian linear regression models are constructed on cross-section data. The main advantage of all this models is the fact that they could be used on short

data sets like in the case of this research. There is a small number of years, from 2008 to 2014, and panel data approach or Bayesian time series regressions are recommended. Bayesian linear regression models on time series are more suitable than a traditional linear regression that works under the incidence of law of large number.

In this study, Bayesian random effects models are estimated in two varieties. The baseline model considers that the cross-sectional intercept has a conjugate normal distribution. In the second version, the positive random effects model considers a cross-sectional intercept with exponential prior that leads to a truncated normal posterior.

The model for Bayesian panel data random effect with cross-sectional intercepts has the following form:

$$Y_{it} = \beta \cdot X_{it} + (e_{it} + u_i)$$

$$e_{it} \sim N(0, s_e^2)$$

$$u_i \sim N(0, s_u^2)$$

where: Y – dependent variable (nT × 1 vector); X – regressors (nT × k matrix); β – vector of k parameters; u_i – individual effects; e_{it} – idiosyncratic error; s_u^2 – errors' variances; k – number of parameters; n – number of cross-sections; T – number of time periods; u_i is not correlated with X_{it}.

The estimation algorithm is Gibbs sampler with proper priors, where:

$$\beta \sim N(m_u, V)$$

$$s_e^2 \sim IG(a_1, b_1)$$

$$s_u^2 \sim IG(a_2, b_2)$$

So, β follows a normal distribution of average m_u and covariance matrix V. The errors' variances follow an inverse-gamma distribution of parameters a_1, b_1 and, respectively a_2, b_2.

All the conditional posteriors take conjugate forms.

The model for Bayesian panel data random effect with positive cross-sectional intercepts has the following form:

$$Y_{it} = \beta \cdot X_{it} + (e_{it} + u_i)$$

$$e_{it} \sim N(0, s_e^2)$$

$$u_i \sim exp(\lambda)$$

where: Y – dependent variable (nT × 1 vector); X – regressors (nT × k matrix); β – vector of – parameters, u_i – individual effects; e_{it} – idiosyncratic error; s_e^2 – errors' variance; λ – parameter of exponential distribution; k – number of parameters; n – number of cross-sections; T – number of time periods; u_i is not correlated with X_{it}.

The estimation algorithm is Gibbs sampler with proper priors, where:

$$\beta \sim N(m_u, V)$$

$$s_e^2 \sim IG(a_1, b_1)$$

$$\lambda \sim IG(a_2, b_2)$$

So, β follows a normal distribution of average m_u and covariance matrix V. The errors' variance s_e^2 follows an inverse-gamma distribution of parameters a_1, b_1, while λ follows an inverse-gamma distribution of parameters a_2, b_2.

Conditional posteriors of β, s_e^2 and λ take conjugate forms. Conditional posterior of latent U_i has truncated normal distribution.

On panel data, a panel VAR model will also be estimated in order to capture the potential effects of past values of the variables on current variables. The general form of a panel vector-autoregressive model is:

$$y_{it} = u_i + A_i(j) \cdot Y_{i(t-1)} + e'_{it}$$

$Y_{it} = (y_{1t'}, y_{2t'}, ..., y'_{nt})$, contains data for all cross-sections, i = 1, 2, …, n

y_{it} – vector of variables for each cross-section; u_i – specific-intercept of cross-section; $A_i(L)$ – lag polynomial including VAR coefficients; e'_{it} – errors (null average, cross-section – specific variance σ_i^2); k – number of variables.

If the model has no restrictions, n × k × n coefficients are included in matrix A_n.

The coefficients in $A_i(L)$ vary randomly across cross-sections under the hypothesis of mean group estimator. The standard element a_{ijm}^p in $A_i(L)$ is: $a_{ijm}^p = a_{jm}^p + \mu_{ijm}^p$, where p is the lag order of VAR model, p = 1, 2,…, P and i is the cross-section index, j,m = 1, 2, …, K.

The reduced-form of the VAR model is:

$$y_{it} = u + A_i(L) \cdot y_{it} + e'_{it}$$

Panel VAR models solve issues regarding macroeconomic policies, because their specific advantages: the capacity to capture both dynamic and static interdependencies, the relationships across units are viewed in an unrestricted manner, the easy inclusion of parameters' and shocks' time variations and the inclusion of units' dynamic heterogeneities.

In this research, a panel VAR model with two variables will be estimated (real GDP rate and FDI) and k will be 2. The number of cross-sections is 28, each country being a cross-section. The time period refers to 2008-2014 (7 years, t = 2008, …, 2014).

Using time series for each country, some Bayesian regressions will be built. For Bayesian linear regression model, the following form is used:

$$Y_t = \beta \cdot X_t + e_t$$

$$\beta \sim N(m_u, V)$$

$$s_e^2 \sim IG(a, b)$$

Y – dependent variable; X – regressors; β – vector of parameters; e_{it} – error; s_e^2 – errors' variance; m_u, V – parameters of normal distribution; a, b – parameters of inverse-gamma distribution.

Conditional posterior of β follows a normal distribution. Conditional posterior of s_e^2 follows an inverse-gamma distribution: $IG \sim (\frac{n}{2} + a, \frac{2b}{b \cdot RSS + 2})$ RSS is the sum of square residuals, n is the number of observations and a and$b$ are the parameters of prior inverse-gamma distribution.

In our research, each variable (GDP rate and FDI) will become by turn dependent variable. Each model will be run for each country on 7 years (period is 2008–2014).

4. Data and empirical analysis

In this study, data refer to real GDP rate and foreign direct investment (FDI) as net inflows (% of GDP) in EU-28 states as destination countries, the foreign capital belonging to the rest of the world. The data series are analysed from the beginning of the recent economic crisis (2008) for the EU-28 countries. Croatia was also included in the analysis, even if it entered EU in 2013, in order to have a complete picture of the phenomenon. The data for GDP rate are provided by Eurostat, while World Bank calculated the FDI as net inflows in the economy over GDP. FDI is composed by: short-run capital, equity capital, earnings reinvestment and other long-run capital. The net inflows are computed by subtracting disinvestment from new investment inflows.

For estimating the panel data models the presence of unit roots in panel data is checked before. According to different versions of Harris-Tzavalis test, the panels are stationary for GDP rate at a significance level of 5%. Moreover, stationary data was detected for FDI (see Appendix A1). A panel VAR model of order 1 (PVAR

(1)) was built for EU-28. FDI in the previous had a positive and significant impact on actual economic growth. On the other hand, real GDP rate in the previous negatively influenced the FDI in the current period (Appendix A2).

Table 1: Panel VAR Granger causality test

Equation	Excluded variables	Chi-square	Prob.
GDP rate	FDI	71.294	0.000
GDP rate	All	71.294	0.000
FDI	GDP rate	15.532	0.000
FDI	All	15.532	0.000

Source: Author's calculation

The Granger causality test on panel data indicated a bi-directional causal relationship between GDP rate and FDI at a significance level of 5%.

Both types of Bayesian random effect models that explain real GDP rate using FDI as explanatory variables indicated that, in average, FDI had a positive and quite slow impact on economic growth in EU-28 in the period 2008-2014 (Appendix A3).

Table 2: Bayesian random effect models for explaining economic growth in EU-28

Parameters	Bayesian panel data random effect with cross-sectional intercepts		Bayesian panel data random effect with positive cross-sectional intercepts	
	Posterior mean	Posterior standard deviation	Posterior mean	Posterior standard deviation
Constant	-0.3927	0.3358	-0.7489	0.3759
β	2.2991e-006	9.8254e-007	2.3034e-006	9.8539e-007
s_e^2	12.5489	1.2935	12.5927	1.3065
s_u^2, respectively ë	0.1731	0.1176	0.3651	0.1888

Source: Author's calculation

According to Bayesian random effect model with cross-sectional intercepts, the economic growth had a positive impact on economic growth in EU-28 in the period 2008-2014. On the other hand, when positive cross-sectional intercepts are considered, FDI had a negative impact on economic growth.

Table 3: Bayesian random effect models for explaining FDI in EU-28

Parameters	Bayesian panel data random effect with cross-sectional intercepts		Bayesian panel data random effect with positive cross-sectional intercepts	
	Posterior mean	Posterior standard deviation	Posterior mean	Posterior standard deviation
Constant	-0.0118	10.0322	0.0518	9.9985
β	0.0301	9.9792	-0.0247	9.9983
s_e^2	6.5499e+010	7.3858e+009	1.0877e+011	1.1082e+010
s_u^2, respectively ë	3.5346e+010	1.1917e+010	0.4721	0.3781

Source: Author's calculation

Moreover, it is important to analyse the relationship between real GDP growth and FDI for each country in EU. The short length of data series imposes the application of Bayesian techniques. Therefore, Bayesian linear regressions will be estimated for each country in order to explain the GDP rate evolution and the FDI evolution after the start of global economic crisis.

The posterior means for the coefficients associated to explanatory variables are computed. Two types of models are estimated: first one explains GDP rate using FDI and the second one considers FDI as dependent variable.

Table 4: Posterior means of the coefficients for explanatory variables in Bayesian linear regressions

Country	Posterior mean (dependent variable: real GDP rate)	Posterior mean (dependent variable: FDI)
Belgium	0.0221	2.7563
Bulgaria	0.2432	0.8596
Czech Republic	0.2750	0.0517
Denmark	*-0.2398*	*-0.2406*
Germany	0.9565	0.0682
Estonia	*-1.1686*	*-0.2192*
Ireland	*-0.1501*	*-0.7047*
Greece	4.4701	0.1000
Spain	0.7852	0.3298
France	0.5233	0.1459
Croatia	0.0765	0.0655
Italy	0.4967	0.0356
Cyprus	*-0.4275*	*-1.1983*
Latvia	2.7905	0.2053

Table 4 (*continuation*)

Lithuania	2.7950	0.1243
Luxembourg	0.0146	11.3888
Hungary	0.0286	1.0309
Malta	*-0.0020*	0.6534
Netherlands	*-2.1424e-004*	0.0908
Austria	*-0.1411*	*-0.3898*
Poland	0.6694	0.9278
Portugal	*-0.5573*	*-0.2745*
Romania	0.7435	0.1995
Slovenia	2.4833	0.2939
Slovakia	0.3781	0.2218
Finland	0.5229	0.5521
Sweden	*-0.4189*	*-0.2560*
United Kingdom	*-0.0214*	-0.0301

Source: Author's calculation

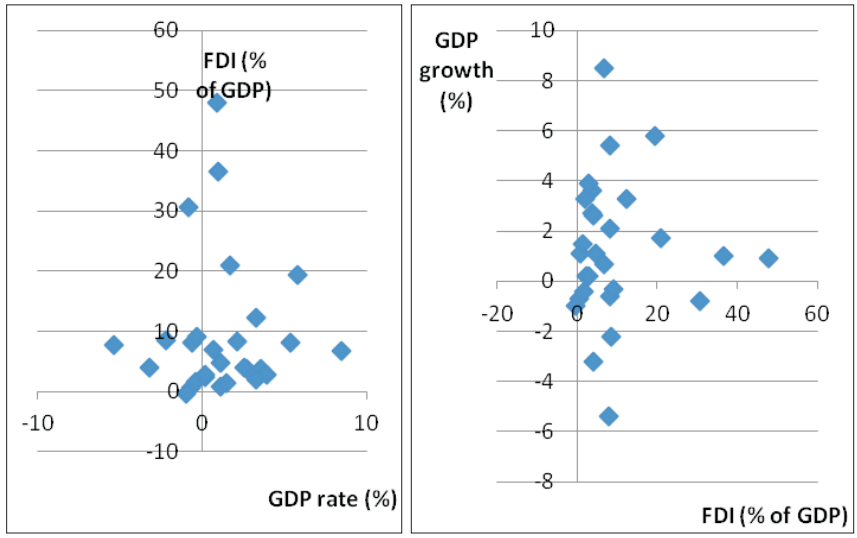
The analysis of the Bayesian regression estimations allows the identification of several groups of countries:

- Countries where FDI positively influence economic growth and GDP rate has a positive impact on FDI (Belgium, Bulgaria, Czech Republic, Germany, Greece, Spain, France, Croatia, Italy, Latvia, Lithuania, Luxembourg, Hungary, Poland, Romania, Slovenia, Slovakia, Finland);
- Countries where FDI negatively influence economic growth and GDP rate has a negative impact on FDI (Austria, Denmark, Estonia, Cyprus, Portugal, Sweden, United Kingdom);
- Countries where FDI negatively influence economic growth and GDP rate has a positive impact on FDI (Malta and the Netherlands).

So, in most countries of EU-28 (19 out of 28), FDI is an engine of economic growth and a high GDP rate attracts more FDI.

A cluster analysis was conducted for 2018 and 2014 in order to identify some groups of countries with common characteristics.

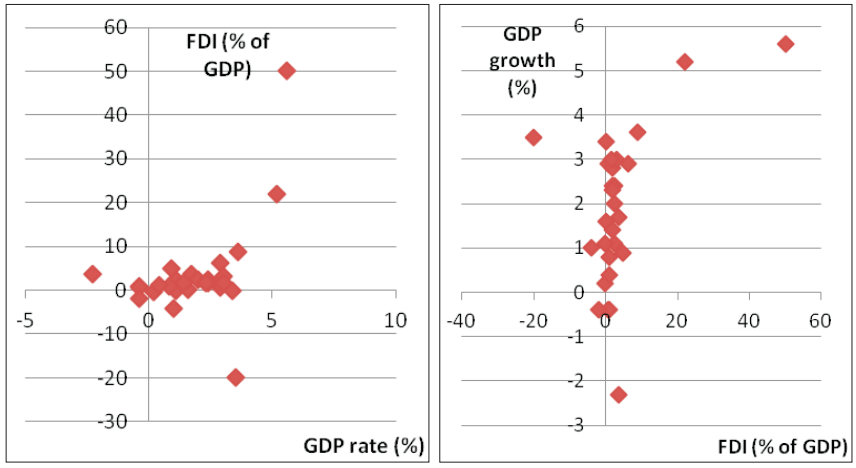
Figure 1: EU-28 countries in 2008 according to real GDP rates and FDI



Source: Author's graph

At the beginning of the global economic crisis, most of the EU countries had positive real GDP rates and rather high FDI as net inflows (% of GDP), but no more than 20% of GDP. A maximum of real GDP rate was registered by Romania (8.5%), but this value was associated with a quite low level of FDI (almost 6.8% of GDP). On the other hand, Hungary had a quite low GDP rate (0.9%), but the highest net inflows of FDI (almost 48% of GDP).

Figure 2: EU-28 countries in 2014 according to real GDP rates and FDI



Source: Author's graph

In 2014, the disparities between EU-28 countries regarding real GDP rates and FDI diminished. Some outliers can be observed in the above graph. Ireland and Luxembourg registered high GDP rates and high FDI as percent of GDP. On the other hand, Cyprus registered a negative real GDP rate and a low amount of FDI. A quite high economic growth associated with high decrease in FDI was observed for Malta.

Table 5: Clusters of EU-28 countries according to real GDP rates and FDI values

Country	2008	2014
Belgium	2	2
Bulgaria	2	2
Czech Republic	1	2
Denmark	1	2
Germany	1	2
Estonia	1	2
Ireland	1	*1*
Greece	1	2
Spain	1	2
France	1	2
Croatia	1	2
Italy	1	2
Cyprus	1	2
Latvia	1	2
Lithuania	1	2
Luxembourg	2	*1*
Hungary	2	2
Malta	1	2
Netherlands	2	2
Austria	1	2
Poland	1	2
Portugal	1	2
Romania	1	2
Slovenia	1	2
Slovakia	1	2
Finland	1	2
Sweden	1	2
United Kingdom	1	2

Source: Author's calculation

Most countries are placed in cluster 1. In the second cluster, there are countries with quite low GDP rates, but high FDI (Belgium, Bulgaria, Luxembourg, Hungary, the Netherlands). While most countries are located in the same cluster in 2014, only Ireland and Luxembourg are placed inside the cluster with high GDP rates and high FDI.

5. Results and discussion

The study of the relationship between FDI and economic growth was conducted at two levels: an overall perspective on the entire EU-28 using panel data approach and an individual analysis for each country based on Bayesian linear regressions and cluster analysis. At aggregate level, there was a positive and bidirectional relationship between GDP rate and FDI in the period from 2008 to 2014. Since 2008, in the context of world crisis, FDI decreased fast, but also the economic growth of the EU countries was negatively affected. Actual FDI had a positive, but very slow impact on actual economic growth in the EU-28 countries during 2008-2014. The global decline brought weak economic performance in EU and other world regions. The financial capabilities of trans-national firms had also diminished. The profit reduction brought less reinvested earnings and more intra-companies loans in developed countries. In 2008, the developing countries did not feel so much the global turmoil as developed ones. The effects of economic crisis on GDP and FDI were observed in developing countries later, starting with 2009 and, in general, the developed countries were more affected by world economic crisis during 2008-2014. On the other hand, the Bayesian panel data models showed that economic growth had also a slow influence on FDI. Moreover, a negative impact of GDP in the previous period on actual FDI was detected by panel VAR model. Indeed, the foreign investors' decision of investing in a certain country is taken also by analysing if that country registered economic growth in the previous year. In the context of an unstable economic environment the GDP in the previous year might provide a good orientation for foreign investors that tend to be more cautious in periods of world economic crisis.

The individual analysis of the relation FDI-economic growth allowed for a classification of countries in the EU-28. The Bayesian analysis based on time series identified three groups of countries regarding the correlation between the two macroeconomic variables: a positive and reciprocal dependence for 19 countries of the EU, a negative and reciprocal relationship for seven countries in the EU and a specific group with negative relationship from FDI to economic growth and positive influence from GDP rate to FDI.

Except for Malta and the Netherlands, the rest of the EU countries had a positive/negative and reciprocal influence between FDI and real GDI rate during 2008–2014.

For Malta and the Netherlands, FDI did not generate economic growth, but increases in economic growth attracted more investors. Malta is a small country, but with some advantages for foreign investors (competitive labour cost and highly-skilled labour force, geographical location). However, it was more affected by global crisis than the rest of the countries in the EU. To global crisis that negatively influenced FDI in Malta we might add the high geopolitical risk, small domestic market, lack of natural resources and policy uncertainty. Therefore, the government from Malta continues to promote a pro-investment policy.

The Netherlands is known as the county with the most outwards FDI assets that are oriented mainly in Luxembourg, Belgium, Ireland and Switzerland. The foreign investors were discouraged to open an affair in the Netherlands by: high labour cost, complicated legislation and administrative system, limited domestic market and a quite weak road infrastructure. However, the Government took some measures to attract more foreign investors by creating a favourable tax environment for foreign companies.

For seven countries in the EU (most of them developed countries), FDI did not bring economic growth and the increases in GDP did not attract more foreign investors. For example, Austria is known as an important capital exporter, being dependent mostly on Central and Eastern European countries. The foreign investors are discouraged to come in Austria by many restrictive labour practices and migration laws. There is not financing for risk capital and many restrictions were imposed on domestic market. Given the decrease in FDI, Government offers better conditions in terms of taxation for foreign companies that want to invest in research and development and in capital intensive sectors. Contrary to expectations, Estonia was placed in the group of countries with negative relationship between FDI and economic growth. The explanation could be given by the fact that it has a small domestic market that was stronger affected by world economic crisis. The main partners are Finland and Sweden that were also influenced by crisis. The Government implemented many policies for attracting FDI, providing a very friendly legislative framework for investors.

The cluster analysis for 2008 and 2014 indicated that disparities in the distribution of GDP rate and FDI reduced in 2014 compared to 2008. Ireland and Luxembourg had in 2014 high GDP rates and high FDI. Despite the global economic crisis, Luxembourg achieved the highest FDI rate in Europe in 2014. This country has one of the most open economies in the world and it has a favourable taxation system for foreign investors. The labour force is highly skilled and foreign capital moves freely. Ireland made constant efforts to attract FDI by offering the lowest tax rates in the EU. This country has a skilled labour force, a competitive economy and a modern infrastructure. Ireland was strongly affected by the economic crisis, but in 2014 created many jobs due to FDI attraction.

In the EU, FDI flows are essential for consolidating the Single Market. Investments from the rest of the countries in the world in the EU will bring a better position of Europe in global markets and the advantage of technology flows.

Since the financial crisis, the FDI attraction from the rest of the countries is a main challenge for the EU. Therefore, the EU policies should direct on the following directions: the extension of the unique market, making more competitive and more open markets in the EU, improving the regulations, ensuring a modern infrastructure.

6. Conclusions

The hypothesis regarding the type of relationship between economic growth and FDI for the EU-28 was tested and the results of panel data analysis stated that there was a reciprocal and positive relationship between FDI and economic growth starting with 2008 in the EU-28. However, time series analysis identified several countries for which FDI did not generate economic growth. The personal contribution in the economic research is giving by the empirical study of the relation between FDI and economic growth on a short period, since the beginning of the world economic crisis. Even if the FDI decrease was observed in the EU in the context of recent economic crisis, few studies in literature focused on the type of relation between the two macroeconomic variables in this specific period. Most of the researches considered longer periods for analyzing the impact of FDI on economic growth in the EU. The short time series used in this research allow the use of specific methods that were not employed yet in literature in analyzing the dependence between FDI and GDP rate. Despite other studies that identified a positive impact of FDI on economic growth, this research showed that higher GDP rates attract more foreign investors in the most EU countries. The limit of the research is given by the fact that for Bayesian linear model on longer data series and for other priors the results might slightly change. On the other hand, the research is limited to the relationship between FDI and economic growth, but other macroeconomic variables might be added. It is possible for some of them to have a higher impact on FDI than GDP growth. It is important to continue this research by adding other variables, like exports and imports, in order to identify more FDI and economic growth determinants. Moreover, this research could be developed by analyzing the FDI-economic growth relationship for the Euro area countries. This analysis is important for developing suitable economic policies for ensuring a higher economic growth by attracting more FDI. For countries where FDI did not generate economic growth, specific policies should be developed to provide a friendly legislative environment and reductions in taxes for foreign investors. However, the EU remains the highest recipient of FDI in the world, but constant efforts should be made to improve its position, mainly in this period of high uncertainties. The EU policies should follow key points like the extension of

the single European market, increasing the degree of openness and competitiveness outside and inside the European Union, an attractive tax system and a modern infrastructure in all of the EU countries.

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Odnos između ekonomskog rasta i izravnih stranih investicija u vrijeme ekonomske krize u Europskoj uniji

Mihaela Simionescu[1]

Sažetak

Cilj ovog istraživanja je ispitati odnos između ekonomskog rasta i priljeva izravnih stranih investicija (ISI) u Europskoj uniji (EU-28) u razdoblju nedavne gospodarske krize. Panel analize podataka i Bayesove tehnike koriste se za rješavanje problema malog skupa podataka (u razdoblju između 2008. i 2014.). Panel analize podataka (panel vektorski auto-regresijski model i Bayesovi modeli slučajnih učinaka) potvrđuju recipročno pozitivan odnos između ISI-a i gospodarskog rasta u EU-28, počevši s 2008. godinom. Individualni pristup temeljen na Bayesovoj linearnoj regresiji ukazuje na tu tendenciju specifičnu za većinu zemalja EU-28. Međutim, u nekim zemljama viši ISI nije generirao gospodarski rast, u nekim zemljama viši BDP nije privukao veća izravna ulaganja, kao što u nekim zemljama veći ISI nije donio veći gospodarski rast. Prema klaster analizi, u 2014. godini u usporedbi s 2008. godinom smanjena je nejednakost među zemljama u svezi raspodijele ISI-a u odnosu na stopu rasta BDP-a i stopa raspodjele BDP-a u odnosu na ISI. Iz navedenog proizlazi temeljni zaključak da je u Europskoj uniji sveukupan odnos recipročan između gospodarskog rasta i privlačenja izravnih stranih investicija.

Ključne riječi: *ekonomski rast, izravna strana investicija, panel podaci, Bayesov model, kriza*

JEL klasifikacija: *C51, C53, F21*

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Appendices

Appendix A1: Unit root tests on panel data

Harris-Tzavalis test for real GDP rate data series (no time trend for the test)

```
Harris-Tzavalis unit-root test for gdp_rate
----------------------------------------------
Ho: Panels contain unit roots               Number of panels  =     28
Ha: Panels are stationary                   Number of periods =      7

AR parameter: Common                        Asymptotics: N -> Infinity
Panel means:  Included                                   T Fixed
Time trend:   Not included
------------------------------------------------------------------------------
                     Statistic         z         p-value
------------------------------------------------------------------------------
 rho                  -0.0319       -9.3341       0.0000
------------------------------------------------------------------------------
```

Harris-Tzavalis test for real GDP rate data series (with time trend for the test)

```
. xtunitroot ht gdp_rate, trend

Harris-Tzavalis unit-root test for gdp_rate
----------------------------------------------
Ho: Panels contain unit roots               Number of panels  =     28
Ha: Panels are stationary                   Number of periods =      7

AR parameter: Common                        Asymptotics: N -> Infinity
Panel means:  Included                                   T Fixed
Time trend:   Included
------------------------------------------------------------------------------
                     Statistic         z         p-value
------------------------------------------------------------------------------
 rho                  -0.3256       -5.7897       0.0000
------------------------------------------------------------------------------
```

Harris-Tzavalis test for FDI data series (without time trend for the test)

```
Harris-Tzavalis unit-root test for gdp_rate
----------------------------------------------
Ho: Panels contain unit roots               Number of panels  =     28
Ha: Panels are stationary                   Number of periods =      7

AR parameter: Common                        Asymptotics: N -> Infinity
Panel means:  Not included                               T Fixed
Time trend:   Not included                  Cross-sectional means removed
Small-sample adjustment to T applied
------------------------------------------------------------------------------
                     Statistic         z         p-value
------------------------------------------------------------------------------
 rho                   0.4835      -10.5861       0.0000
------------------------------------------------------------------------------
```

Fisher-type test for FDI data series

```
Fisher-type unit-root test for fdi
Based on augmented Dickey-Fuller tests
```

Ho: All panels contain unit roots		Number of panels	= 28
Ha: At least one panel is stationary		Avg. number of periods	= 6.79
AR parameter: Panel-specific		Asymptotics: T -> Infinity	
Panel means: Included			
Time trend: Not included			
Drift term: Not included		ADF regressions: 0 lags	

		Statistic	p-value
Inverse chi-squared(56)	P	685.6665	0.0000
Inverse normal	Z	-17.0820	0.0000
Inverse logit t(144)	L*	-34.8468	0.0000
Modified inv. chi-squared	Pm	59.4979	0.0000

Appendix A2: Estimation of panel VAR model

GMM estimation of panel VAR model

```
GMM Estimation

Final GMM Criterion Q(b) =      .531
Initial weight matrix: Identity
GMM weight matrix:     Robust
```

No. of obs	= 78
No. of panels	= 28
Ave. no. of T	= 2.786

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
gdp_rate						
gdp_rate						
L1.	-.975458	.1266308	-7.70	0.000	-1.22365	-.7272663
fdi						
L1.	.0155994	.0018475	8.44	0.000	.0119784	.0192204
fdi						
gdp_rate						
L1.	-3.652583	.9267951	-3.94	0.000	-5.469069	-1.836098
fdi						
L1.	.0633238	.0167795	3.77	0.000	.0304365	.0962111

Wald test for checking Granger causality between GDP rate and FDI on panel data

```
panel VAR-Granger causality Wald test
  Ho: Excluded variable does not Granger-cause Equation variable
  Ha: Excluded variable Granger-causes Equation variable
```

Equation \ Excluded	chi2	df	Prob > chi2
gdp_rate			
fdi	71.294	1	0.000
ALL	71.294	1	0.000
fdi			
gdp_rate	15.532	1	0.000
ALL	15.532	1	0.000

Appendix A3: Estimation of Bayesian panel data models for real GDP rate and FDI

Bayesian random effect model with cross-sectional intercepts for explaining real GDP rate

Cross-sectional ID is not specified.

The dependent variable: gdp_rate

The regressor: fdi

Unbalanced panel data:

Sample size = 190, N = 28, T(min) = 6, T(max) = 7

A constant is added to X.

‘Coeff.’’Post.mean’ ‘Post.std’

‘C(0)’ [-0.3927] [0.3358]

‘C(1)’ [2.2991e-006] [9.8254e-007]

‘se^2’ [12.5489] [1.2935]

‘su^2’ [0.1731] [0.1176]

Bayesian random effect model with positive cross-sectional intercepts for explaining real GDP rate

The dependent variable: gdp_rate

The regressor: fdi

Unbalanced panel data:

Sample size = 190, N = 28, T(min) = 6, T(max) = 7

A constant is added to X.

‘Coeff.’’Post.mean’ ‘Post.std’

‘C(0)’ [-0.7489] [0.3759]

‘C(1)’ [2.3034e-006] [9.8539e-007]

‘se^2’ [12.5927] [1.3065]

‘lambda’ [0.3651] [0.1888]

Bayesian random effect model with cross-sectional intercepts for explaining FDI

The dependent variable: fdi

The regressor: gdp_rate

Unbalanced panel data:

Sample size = 190, N = 28, T(min) = 6, T(max) = 7

A constant is added to X.

‘Coeff.’’Post.mean’ ‘Post.std’

‘C(0)’ [-0.0118] [10.0322]

‘C(1)’ [0.0301] [9.9792]

‘se^2’ [6.5499e+010] [7.3858e+009]

‘su^2’ [3.5346e+010] [1.1917e+010]

Bayesian random effect model with positive cross-sectional intercepts for explaining FDI

The dependent variable: fdi

The regressor: gdp_rate

Unbalanced panel data:

Sample size = 190, N = 28, T(min) = 6, T(max) = 7

A constant is added to X.

‘Coeff.’’Post.mean’ ‘Post.std’

‘C(0)’ [0.0518] [9.9985]

‘C(1)’ [-0.0247] [9.9983]

‘se^2’ [1.0877e+011] [1.1082e+010]

‘lambda’ [0.4721] [0.3781]