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DETERMINANTS OF FOREIGN DIRECT INVESTMENT IN THE VISEGRAD GROUP COUNTRIES AFTER THE EU ENLARGEMENT

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Abstract. Considering the role of foreign direct investment (FDI) inflows in the sustainable development of a country, the main aim of this paper is to identify some macroeconomic factors that positively or negatively influence FDI in Visegrad group countries after the European Union (EU) enlargement in 2004. We employed two types of approaches in our analysis: i) time series and ii) panel data approach. According to the generalized ridge regressions estimated in Bayesian framework, the perceived corruption was a factor that influenced FDI in all the countries. In Poland, Czech Republic and Slovakia corruption came through as a serious obstacle for FDIs since 2005, but this was not the case for Hungary. Even if Hungary is perceived as a country with high influence, foreign investors seem no to care about this fact and are more interested in the quality of human resources and the possibility to increase exports. Our panel approach based on a panel ARDL model identified a significant relationship between FDI, corruption index and labour force with advanced education however this causality was only detected in the long run. According to the Granger causality in panel, the attraction of FDI inflows succeeded in generating changes in total tax rate, but the issues related to corruption were not reduced at an acceptable level for foreign investors in Poland, Slovakia, and the Czech Republic.

Keywords: foreign direct investments, V4 countries, perceived corruption index, ridge regression, panel ARDL model.

JEL Classification: C51, C53, E22.

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Introduction

After the collapse of the Socialism and the planning system in the beginning of the 1990s, the countries of Central and Eastern Europe (CEECs) developed various strategies to attract foreign investment in order to achieve a sustained economic growth (Chidlow, Salciuviene, & Young, 2009; Chen, Cheng, Nikic, & Song, 2018; Qi & Li, 2017). The foreign direct investments (FDI) brought by multinational corporations (MNCs) had an important role in the process of transformation of planned economies into functional market economies, due to the inflow of jobs, management skills, technological transfer together with increasing exports.

A large amount of empirical literature examined the factors that determine FDI to the Central and Eastern European countries, among them a factor of belonging to the Visegrad Group countries (see e.g. Abrhám, Strielkowski, Vošta, & Šlajs, 2015a). There are more reasons for this tendency. First of all, since the middle of 1990s, a large number of investors, mostly from Western Europe, have chosen these states as host for their investment. Poland is the leader among these countries, being followed by Czech Republic and Hungary. A second reason is related to the fact that FDI is a significant source of external finance in the capital formation and ensures transfer of human capital, resources and technological progress between countries that generate economic and social development in the transition economies. Lastly, the liberalization towards a regime based on market depends on the changing nature of FDI (Stack, Ravishankar, & Pentecost, 2017).

1. Determinants and allocations of FDI

There is a plethora of theories, concepts and models in literature that attempts to explain the FDI allocation. Kilic, Bayar, and Arica (2014) identified three groups of theories that explain FDI: micro-level theories, macro-level ones and development theories that combine macro and micro-level theories. There is no single theory that explains FDI. Microeconomic theories express the perspective of multinational enterprises (MNEs) trying to explain why these companies choose FDI rather than licensing or exporting (oligopolistic market theory, eclectic theory, company specific advantage theory, theory of internalization). Macroeconomic theories consider FDI as a type of capital flow between various economies and world in order to explain reasons and determinants of FDI (exchange rate theory, gravity approach, dynamic macroeconomic theory, economic geography, capital market theory, institutional analysis). Development theories consist of product life cycle theory, Japanese FDI theories and the five-stage theory of Dunning (1980), just to name a few. Other approaches, including various methods of multi criteria decision analysis and evaluation, such as the MCDA or MAGDM approaches, for example, can also be used (Hajiagha, Mahdiraji, Hashemi, & Zavadskas, 2015; Hashemkhani Zolfani, Maknoon, & Zavadskas, 2016; Ghorabaee, Amiri, Zavadskas, Hooshmand, & Antuchevičienė, 2017; Zeng, Streimikiene, & Baležentis, 2017; Zeng, Mu, & Balezentis, 2018; Zeng, 2017; Rostamzadeh, Esmaeili, Nia, Saparauskas, & Ghorabaee, 2017; Zhou, Su, Baležentis, & Streimikiene, 2018). The use of the frontier techniques can also be applied in this case (Song, Fisher, Wang, & Cui, 2018a; Song, Peng, Wang, & Dong, 2018b; Song & Wang, 2018).

From the macroeconomic perspective, the determinants of FDI hold a central position. They can be identified in connection with the main theories. According to capital market theory, FDI is determined by interest rates. The basic reason for FDI and portfolio investment is the expectation for a higher rate of return than in the origin country. Moreover, the expected profit rate should compensate the risks and costs related to the business location and foreign currency. The limits of this theory were observed by Hymer (1976) who showed that there should be other factors than location to explain FDI. Moreover, Caves (1996) showed that the international difference in expected returns is not enough to generate FDI.

Dynamic macroeconomic FDI theory explains the flows of FDI by the changes in the macroeconomic environment. The connection between FDI and exchange rate is made by exchange rate theory in which FDI is perceived as a possibility of exchange rate reduction (Fernando, Hosseini, Zavadskas, Perera, & Rameezdeen, 2017). The Porter's economic geography theory looks for success factors in a certain region where industries operate (Porter, 1990). The distribution of FDI according to spatial, cultural or economic distance is the central part of gravity approach (Isard, 1954). The impact of institutional framework on FDI is analyzed in the institutional theory of FDI (Wilhelms & Witter, 1998). Some of these approaches include complicated decision-making, such as described by Stanujkic and Zavadskas (2015).

The eclectic theory of Dunning (1980) identifies four main categories of FDI investors: market seekers, resource seekers, efficiency seekers and strategic capabilities or asset seekers. The recent advances in reasons for FDI location identify four motives: efficiency-seeking FDI (vertical FDI), market-seeking FDI (horizontal FDI), complex FDI and export-platform FDI (Shepotylo, 2012).

Considering the important role of FDI in the economic and social development of the V4 countries, this paper identifies some macroeconomic determinants of FDI inflows into these economies. The description of common characteristics of these states will help them in designing the best FDI strategies to attract more foreign capital.

2. Literature review

The list of possible determinants of FDI is very large and it is difficult to get a global image of all the studies. Among the most popular determinants are infrastructure, the size of market and taxes and tariffs (Wach & Wojciechowski, 2016), labor costs, exchange rate, unemployment rate, trade openness (Boateng, Hua, Nisar, & Wu, 2015).

The traditional determinants employed by Botrić and Škuflić (2006) for host country are related to resources (skilled labour resources, business environment, infrastructure, natural resources), efficiency (trade costs, labour and production factors), and market seeking (market size, market potential, GDP per capita and economic growth).

Other factors like corruption or governance are less investigated (Subasat & Bellos, 2013; Čábelková, Abrhám, & Strielkowski, 2015). Most of the determinants were empirically tested, but only on particular regions or countries and in certain periods.

There are several common determinants of FDI in the CEECs: the presence of free trade areas and openness, advantages regarding market and efficiency (Merlevede & Schoors, 2009). However, there are many determinants that are specific to some countries, being re-

lated to location, quality of human capital and the evolution of some macroeconomic indicators (Demekas, Horvath, Ribakova, & Wu, 2005).

The empirical evidences showed that transitional variables like progress in privatization, national risk in the host economy, trade liberalization, implemented reforms in banking sector had a strong impact on FDI in the CEECs (Brada, Kutan, & Yigit, 2006).

The determinants of FDI from Western countries to CEECs in the period 1994–2000 were investigated by Bevan and Estrin (2004) using random effect models. The relevant factors that attracted FDI in this period were: gravity factors, unit labour costs in the host economy, proximity and market size. Labour costs were also identified by Janicki and Wunnava (2004) as factors that attracted FDI in 1997 from EU-15 to the CEECs that were later integrated in the EU: Romania, Bulgaria, Estonia, Czech Republic, Poland, Hungary, Slovenia and Slovakia. Moreover, the authors also identified other relevant drivers of FDI: the risk and the size of host economy and openness to trade.

The FDI from 10 Western European countries to EU-10 were explained by Stack, Ravishankar, and Pentecost (2017) for the period 1996–2007. The estimations based on a knowledge capital model suggested that for horizontal FDI similar countries characteristics in terms of income, size and factor endowments and trade costs are important determinants of FDI.

Wach and Wojciechowski (2016) identified the factors that attract FDI from EU-15 in the Visegrad Group countries in the period 2000–2012. The foreign investors in these states were interested in the host market potential reflected by GDP and in the short distance between the origin place and the chosen country. Contrary to the results obtained before by Gorynia, Nowak, Howak, and Wolniak (2007), these investors are not anymore efficiency-seekers.

Moreover, the location perspective was improved by Avioutskii and Tensaout (2016) who added the political element in choosing the location. For some CEE countries (Romania, Poland, Bulgaria, Czech Republic and Slovak Republic), the authors showed, using a panel data approach, that ideology influences the selection of a location for FDI. Factors like political risk, economic reforms and liberalization are significant drivers of FDI in these countries. Determinants of FDI like labour cost, market size and trade liberalization were also identified by Günther and Kristalova (2016) in the period 1994–2013 for CEECs that became EU members.

Most of the studies focusing on FDI determinants in the CEECs analyzed them from the perspective of transition process, but few studies identified the factors affecting FDI during the global crisis (Sakali, 2013; Jimborean & Kelber, 2017).

The economic crisis from 2007 and 2011 were also taken into account when analyzing the FDI determinants in the CEECs in the period 1993–2014. In this context, using a panel data general to particular approach, Jimborean and Kelber (2017) identified domestic determinants (human resources, competitiveness, past FDI, infrastructure, trade openness, risk premium, corporate tax system, market dimension, progress in achieving structural reforms, spatial proximity to Western Europe, EU membership) and external ones (global economic conditions and risk environment, financial and macroeconomic conditions the euro area).

Some of the studies focused on the determinants of FDI in a certain region or country at sectoral level to highlight that there are differences in attracting FDI according to the sector

of activity. Resmini (2000) analyzed the determinants of the FDI from EU to CEECs before 2000 (1986–1997) at sectoral level. The study focused on manufacturing sectors and the estimations based on a fixed-effect model indicated heterogeneity at sectoral level in attracting FDI. The progress towards a market economy had a significant impact on the FDI sent in CEECs. Wage differentials attracted FDI only in science-based sectors and scale-intensive sectors. In traditional sectors, the determinants of FDI were: the opportunity to exploit the agglomeration economies and the economy's degree of openness. However, these conclusions are valid for the period before countries' integration in the EU. For food industry in Poland with 12 branches, Walkenhorst (2001) identified some determinants of FDI in the period 1991–1997: value-added, privatization speed, company size and import share. A sectoral approach for the determinants of FDI in manufacturing industry was applied for Czech Republic by Michalíkova and Galeotti (2010) who built panel data models for 23 sectors of manufacturing industry over the period 2000–2007. The empirical results indicated that abundance of human capital with technical skill represents a comparative advantage in the Czech Republic. The foreign investors were attracted by those sectors with high educated labour resources. The tendency is to invest in sectors with high energy requirements. Relative unit labour costs are also important for foreign investors when deciding to invest in Czech Republic. The foreign investment in the manufacturing industry from Hungary might be explained by location of the country in Europe (Hlavacek & Bal-Domanska, 2016). In the case of Slovakia, M. Grančay and N. Grančay (2017) showed that foreign investors followed those industries and sectors with higher capital intensity of production and higher added value.

"Special economic areas" with services and infrastructures accessible on preferential basis and low rates of taxation from Poland, Czech Republic and Hungary attracted more FDI compared to those areas that are not considered special in the period 1994–2001 (Guagliano & Riela, 2005). For Hungary, considered that the main factors that explain the FDI attraction are: privatization policy and the relative liberal laws on FDI (Hlavacek & Bal-Domanska, 2016).

The EU membership offers multiple advantages for V4 countries, among them being: access to EU funds, almost unlimited access to the EU markets, non-VAT trading inside the EU, stable legal environment, less regulated migration of labour force, lower costs of operations due to higher concurrence and efforts of liberalization of different markets, improvement regarding transport corridors.

Poland ranks the first among V4 countries according to the distance to frontier score, being ranked as the 24th out of 190 states in the report "Doing Business 2017" published by World Bank (2017). Even if the Czech Republic is ranked on the 24th place, it is the first country as per capita inflows and FDI stock in 2016. Abrhám, Bilan, Krauchenia, and Strielkowski (2015b) note the advantages of the Czech labour market with the other Eastern European countries. The performance is due to some important advantages of the Czech Republic:

- location of the country in Europe (it is placed in the heart of Europe);
- investment incentives;
- well-skilled and cheap labour force;
- strong stability of currency;
- independence and power of central bank;
- fast economic growth;

– rapid increase in the FDI since 2012;
– state policy in favor of Euro zone accession.

Czech government proposed an investment incentive plan to attract greenfield, but also to develop the existent structures. The plan includes several measures:

– equal and non-discriminant treatment of foreign investors;
– protection for property rights and the freedom to export profits;
– avoidance of double taxation and investment protection;
– improved services for foreign investors and intense activity abroad;
– improvement of communication, development and research.

Moreover, the "Welcome Package for Investors" makes the immigration faster for people who need residence and job in the Czech Republic.

Hungary is also an attractive country for foreign investment due to some key points:

– location of the country in Europe (gateway to Central and Southeast Europe);
– well-skilled and high educated labour force, especially in medicine, economics and engineering;
– fast-growing economy;
– most well-developed financial system in the entire region;
– good infrastructure and is still developed using EU funds;
– significant supply chain opportunities in electronic and automotive industries;
– direct support through 2014–2010 National Development Plan for infrastructure, tourism, environmental protection and healthcare;
– economic and political stability induced by the integration in the EU and by the support of international organizations.

Hungarian Government established an agency called Hungarian Investment Promotion Agency to support the foreign investors. In the context of global economic crisis, Hungary took measures to maintain the foreign investors: special guarantee programs and loans, creation of a better administrative situation with lower formalities to encourage acquisition of buildings.

There are some particular advantages for foreign investors that choose Slovak Republic as host country:

– location of the country in Europe (it is placed in the centre of Europe);
– well-skilled and cheap labour force;
– advantageous tax system;
– some financial aid forms for promoting FDI;
– low tax rate;
– use of Euro as national currency since 2009;
– large potential of growth;
– lower cost of living compared to other countries from Europe.

The ability of Poland to attract FDI is justified by some strong points:

– location of the country in Europe (in the centre of Europe);
– well-skilled, cheap and multilingual labour force;
– fast-growing economy;
– ability to manage recent crisis better than other CEE countries;
– government measures to encourage FDI.

Polish Government provided support to foreign investors in order to improve the country's attractiveness. For example, in April 2002, a law was passed by Parliament and stipulated that Government should give assistance to manager access to EU structural funds, investment assistance in Special Economic Zones, creation of technological and industrial regions for more companies working in the same sector. A firm is registered as limited liability company in only 24 hours in Poland since 2012. A stabilization and development plan was formulated by Polish Government to grant credits to medium and small sized firms that invest in renewable energy sources. The Poland's bureaucracy was diminished with the adoption of an Act Limiting Administrative Barriers for Citizens and Businesses in July 2011.

The tendencies observed for the entire region of CEE countries and V4 countries were also observed in Poland, the country that attracted the most FDI. Most of the studies treating the determinants of FDI in CEECs focused on Poland. In this country, the foreign investors are both efficiency and market seekers (Gorynia et al., 2007). Location determinants were identified for FDI inflow into Poland using data based on a survey that uses online questionnaire. Based on these data collected in February 2005 and a multinomial logit model, Chidlow et al. (2009) showed that agglomeration factors and knowledge-seeking factors alongside market are the main FDI determinants for Mazowieckie region that includes the capital. For the rest of the Polish regions, geographical factors and efficiency are the main drivers of FDI. In a recent study, Nazarczuk and Krajewska (2017) showed the importance of geographical factors and structural characteristics in attracting FDI in Polish districts in the period 2011–2015. Using negative binomial regression models, the authors showed that FDI was mostly located in Polish districts near large urban centers with high economic and social development reflected in the quality of human resources, access on labor market and infrastructure. The location is also appreciated by Portuguese investors in Poland (Aleksandruk & Forte, 2016), but it is not the key factor. The surveys among Portuguese investors in Poland showed that large domestic market is the most important determinant of FDI. However, there are also many barriers in locating FDI in Poland, as Portuguese managers indicated: bureaucracy, language obstacles and cultural differences.

Cieślik (2007) and Cieślik, Michałek, and Mycielski (2016) used negative binomial regression models to explain the FDI inflow from EU-15 to Poland in the period 1989–2014. The market size and the differences in factor endowments explained the orientation of the managers from EU-15 towards Poland.

3. Methodology

The methodological framework is conditioned by the analysis made on two types of data: *time series* for the individual analysis of economic phenomenon in each country and *panel data* for simultaneous analysis of all countries in the sample in the same period. Given the short period of analysis, the time series approach is based on Bayesian methods that eliminate the deficiency of a short sample. Moreover, panel data approach also solves the issue of short period. The factors that influence FDI will be identified using different regression models (generalized ridge regression models under Bayesian framework and panel autoregressive-distributed lag models). The analysis is enriched by considering a principal component

analysis based on Bayesian estimations and panel Granger causality test to check if there are significant causes of FDI among explanatory variables.

Considering the time series approach, the traditional regression models in frequentist Econometrics might generate misleading results when using empirical data. This issue is encountered when the method assumptions are not fulfilled. Therefore, the regression model should describe all the possible patterns in data. This disadvantage is not met when a Bayesian nonparametric approach is used since it comes with flexible models presented as an infinite mixture of regressions with minimum assumptions related to data.

The ridge regression linear model provides estimates via shrinkage and it reduces the forecast error and the mean squared error.

For a dataset $D_n = (X, y)$ with $X = (x_{ip})_{nxp}$ and $y = (y_1, \ldots, y_n)^T$ and a conjugate normal-inverse gamma prior density to (β, σ^2), we have:

$$f(y|X,\beta,\sigma^2) = n_n(y|X\beta,\sigma^2 I_n) = \prod_{i=1}^{n} n(y \mid x_i^T\beta,\sigma^2) \text{ and} \quad (1)$$

$$\pi(\beta,\sigma^2) = n_p(\beta|m,\sigma^2 V)ig(\sigma^2|a,b) = nig(\beta,\sigma^2 \mid m,V,a,b), \quad (2)$$

where $n_n(.|\mu,\Sigma)$ is probability density function (pdf) associated to a n-variate normal distribution, $n(.|\mu,\sigma^2)$ is probability density function associated to a univariate normal distribution and $ig(.|a,b)$ is probability density function associated to an inverse gamma distribution (where a is the shape parameter, b is rate parameter and $\frac{1}{b}$ is a scale parameter), $nig(\beta,\sigma^2 \mid m,V,a,b)$ – probability density function (pdf) associated to a NIG distribution (product of two pdfs for inverse-gamma distribution and multivariate normal one, as in Lindley and Smith (1972).

Under the assumption that joint prior distribution of (β, σ^2) follows a NIG distribution, according to marginal approach, β has a Student prior distribution with parameters: mean m and covariance matrix $V1(\beta) = \frac{b}{a-1}V$ with 2a degrees of freedom. σ^2 follows an inverse-gamma prior distribution with average $\frac{b}{a-1}$ and variance $\frac{b^2}{(a-1)^2(a-2)}$.

The ridge regression model (RR model) is defined as a Bayesian linear regression model with normal prior distribution $n_p(\beta \mid 0, \sigma^2\lambda^{-1}I_p)$ for β, conditionally on σ^2. In case (β,σ^2) follows a prior normal inverse-gamma distribution $nig(\beta,\sigma^2 \mid 0,\lambda^{-1}I_p,a,b)$, inferential procedures for the Bayesian normal linear regression model are employed for ridge regression (Karabatsos, 2014).

For the design matrix X, the singular value decomposition (svd) is $X = UDW^T$. In this case, U and W represent orthogonal matrices of $n \times q$, respectively $p \times q$, where $q = \min(n, p)$ and $Z = UD = XW$.

$D = diag(d_1, \ldots, d_q)$ represents a diagonal matrix of singular values $d_1 > d_2 > \ldots > d_q > 0$ $(d_1^2, \ldots, d_q^2)$ provides at most the first q eigenvalues (q different from 0, of X^TX and shows the diagonal values of Z^TZ.

The q principal components associated to X are placed in the columns of XW. The eigenvalues $(d_1^2, \ldots, d_q^2)$ are the column-wise sum of squares over the rows.

In our empirical analysis, we will consider:

$$y_i \mid X_i \sim f\left(y|X_i\right),\ i=1,2,\ldots,n, \tag{3}$$

where: $f(y|X) \sim N(y \mid X'\beta, \sigma^2)$; $\beta \mid \sigma^2 \sim N\left(0, \sigma^2 \cdot \frac{1}{\hat{\lambda}} \cdot I_p\right)$; $\sigma^2 \sim IG(\varepsilon,\varepsilon)$ (inverse Gamma distribution); λ – penalty; $\hat{\lambda}$ – Marginal Maximum Likelihood Estimate of λ; y is centered in order to get a null mean and the explanatory variables are rescaled to get a null mean and a variance equal to 1; β – standardized coefficients (posterior mean) based on zero-mean centered y and rescaled explanatory variables; b – column vector based on β :

$$b = \left[mean\left(y\right) - \frac{mean\left(X\right) \cdot \beta}{SD(X)'} \right] \frac{\beta}{SD\left(X\right)}. \tag{4}$$

The first entry of b is the intercept and the rest ones are the slopes.

$mean(X)$ – row vector for covariate means; $SD(X)'$ – column vector with covariate standard deviations.

If y is a vector of z-scores with null mean and variance 1, β contain the coefficients on correlation scale. β ranges only between –1 and 1, when the predictors are not correlated.

The significant predictors that explain y are selected using PP1SD indicator that represents the posterior probability for the standardized coefficient to be within 1 standard deviation from 0.

The panel data analysis is focused on the technique known as Pooled Mean

Group (PMG) used by Pesaran, Shin, and Smith (1999) to construct nonstationary dynamic panels. The model based on PMG estimation has the following general form:

$$Y_{it} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \delta_{ij} X_{i,t-j} + \mu_i + \varepsilon_{it}\,, \tag{5}$$

where: i is the index for cross-sections taking values from 1 to N; t is the index for time taking values from 1 to T; X_{it} – vector of K x 1 regressors; λ_{ij} – scalar; μ_i – specific effect of group.

When the variables are co-integrated and integrated of order 1, the error term has a stationary data series. The cointegrated variables have the capacity to rejoinder to a deviation from the long-term equilibrium.

The above equation is reparametrized into error correction equation:

$$\Delta Y_{it} = \varphi_i y_{i,t-j} - \theta_i X_{i,t-j} \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij} \Delta X_{i,t-j} + \mu_i + \varepsilon_{it}\,, \tag{6}$$

where φ_i – error correction coefficient indicating the adjustment speed.

In case $\varphi_i = 0$, there is not any long-run relationship between variables. If φ_i is statistically significant and negative, there is a long-run relationship between variables.

Granger Causality is based on bivariate regressions and the analysis on panel data uses more approaches. The bivariate regressions using panel data and y and x as variables have the following form, where t shows time series dimension and i the cross-sectional size:

$$y_{i,t} = \alpha_{0,i} + \alpha_{1,i} y_{i,t-1} + \ldots + \alpha_{l,i} y_{i,t-1} + \beta_{1,i} x_{i,t-1} + \ldots + \beta_{l,i} x_{i,t-1} + e_{i,t}; \tag{7}$$

$$x_{i,t} = \alpha_{0,i} + \alpha_{1,i} x_{i,t-1} + \ldots + \alpha_{l,i} x_{i,t-1} + \beta_{1,i} y_{i,t-1} + \ldots + \beta_{l,i} y_{i,t-1} + e_{i,t}, \tag{8}$$

where e denotes the error term.

The panel causality tests depend on the assumptions about coefficients homogeneity across cross-sections. In this paper, we will employ the approach that considers panel data as a large stacked set of data. The Granger Causality test in standard way is conducted, but not allowing data from one cross-section enter the lagged values from the next cross-section. According to this method, there are the same coefficients across the cross-sections for any *i* and *j*:

$$\alpha_{0,i} = \alpha_{0,j};$$
$$\alpha_{1,i} = \alpha_{1,j};$$
$$\ldots$$
$$\alpha_{l,i} = \alpha_{l,j};$$
$$\beta_{0,i} = \beta_{0,j};$$
$$\beta_{1,i} = \beta_{1,j};$$
$$\ldots$$
$$\beta_{l,i} = \beta_{l,j},$$

There is another approach proposed by Dumitrescu and Hurlin (2012) that allows the coefficients to vary across cross-sections, but the small set of data used in our empirical analysis does not permit us to consider this approach.

4. FDI determinants in V4 countries. Empirical analysis

More factors that affect FDI inflows in the V4 countries (Poland, Hungary, Czech Republic, and Slovakia) and they will be empirically tested in the period 2005–2016. All these countries entered the EU in 2004 and we selected a period after this moment. The variables that were taken into consideration are:

- Foreign direct investment (FDI) net inflows: net inflows of investment in order to have a lasting management interest in a firm (a minimum of 10% of voting stock) when this firm is located in another country compared to investor's one. It includes: short-run capital in balance of payments, earnings' reinvestment, equity capital plus another long-run capital.
- GDP per capita growth (%);
- Poverty headcount ratio at $ 1.90 a day (2011 PPP) (% of population);
- Cost of business start-up procedures (% of GNI per capita);
- Corruption Perceptions Index provided by Transparency International: an aggregate index showing the opinion regarding the level of corruption in the public sector of a state;
- Exports of goods and services (% of GDP);
- Real wage (2010 = 100);
- Total tax rate (% of commercial profits);
- Real effective exchange rate (2010 = 100 for the index);
- Broad money (% of GDP);
- Youth unemployment rate (% of total labor force ages 15–24) (modeled ILO estimate);
- Unemployment rate (% of total labor force) (modeled ILO estimate);
- Time required to start a business (days);

– Labor force having advanced education (% of total working-age population having advanced education);
– Inflation rate based on harmonized index of prices from Eurostat.

Except for inflation and corruption index, the data sets for all the other variables are provided by World Bank.

In Figure 1, the evolution of FDI net inflows in V4 countries between 2005 and 2016 is described. From the very beginning, we observe that Hungary FDI is an outlier compared to the values of FDI from the other countries. The maximum level of FDI net inflows in Hungary was achieved in 2007, before the world economic crisis start (around 51% from GDP). A sudden fall was observed since then till a minimum in 2000. At the end of the period the values of the indicator became rather close. Considering the particular evolution of FDI net inflows in Hungary compared to the other V4 countries, a separate analysis will be provided when the panel data will be described.

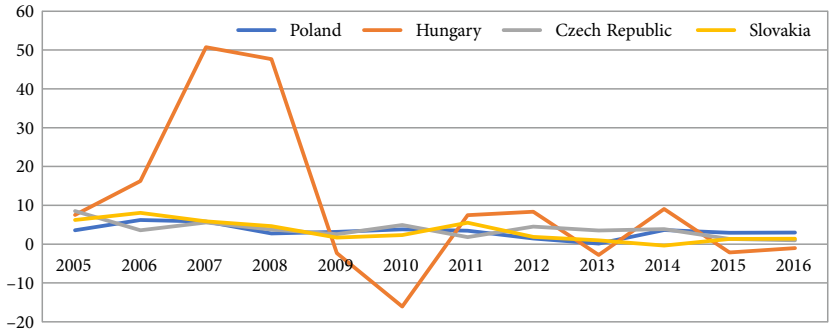

Figure 1. FDI net inflows in V4 countries (% of GDP) (source: own results)

Levin-Lin-Chu test was used to check for the existence of unit roots in the panel data. According to this test, the panel data for FDI, time required to start a business, GDP per capita growth, poverty headcount ratio at $ 1.90 a day, cost of business start-up procedures, total unemployment rate and tax rate were stationary at 5% level of significance.

The data series for exports of goods and services, real effective exchange rate (2010 = 100), board money, youth unemployment rate, wage, inflation rate, labour force with advanced education, and corruption perceptions index were not stationary in level at 5% level of significance and we computed the data series in first difference to achieve stationary data. Therefore, new variables will be constructed as absolute change of these indicators, excepting broad money for which we computed rate of board money.

According to generalized ridge regression model for Poland, the following variables had a significant impact on FDI inflows in Poland in the period 2005–2016:

– GDP per capita growth;
– Total tax rate;
– Inflation rate;
– Corruption index;
– Poverty headcount ratio at $1.90 a day.

GDP per capita growth had a positive impact on FDI net inflows in Poland after 2004 showing that the foreign investors were directly interested on the country's standard of life (Table 1). As expected, the increases in inflation rate and corruption had a negative effect on FDI inflows in Poland in the period 2005–2016. Contrary to expectations, even if the total tax rate and poverty headcount ration increased, the foreign investors continued to come in Poland. Our results are consistent with the conclusion of Amarandei (2013) that showed a negative impact of corruption on FDI in 10 CEE countries (Poland, Hungary, Bulgaria, Estonia, Lithuania, Latvia, Romania, Czech Republic, Slovakia and Slovenia), but the intensity of the relationship FDI-corruption is less than expected. Moreover, Poland made constant improvements in corruption.

According to principal component analysis based on a Bayesian procedure (Table 2), in Poland the most relevant determinants (corruption index and poverty headcount ratio at $1.90 a day) had a negative influence on FDI and could be seen as a component reflecting social issues of Poland.

GDP per capita growth and exports of goods and services had a positive impact on FDI net inflows in Hungary after 2004 showing that the foreign investors were directly interested on the country's standard of life and perspectives on exports (Table 3). Contrary to expectations, the increases in inflation rate, tax rate, cost of business start-up procedures, wage and corruption had attracted FDI inflows in Hungary in the period 2005–2016. Even if the unemployment rate and labor force with advanced education increased, the FDI decreased. Foreign investors in Hungary seemed to be sensitive to poverty issues. The correlation between corruption and FDI is contrary to the result of Smarzynska and Wei (2000) based on microeconomic data and in line with the result of Bellos and Subasat (2012) that showed that corruption did not discourage FDI in developing countries using a gravity panel data approach. However, since then, Hungary made progresses in terms of corruption reduction.

In Hungary, more macroeconomic variables had a significant impact on FDI in the period 2005–2016, after country's integration in the EU:

- Exports of goods and services;
- Cost of business start-up procedures;
- Total tax rate;
- Inflation rate;
- Real effective exchange rate index;
- Broad money;
- Youth unemployment rate;
- Total unemployment rate;
- Wage;
- Labor force with advanced education;
- Poverty headcount ratio at $1.90 a day.

According to principal analysis, the most important component that includes poverty and inflation rate had a negative impact on FDI (Table 4). The high poverty and inflation rate did not attract foreign investors in Hungary. This component might reflect the social instability.

Table 1. Marginal Posterior Summary Estimates for generalized ridge regression in case of Poland (source: own results)

Covariate	Beta	Standard deviation	PP1SD	b
Intercept	0	0	1	6.053
GDP per capita growth	0.67	0.284	**0.097**	0.406
Exports of goods and services	0.013	0.218	0.662	0.003
Cost of business start-up procedures	–0.035	0.565	0.662	–0.012
Total tax rate	0.129	0.042	**0.030**	0.074
Inflation rate	–0.367	0.155	**0.094**	–0.210
Corruption index	–0.149	0.035	**0.004**	–0.015
Real effective exchange rate index	–0.006	0.059	0.66	–0.001
Broad money	–0.088	0.234	0.631	–0.013
Youth unemployment rate	–0.119	0.086	**0.339**	–0.021
Time required to start a business	0.145	0.264	0.596	0.031
Total unemployment rate	0.040	0.255	0.657	0.013
Wage and salaried workers, total	0.093	0.388	0.65	0.068
Labor force with advanced education	–0.062	0.192	0.639	–0.145
Poverty headcount ratio at $1.90 a day	0.404	0.103	**0.006**	1.98

Table 2. Posterior Estimates of Principal Components of explanatory variables in case of Poland (source: own results)

Component	alpha	Eig.	lambda
1	–0.235	101.573	26.525
2	0.000	27.416	10000
3	0.85	15.465	1.744
4	0.000	9.45	10000
5	0.000	7.083	10000
6	0.000	4.822	10000
7	0.000	1.345	10000
8	0.000	0.598	10000
9	0.000	0.201	10000
10	0.255	0.037	1.160
11	0.000	0.01	10000
12	0.000	0.000	10000

Table 3. Marginal posterior summary estimates for generalized ridge regression in case of Hungary (source: own results)

Covariate	Beta	Standard deviation	PP1SD	b
Intercept	0	0	1	–103.075
GDP per capita growth	0.23	0.238	0.661	0.075
Exports of goods and services	1.057	1.041	**0.461**	0.126
Cost of business start-up procedures	0.93	0.704	**0.358**	0.165
Total tax rate	1.877	1.117	**0.245**	0.487
Inflation rate	4.76	1.568	**0.031**	1.898
Corruption index	1.719	2.62	0.57	0.647
Real effective exchange rate index	2.589	1.209	**0.134**	0.528
Broad money	–1.782	0.688	**0.067**	–0.477
Youth unemployment rate	–5.317	2.007	**0.061**	–1.114
Time required to start a business	–0.413	0.633	0.571	–0.032
Total unemployment rate	–4.401	1.738	**0.074**	–2.205
Wage	0.893	0.817	**0.435**	1.109
Labor force with advanced education	–0.851	0.864	**0.471**	–0.473
Poverty headcount ratio at $1.90 a day	–5.315	1.814	**0.038**	–20.165

Table 4. Posterior estimates of principal components of explanatory variables in case of Hungary (source: own results)

Component	alpha	Eig.	lambda
1	–1.203	71.984	99.315
2	0.000	52.214	10000
3	–4.096	14.346	11.032
4	–9.694	13.413	2.2
5	–2.534	7.16	16.506
6	0.000	5.378	10000
7	0.000	2.056	10000
8	0.000	0.774	10000
9	0.000	0.483	10000
10	0.255	0.156	10000
11	0.000	0.036	10000
12	0.000	0.000	10000

In the Czech Republic, more macroeconomic variables had a significant impact on FDI in the period 2005–2016 (Table 5):

- Cost of business start-up procedures;
- Corruption index;
- Available money loans;
- Youth unemployment rate;

– Labor force with advanced education;
– Time required to start a business.

The foreign investors in Czech Republic are not interested in aspects related to business start-up (costs and time to start a business) since the time and costs for beginning a business in this country are acceptable. Corruption issue seems to be an important criterion in deciding to locate a foreign company in Czech Republic. Our result is consistent with the conclusion of Castro and Nunes (2013) that showed a negative impact of corruption on FDI in Czech Republic and other CEE countries. Moreover, the increase in the labour force with advanced education attracted FDI in Czech Republic while the growth of youth unemployment rate did not encourage foreign investors to come in Czech Republic.

According to principal analysis, the most important component that includes Time required to start a business and Cost of business start-up procedures had a negative impact on FDI (Table 6). When costs and time increase, the foreign investor are less encouraged to invest in Czech Republic.

Table 5. Marginal posterior summary estimates for generalized ridge regression in case of Czech Republic (source: own results)

Covariate	Beta	Standard deviation	PP1SD	b
Intercept	0	0	1	–25.568
GDP per capita growth	–0.091	0.125	0.549	–0.048
Exports of goods and services	0.109	0.202	0.599	0.023
Cost of business start-up procedures	0.582	0.301	**0.177**	0.721
Total tax rate	–0.067	0.198	0.637	–0.065
Inflation rate	–0.001	0.051	0.663	–0.001
Corruption index	–0.885	0.545	**0.261**	–0.422
Real effective exchange rate index	–0.048	0.062	0.536	–0.013
Broad money	0.065	0.203	0.639	0.015
Youth unemployment rate	–0.385	0.31	**0.384**	–0.186
Time required to start a business	0.291	0.092	**0.025**	0.069
Total unemployment rate	–0.107	0.154	0.559	–0.158
Wage and salaried workers, total	–0.187	0.247	0.542	–0.388
Labor force with advanced education	0.848	0.489	**0.23**	1.379
Poverty headcount ratio at $1.90 a day	0.033	0.124	0.646	1.92

Table 6. Posterior estimates of principal components of explanatory variables in case of Czech Republic (source: own results)

Component	alpha	Eig.	lambda
1	–0.554	76.501	5.055
2	0.000	43.465	10000
3	0.000	26.219	10000
4	0.000	9.905	10000

End of Table 6

Component	alpha	Eig.	lambda
5	0.000	5.885	10000
6	0.000	3.204	10000
7	–0.023	1.528	100.944
8	–1.358	0.853	0.909
9	0.000	0.278	10000
10	0.000	0.111	10000
11	0.000	0.050	10000
12	0.000	0.000	10000

In Slovakia, more macroeconomic variables had a significant impact on FDI in the period 2005–2016, after country's integration in the EU (Table 7):

- GDP per capita growth;
- Exports of goods and services;
- Total tax rate;
- Inflation rate;
- Corruption index;
- Youth unemployment rate;
- Time required to start a business;
- Labor force with advanced education;
- Poverty headcount ratio at $1.90 a day.

GDP per capita growth had a positive impact on FDI inflows in Slovak Republic, but the increase in exports did not encouraged FDI, because exports level had not a satisfactory level compared to other countries in the region. The foreign investors in Slovakia look for human resources quality, but they are sensitive to poverty issues. They are not interested in aspects related to business start-up (costs and time to start a business) since the time and costs for beginning a business in this country are acceptable. Corruption issue seems to be an important criterion in deciding to locate a foreign company in Slovakia. Our result is consistent with the conclusion of Amarandei (2013) and Castro and Nunes (2013) that showed a negative impact of corruption on FDI in Slovakia and other CEE countries.

Table 7. Marginal posterior summary estimates for generalized ridge regression in case of Slovak Republic (source: own results)

Covariate	Beta	Standard deviation	PP1SD	b
Intercept	0	0	1	–9.026
GDP per capita growth	0.332	0.101	**0.02**	0.081
Exports of goods and services	–0.203	0.035	**0.000**	–0.022
Cost of business start-up procedures	0.344	0.062	**0.000**	0.247
Total tax rate	–0.310	0.062	**0.001**	–0.259
Inflation rate	0.209	0.041	**0.001**	0.116
Corruption index	–0.199	0.131	**0.294**	–0.056

End of Table 7

Covariate	Beta	Standard deviation	PP1SD	b
Real effective exchange rate index	–0.026	0.106	0.649	–0.005
Broad money	–0.131	0.164	0.531	–0.0035
Youth unemployment rate	–0.155	0.079	**0.171**	–0.033
Time required to start a business	0.452	0.125	**0.011**	0.076
Total unemployment rate	–0.006	0.070	0.661	–0.003
Wage and salaried workers, total	0.284	0.070	0.6005	0.247
Labor force with advanced education	0.342	0.058	**0.000**	0.124
Poverty headcount ratio at $1.90 a day	–0.050	0.043	**0.407**	–0.388

The most relevant FDI determinants in Slovakia (exports, cost of business start-up procedures, labour force with advanced) could be summarized as a principal component that reflects aspects related to costs and resources in the host country (Table 8).

Table 8. Posterior estimates of principal components of explanatory variables in case of Slovak Republic (source: own results)

Component	alpha	Eig.	lambda
1	–0.899	71.503	1.728
2	0.000	41.814	10000
3	0.000	19.364	10000
4	0.000	16.667	10000
5	0.000	9.729	10000
6	0.000	4.286	10000
7	0.298	3.313	13.699
8	–1.358	0.911	10000
9	0.000	0.3	10000
10	0.000	0.089	10000
11	0.000	0.025	10000
12	0.000	0.000	10000

Overall, the generalized ridge regressions identified a common factor affecting FDI net inflows in the V4 countries: perceived corruption index. Total tax rate is common for three countries (Poland, Hungary and Slovak Republic). In Poland, Czech Republic and Slovakia, the perceived corruption negatively affected the FDI, will in Hungary the level of corruption did not discourage the foreign investors. Even if corruption is a big risk for business environment and Hungary is classified by Transparency International among the most corrupted countries in the CEE region, aspects related to standard of life and exports seem to be more important for foreign investors when deciding to come in Hungary. For Hungary, Czech Republic and Slovakia, there are some common factors affecting FDI that are related to human resources quality: youth unemployment rate and labor force with advanced education.

These variables will be considered in the panel analysis. Granger causality in panel was tested on stationary data (Table 9).

Table 9. Granger causality test for FDI and other variables in V4 countries (2005–2016) (source: own results)

Cause → Effect	F- statistic	Prob.
Youth unemployment variation → FDI	0.5699	0.5722
FDI → Youth unemployment variation	1.8819	0.1717
Corruption index variation →FDI	1.4127	0.2609
FDI → corruption index variation	2.3863	0.1111
Total tax rate → FDI	1.6646	0.2057
FDI → total tax rate	3.3989	0.0463
Change in Labour force with advanced education → FDI	0.4863	0.6201
FDI → Change in Labour force with advanced education	0.0261	0.9742

According to Granger causality test, the changes in youth unemployment rate and labour force with advanced studies as well as total tax rate and corruption index were not causes for FDI. However, the FDI attraction in V4 countries generated changes in corruption index and total tax rate at 10% level of significance.

A panel ARDL model was estimated for V4 countries (Table 10). The PMG estimator is used to restrict the long- term coefficients to have the same value across countries and only the short-term coefficients may change.

Table 10. Panel ARDL model to explain FDI in V4 countries (2005–2016) (source: own results)

Error correction term	Coefficient	z	Prob.
Corruption index in previous year	–0.1694	–5.2	0.000
Labour forced with advanced education in previous year	0.9291	10.99	0.000
Short-run			
ECT	–1.2189	–4.43	0.000
Corruption index in first difference	0.0871	0.51	0.607
Labour forced with advanced education in first difference	–1.1382	–1.21	0.224

The results based on panel ARDL model indicated that there is a significant relationship between FDI, corruption index and Labour forced with advanced education in V4 countries only on long-run. The relation is not significant on short-run at 5% level of significance. So, the foreign investors are interested in corruption and the quality of labour resources as tendency on a longer period and they are not so sensitive to sudden changes from a year to another.

Given the particular position of FDI inflows in Hungary compared to the other countries, a separate analysis in panel will be provided for Poland, Slovakia and Czech Republic.

The Granger causality on panel data was checked (Table 11) for three countries (Poland, Czech Republic and Slovakia) because Hungary FDI behaved as an outlier.

Table 11. Granger causality test for FDI and other variables in Poland, Czech Republic and Slovakia (2005–2016) (source: own results)

Cause → Effect	F- statistic	Prob.
Youth unemployment variation → FDI	0.4138	0.6669
FDI → Youth unemployment variation	1.7759	0.1963
Corruption index variation → FDI	1.8232	0.1886
FDI → corruption index variation	2.4078	0.1169
Total tax rate → FDI	1.4198	0.2630
FDI → total tax rate	4.6916	0.0201
Change in Labour force with advanced education → FDI	0.8518	0.4423
FDI → Change in Labour force with advanced education	0.1358	0.8738

The results are almost similar with those for V4 countries. According to Granger causality test, the changes in youth unemployment rate and labour force with advanced studies as well as total tax rate and corruption index were not causes for FDI. However, the FDI attraction in the three countries generated changes only in total tax rate at 5% level of significance, but the issues related to corruption were not changed, as expected from the previous results. One can conclude that Poland, Czech Republic and Slovakia are more sensitive to corruption compared to Hungary.

Table 12. Panel ARDL model to explain FDI in Poland, Czech Republic and Slovakia (2005–2016) (source: own results)

Error correction term	Coefficient	z	Prob.
Corruption index in previous year	–0.1697	–5.21	0.000
Labour forced with advanced education in previous year	0.9293	10.99	0.000
Short-run			
ECT	–1.4419	–6.34	0.000
Corruption index in first difference	–0.04465	–0.30	0.765
Labour forced with advanced education in first difference	–0.3163	–0.5	0.619
Constant	86.6476	7.36	0.000

The results based on panel ARDL model (Table 12) are similar to those obtained for V4 countries. There is a significant relationship between FDI, corruption index and Labour forced with advanced education in Poland, Czech Republic and Slovakia only on long-run. The relation is not significant on short-run at 5% level of significance.

Conclusions and discussions

In this paper, an individual and panel analysis were conducted in order to identify the factors that affect FDI in V4 countries. In the study, we chose V4 countries as they are new EU member states from 2004, being among the most industrialized economies among recent

EU members. The new economic realities after 2004 (EU integration and world economic crisis) made V4 one of the region that attracted most of the FDI from EU-15, but significant decreases were observed in crisis period. All these countries make effort to attract more FDI inflows from EU-15 and other states (different incentives for FDI and plans established by Government) due to positive effects of FDI for economy (economic growth, jobs creation, higher salaries, productive sector expansion, innovation in production techniques etc.). However, Brincikova and Darmo (2014) did not find evidence for a positive impact of FDI on employment and, therefore, new efforts should be made to attract FDI that ensure a sustainable development in the host country. From this perspective, we considered necessary to identify the factors with a significant impact on FDI in V4 countries in order to focus the actions in precise key points. The efforts should follow two directions: improvement in strong points that attract FDI inflows in V4 region and minimization of negative points as corruption that the foreign investors.

The empirical results based on individual analysis showed that perceived corruption is a common factor that affects FDI inflows in V4 countries. In Poland, Czech Republic and Slovakia corruption was a serious brake for FDI since 2005. Even if Hungary is perceived as a country with high influence, the foreign investors do not care about this, being more interested in the quality of human resources and the possibility to export more. The panel approach based on a panel ARDL model identified a significant relationship between FDI, corruption index and Labour forced with advanced education but only on long-run, the foreign investors following corruption and the quality of human resources only as tendency in these countries. On the other hand, the Granger causality in panel was checked and the attraction of FDI inflows succeeded in generating changes in total tax rate, but the issues related to corruption were not reduced at an acceptable level for foreign investors in Poland, Slovakia and Czech Republic.

Our empirical study is limited by the short period of analysis (2005–2016) based on the data availability and conditioned by the EU membership. However, in a follow-up study a comparative analysis of FDI determinants before and after the entrance in the EU should be conducted and it would constitute an interesting pathway for further research. Therefore, novel strategies intended for attracting FDI designed by the governments and governmental agencies should take into account more effective measures to reduce corruption in Poland, Slovakia and Czech Republic. In Hungary, the measures to reduce poverty are welcome together with the improvement of human resources quality.

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