

THE POTENTIAL OF THE EU ECONOMIES IN ATTRACTING FDI – A COMPOSITE INDEX BASED APPROACH¹

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Abstract

The paper presents a composite index which measures the potential of the 28 European Union (EU) member countries in attracting foreign direct investments (FDI), for the period 2000 – 2012. Several new variables (in respect to other aggregated Indices) linked to the latest development policies of the European Union are considered in the construction process of the proposed index. By comparing several versions of the constructed index with some of the most notorious indicators used to measure the FDI attractiveness, we find that the PCA (principal component analysis) version of our index shows the best performance in tracking the FDI activity of the EU economies. The empirical results show that the FDI activity is concentrated in the developed economies, confirming therefore previous results presented in the literature. The construction methodology of our index allows the identification of the main characteristics of the European economies which should be taken in consideration by the national governments when forging policies for increasing the FDI attractiveness of their economies. Among other practical applications of the proposed index, it can be used as a starting point for identifying benchmark economies which can help policymakers identify best practices and innovative approaches for the areas where their economies are lagging behind.

Keywords: FDI potential index; FDI determinants; PCA; composite index; EU member states

1. Introduction

Even though, the foreign direct investments (FDI) are considered as being a rather important determinant of the economic development of an economy, researchers have not reached a generally acceptable conclusion and their results are strongly influenced by the panel of countries included in the analysis, by the time period taken under scrutiny and by

the methodological approach employed.

FDI are bidirectional linked with globalization and they have become a desired source of capital inflows for most governments which are doing their best to lower barriers. Following this trend, the European Union can be considered a very good example in this regard due to its fundamental principles which aim to ensure the free movement of capital, goods and labour force within the Union and progressively increase the degrees of domestic market openness to foreign investors and international trade.

The objective of this article is twofold: to measure the potential of EU member countries in attracting FDI and to compare our index with the alternative indicators proposed in literature. Even though there is a wide debate on the main determinants of FDI inflow in the empirical literature, the niche dealing with aggregate indicators which measure different characteristics of the FDI phenomenon is rather poor. In order to contribute on this issue, we propose an aggregation of some macro-economic characteristics of the 28 EU member states in an index which can measure the potential of these economies in attracting FDI.

From a methodological viewpoint, we modify the methodology proposed by Nardo et al. (2005) to better fit the structure of our sample (panel data). As a positive result, we report the construction of an aggregate index which has a higher power in tracking the FDI potential (measured through stock of FDI/capita) of the economies from the European Union than other existing indices developed by the United Nations Conference on Trade and Development (UNCTAD) and by Groh and Wich (2012). As an important limitation, for a wide use of the proposed index, we point out that in order to preserve its characteristics it needs to be periodically monitored and optimized.

The outline of the paper is as follows. The section 2 provides an overview of the empirical and theoretical literature on FDI flows. Section 3 describes the empirical approach and data. The results are discussed in Section 4 which is followed by a section of conclusions

2. Literature review and general framework

FDI are considered one of the most important catalysts both for the economic growth at national level and, as the driving force of the globalization process. An ample literature deals with the analysis of the main determinants of FDI³. Taking this literature as a theoretical background, this article aims to contribute to this issue by providing an aggregate measure of those determinants identified by previous research.

The research conducted in the field follows two main directions when discussing the topic of FDI determinants. The first direction pursues a micro level approach and tries to identify which (external and internal) factors can incentivize the management of a firm to consider investing abroad as a viable development opportunity. As regards our approach, these papers can only provide hints of some potential macroeconomic characteristics of national economies related with the FDI activity, but cannot be considered direct sources for FDI determinants. Therefore, studies on this topic are not to be considered first hand materials that can be used when trying to analyse the potential or the attractiveness of a sample of economies regarding the FDI issue.

The second perspective deals with the FDI activity at macro level. It tries to identify those macroeconomic characteristics of an economy that are important for a sample of countries during a specific period of time. An impressive variety of factors were identified in literature as having implications in the location process of FDI.

The main limitation of this approach, as far as our research is concerned, is represented by the fact that the literature provides a large variety of determinants without being able to reach universally accepted conclusions. However, most of the researchers agree that FDI are attracted to a country by a combination of some of the following aspects: the existence of a potential new market, the possibility of increasing the efficiency of the activity and/or of using a better infrastructure, the possibility of optimizing the process of procuring the required resources and the presence of a stable economic and political environment.

Over time, different theories have been constructed, with the clear purpose of explaining the reasons behind the location process of FDIs.

2.1. Main FDI theories

Because this is principally an empirical paper, a comprehensive review of the FDI theories are beyond its scope. As a result we only consider some of the main researches relevant for our approach.⁴ The first attempts in this direction were made by researchers who presented the so called FDI theories which assume market perfection. Among these, the most important are the Heckscher-Ohlin model of neoclassical trade theory and the market size theory (Jorgenson, 1963; Chenery, 1952; Koyck, 1954). The latter tries to explain FDI as a response to the market behaviour represented by increasing sales. Noteworthy is the fact that most of the studies conducted in the field identify market size as being one of the most important determinants of the FDI. Another group of theories describes FDI activity as a result of the existing market imperfections both for goods and production factors (significant differences among different economies). Hymer (1976) and Kindleberger (1969) explain the FDI through the market structure and the firm specific advantages inside the industrial organization theory. According to this theory, companies may engage in FDI activities both in order to exploit one of their advantages (competitive advantage) and to diminish or eliminate competition between the two locations. The product life cycle theory, proposed by Vernon (1966), argues that firms engage in different types of FDIs depending on the stage of the life cycle of their product (they select between developing and developed economies) in order to maintain their competitiveness. Another important theory is the internalization theory (Coase, 1937; Buckley and Casson, 1976) which describes the FDI activity as one of the options that companies have in order to replace some forms of market transactions with internal (within the organization) transactions. The eclectic paradigm proposed by Dunning (1979, 1988) tries to be more like a general framework for explaining the FDI activity and it incorporates elements from the taxonomy developed by Behrman (1972), from the industrial organization theory, from the internalization theory and also from the location theory⁵. The currency area theory suggested by Aliber (1970, 1971) considers FDI as a result of different strengths among currencies. As far as our study is concerned these aspects are of little importance inside the European Union, where we have the Eurozone and a large part of the FDI are made by countries outside the Union (the common European market needs to be also taken in consideration). Other researchers (e.g., Kojima, 1973) explain the FDI activity through the propensity of companies towards trade activities and they identify trade oriented firms and anti-trade oriented firms. Another notable theory is the proximity – concentration theory (Helpman, 1984; Horstmann and Markusen, 1987) which explains the FDI as a response of the companies to the necessity of minimizing the distance to the potential customers. The knowledge – capital model proposed by Markusen (Markusen et al. 1996; Markusen, 1997) tries to provide an explanation for the mechanism employed by companies in

choosing between horizontal and vertical types of FDIs. According to the institutional theory (Narula and Dunning, 2000), companies tend to engage in FDI activities in search of a stable and predictable political and institutional environment. This theory might also be associated with certain geo-political aspects which tend to affect the attractiveness of some potential host countries.

2.2. Main FDI determinants

Considering that the literature providing empirical evidence about different FDI determinants is extremely large, we will just focus on those directions which we believe meaningful for our present research.

- Market related characteristics are crucial aspects for companies who decide to engage in FDI activities. Schneider and Frey (1985) identify market size measured through GNP/capita as having a significant influence on the inward FDI activity. Similar conclusions are reached by Vijayakumar et al. (2010) who find a positive link between GDP and the inflows of FDI. Even though market growth is not considered by the researchers as being of the same importance as the market size, Schneider and Frey (1985), Cleeve (2008) and Gastanaga et al. (1998) bring empirical evidence of a positive relationship between market growth and inflows of FDI.
- Natural resources are considered another important determinant due to the fact that having facilities in the proximity of such resources might ensure a better access to them (lower transport cost and often priority in exploiting/using them). Moosa (2002) and Asiedu (2006) bring empirical evidence linking positively the existence of natural resources with inward FDI activity.
- Infrastructure has been extensively studied by researchers as being a necessary a-priori condition for developing successful FDI. This is due to the fact that poor infrastructure increases operating costs and also slows the entire production-sale process. As far as the transport infrastructure is concerned, Khadaroo and Seetanah (2009) find that the length of paved roads positively influences the inflows of FDI. The communication infrastructure is also identified both by Asiedu (2002) and Khadaroo and Seetanah (2009) as having a positive impact on the inward FDI.
- The operating costs (mainly the production costs). Vijayakumar et al. (2010) find a significant evidence of a positive relationship between operating cost and FDI. On the contrary, Wheeler and Mody (1992) argue that low wages might be regarded as an indicator of low quality and low productivity, making therefore such a location unattractive for foreign investors.
- Corruption is considered as an inhibitor of FDI activity (e.g., Gastanaga et al. 1998, Wei 2000, Asiedu 2006, Cleeve 2008, Al-Sadig 2009, Morrissey and Udomkerdmongkol 2012).
- Political and institutional stability, together with corruption related aspects are assimilated to the institutional theory, mentioned in the previous sub-section. Schneider and Frey (1985), Asiedu (2006) and Morrissey and Udomkerdmongkol (2012) support through their findings the positive impact of political (institutional) stability on the inward FDI.

- Trade openness is found to have a positive influence on the FDI attractiveness. Asiedu (2002), Cleeve (2008) and Al-Sadig (2009) show that the openness of an economy is positively correlated with the inward FDI activity of an economy.
- The (social and) economic stability is also mentioned by some studies as being an important determinant of the inflows of FDI. Most researchers use as proxy for the macroeconomic stability the inflation rate (Al-Sadig 2009; Asiedu 2006) or the unemployment rate (Botrić and Skuflić, 2006).
- The human capital and the research and development level are other factors identified by empirical studies as having a positive impact on the FDI attractiveness of an economy. Al-Sadig (2009) and Cleeve (2008) both use as a proxy for human capital the secondary school enrolment level and find a positive correlation with the inflows of FDI.
- Environment related aspects. Some studies support the idea that FDI tend to be attracted by locations where legislation in this domain is more permissive (e.g., Henna, 2010).

2.3. Aggregate indices measuring the FDI attractiveness or FDI potential of an economy

Few studies present aggregate indicators with a large usability as far as the measurement of the FDI potential or FDI attractiveness of an economy is concerned. One of the best known indices from the field is the FDI Inward Potential Index developed by UNCTAD. This index is used to assess the FDI activity of a country. The latest version of the methodology employed for constructing the FDI Inward Potential Index (hereinafter FDIUN) was presented by World Investment Report (WIR) 2012. The present methodology implies a simple average of four intermediate indices computed for four key economic determinants of FDI:⁶ market attractiveness, availability of low labour and skills, presence of natural resources and enabling infrastructure (which has three sub-groups: transport infrastructure, energetic infrastructure and telecom infrastructure). The FDI Inward Potential Index is computed for a sample of 177 countries across the world.

Another notable index is the FDI Index proposed by Groh and Wich (2012) (hereinafter FDIGW). Groh and Wich's approach follows the methodology proposed by Nardo et al. (2005). It includes four sub-indices: economic activity, legal and political system, business environment and infrastructure. The FDI index is estimated for a sample of 127 countries.

Other studies have used a gravity approach to derive a measure of the FDI potential (Egger, 2010). This method has the advantage that the weights are implicitly estimated by a regression model and to predict the level of FDI by the model which is based on the actual values of exogenous variables and the parameter estimates (see also Bellak et al. 2010). However the differences in FDI theories explain the different models and results of empirical applications of gravity approach, therefore a puzzling issue exist in this approach on econometric specification.⁷

2.4. FDI activity across the European Union for the analysed period

The inward FDI activity, measured as FDI stock, at the level of the European Union during the 2000 – 2012 period, expressed as a percentage of total world activity peaked in 2004, when 10 new members were accepted. Another important year was 2008 (last year before the effects of the global economic crisis were severely affecting European economies)

when two new members, namely Romania and Bulgaria, were included in the Union. From 2008 the trend continuously descended until 2013, when the EU stock of FDI represented only little over 33.7% of the world stock. During the same period, the USA stock dropped severely from 37.06% to only little over 19.3% and the stock of the BRICS countries almost doubled from 5.43% to over 10.3%. Also notable is the fact that at the end of the analysed period the only stock on a negative trend, among the three presented economies, was the European one. Even though, our main concern is with the potential of EU economies in attracting FDIs, the performance of EU in attracting FDI, relative to the performance of other entities can provide important information about the real exploitation of the existing potential.

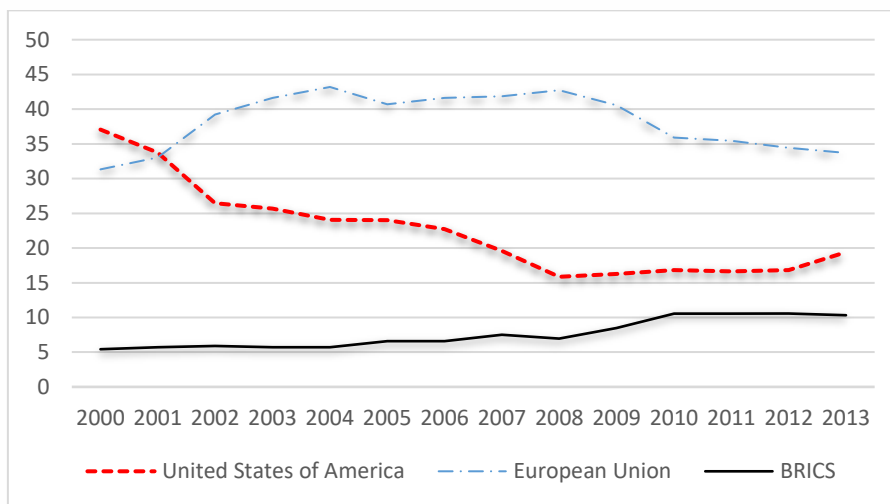


Figure 1. The evolution of FDI stock (% of world total) for USA, EU and BRICS 2000 – 2013

Source: Authors' work

3. Data issues and methodology

The proposed aggregate index starts by including the variables used in the last version of the FDIUN. To the list of 17 (divided into four groups) variables we have added 6 new variables (variables from 17 to 23, included in group 5 – Table 1) which are in line with the previously presented literature on the determinants of the FDI location process, even though they were not previously included in the construction of a potential/attractiveness index. These 6 new variables are also important for the fundamental principles of the European Union and for the Europe 2020 Strategy, and as a consequence it is highly probable that investors considering EU economies for future investments will also take these aspects in consideration (as opposed to economies where these aspects are of no or just of marginal interest). The corporate tax rates are not included among the proposed variables (even though, several authors like Egger et al. 2009, argue that FDI inflows are located for tax saving motives) because they do not reflect the potential of an economy in attracting FDI and moreover, FDIs located based on taxation motives (conducting their business in other economies than the host economy) are under the attention of the European authorities and therefore this variable will probably lose much of its importance in the future. The employed data series are presented at the level of each of the 28 national economies for the period 2000 – 2012. All data were downloaded from the databases of the World Bank, Eurostat

and UNCTAD. The data series were affected by the presence of missing values. We replace these values with the average values of the neighbour values or with the average for a period of three years (previous years or following years) before the construction of the index. All the information regarding the included variables will be presented in table 1.

Table 1. Individual indicators included in the construction of the aggregate index

Number	Title of the indicator	Group var.	Source	Missing values	Measurement units	Min (z - score)	Max (z - score)
V1	GDP	G1	WB	No	PPP (constant 2011 intern. \$)	-0.69	3.43
V2	GDP percapita	G1	WB	No	PPP (constant 2011 international \$)/population	-1.54	4.36
V3	GDP growth	G1	WB	No	Annual %	-5.33	2.59
V4	Total labour cost	G2	Eurostat	Yes	Euro	-1.45	2.00
V5	Labour productivity per hour worked	G2	Eurostat	Yes	Euro per hour worked	-1.37	2.37
V6	Employment in industry	G2	WB	Yes	% of total employment	-2.60	2.23
V7	Ores and metals exports	G3	WB	No	current US\$	-0.62	6.45
V8	Fuel exports	G3	WB	No	current US\$	-0.60	6.17
V9	Agricultural land	G3	WB	No	sq. km.	-0.84	2.83
V10	Road density	G4	WB	Yes	km of road per 100 sq. km of land area	-0.94	4.93
V11	Length of motorways	G4	Eurostat	Yes	Km.	-0.64	3.47
V12	Rail lines	G4	WB	Yes	total route-km	-0.87	3.27
V13	Liner shipping connectivity index	G4	UNCTAD	Yes	points	-0.95	2.26
V14	Electric power consumption	G4	WB	No	kWh per capita	-1.25	3.02
V15	Fixed telephone subscriptions	G4	WB	No	per 100 people	-2.11	2.05
V16	Mobile cellular subscriptions	G4	WB	No	per 100 people	-2.74	2.82
V17	Fixed (wired) broadband subscriptions	G4	WB	Yes	per 100 people	-1.23	2.34
V18	Aggregate Index of Corruption	G5	WGI - Authors	No	points	-1.72	1.82
V19	Electricity production from all renewable sources	G5	WB - Authors	Yes	% of total	-1.02	2.85
V20	Activity rate (15 to 64 years)	G5	Eurostat	Yes	% of total	-12.9	1.96
V21	WGI Aggregate Index	G5	Authors	No	points	-2.69	1.77
V22	Research and development expenditure	G5	WB	Yes	% of GDP	-1.55	3.08
V23	Import + Export	G5	WB	Yes	PPP (constant 2011 intern. \$)	-0.79	4.81

Source: Authors' work

The methodology employed for construction of the aggregate indicator follows Nardo et al. (2005) for constructing composite indices.

In the first step, we smooth the differences caused by different measurement units of the variables by standardization. Following Nardo et al. (2005), the standardized values were computed as follows:

$$\bar{x} = \sum_{i=1, \dots, 28} \sum_{j=1, \dots, 13} x_{ij} / 364; \sigma = \sqrt{\sum_{i=1, \dots, 28} \sum_{j=1, \dots, 13} (x_{ij} - \bar{x})^2 / 364}; z = (x_{ij} - \bar{x}) / \sigma \quad (1)$$

In the second step, the weights are computed using three alternative methods: (1) a Principal Component Analysis (PCA) is conducted to compute the weights using the eigenvalues and the percentage of variance explained by the selected PC-s; (2) Equal weights for all included variables; (3) Equal weights for all variables of a group (within the group) and equal weights for each group.

As a final step we apply a linear aggregation method.⁸ Accordingly, the FDI Potential Index (FDI_{PI}) is given by a linear combination of the included variables.

$$FDI_{PI} = \sum_{i=1}^n w_i V_i \quad (0)$$

Concerning the weighting scheme, we apply the following approach. First, we estimate PCA on all 23 potential determinants of FDI inflow. PCA outcome shows that GDP growth (V3), employment in industry (V6) and road density (V10) have negative weights (i.e. aggregate loadings based on the first five eigenvectors). This result is theoretically counterintuitive therefore we eliminate these three variables. Afterwards a new PCA is conducted on the remaining 20 variables. The obtained weight for the variable agricultural land is negative and according to the previously adopted approach this variable was eliminated and a new PCA is conducted on the remaining 19 variables. In order to select the best performing index all the computed indices (PCA weights, equal weights, or group equal weights) were compared (in a third step methodology) using correlation coefficients computed for each country between the time series of the index and the time series of the FDI stock of the next year.

Summarizing the results of this comparison we conclude that the best performing index, in term of better prediction of FDI stock in the next period, is the one computed with PCA weights from 20 variables. However, we need to mention that the differences between the PCA index and the indices computed with equal weights or group equal weights are of little magnitude. Further assessment of their performances will be conducted in the following sections.

4. Empirical results

In this section we discuss the outcomes of the composite index of attractiveness of FDI and we benchmark our index with two main alternative measures proposed in literature: the FDI Inward Potential Index estimated by UNCTAD and the FDI Attractiveness Index proposed by Groh and Wich (2012).

This section ends with an assessment of the tracking power of our index regarding future FDI activity.

4.1. The FDI_{PI} - PCA approach

Concerning the PCA, we find that the first principal component is strongly correlated with five of the original variables. In particular, the first PC increases when labour productivity, labour costs, expenditure on research and development, size of imports plus exports and freedom from corruption increase. At the same time, the second PC increases when consumption of electric power, the WGI aggregate index, freedom from corruption, the GDP/capita and research and development expenditure increase. The third PC increases when the number of mobile subscriptions, the number of broadband subscriptions, ores and metals exports and fuel exports and the activity rate increase. Finally, the fourth PC increases

when the quantity of electricity produced from renewable resources, expenditure on research and development, the length of the rail lines, the area of agricultural land and the length of the motorways increase.

Table 2. The loadings of the individual indicators and the aggregated loading for the index

Variables	Loadings				Aggregated Loadings
	PC 1	PC 2	PC 3	PC 4	
GDP	0.24405	-0.30667	-0.04605	0.06881	0.03454
GDP percapita	0.22813	0.23744	-0.10007	-0.15024	0.13379
GDP growth	0.30293	0.15745	-0.03968	-0.01965	0.16063
Total labour cost	0.29520	0.17453	-0.12365	-0.09800	0.14931
Labour productivity per hour worked	0.25353	-0.20808	0.17149	-0.04679	0.07217
Employment in industry	0.22483	-0.12358	0.28831	-0.30238	0.07314
Ores and metals exports	0.13843	-0.34589	-0.10800	0.19431	-0.01688
Fuel exports	0.22718	-0.28007	-0.07919	0.18813	0.03805
Agricultural land	0.18870	-0.32533	-0.09209	0.25346	0.01427
Road density	0.24748	-0.21632	0.03879	-0.24043	0.04453
Length of motorways	0.19200	0.28859	-0.11142	0.14931	0.14770
Rail lines	0.23205	0.06240	-0.36490	-0.11750	0.07530
Liner shipping connectivity index	0.10596	0.11896	0.57484	0.04102	0.12317
Electric power consumption	0.19091	0.10905	0.52599	-0.03504	0.14833
Fixed telephone subscriptions	0.26761	0.23833	-0.13707	-0.01187	0.15632
Mobile cellular subscriptions	0.00157	0.12193	0.11168	0.71783	0.08248
Fixed (wired) broadband subscriptions	0.15876	0.13282	0.16388	0.11864	0.11918
Aggregate Index of Corruption	0.23961	0.26980	-0.13810	-0.07476	0.14757
Electric. Prod. from all renewable sources	0.25518	0.18621	-0.01135	0.31549	0.17002
Activity rate (15 to 64 years)	0.26323	-0.27394	0.02367	-0.01595	0.05078

Source: Authors' work

Table 3. The percentage of variance recovered by each PC

Principal Component	Proportion of variance recovered	Cumulative proportion of variance recovered
PC1	42.66%	42.66%
PC2	22.82%	65.49%
PC3	8.40%	73.88%
PC4	6.21%	80.10%

Source: Authors' work

Using the aggregated weights (computed using the loadings in the eigenvectors) we have constructed four groups of variables, using an approach based on quartiles.

Table 4. Relative importance of the individual indicators in the aggregate index

	Variables
Top five highest weights	Research and development expenditure, Total labor cost, Aggregate Index of Corruption, Labor productivity per hour worked, Fixed (wired) broadband subscriptions
High weights	Electric power consumption, WGI Aggregate Index, GDP/capita, Mobile cellular subscriptions, Activity rate (15 to 64 years)
Low weights	Electricity production from all renewable sources, Fixed telephone subscriptions, Fuel exports, Ores and metals exports, Import + Export
Top five lowest weights	Liner shipping connectivity index, Length of motorways, GDP, Rail lines, Agricultural land

Source: Authors' work

The first group of variables includes variables related with research and development, labour cost, corruption and IT&C infrastructure. The inclusion of these variables in the first group might be regarded as a clear explanation of the FDI concentration in the developed economies and an empirical evidence that foreign investors targeting EU economies look for uncorrupted and developed high tech economies. The second group also includes infrastructure related variables, GDP per capita and activity rate which might be a measure of both the purchasing power of a market and the overall institutional context of a national economy. Therefore, based on the clusters presented above we infer that foreign investors interested in EU economies seek a stable economy with efficient and low cost labour and an environment free of corruption and with significant investments in and consumption of IT technologies.

The third group of variables reveals that EU countries are not a target for investors seeking natural resources. The less relevant loadings in the first five PCs include variables related to transport infrastructures. This might be due to the fact that most EU countries (except Romania and Bulgaria) have a highly developed transport infrastructure system. The development of the transport infrastructure (TENT-Network) at the level of the entire UE reduces disparities on FDI attractiveness among the member states. Also, the inclusion of the level of GDP in this group might be evidence of the fact that foreign investors interested in investing in the European Union, do not target the size of a specific market for their products, but given the free movement of goods, they take into account the quality of the institutional and technological environment for productive activities.

The six newly added variables are distributed among the three groups, namely two for each group (see Table 4). Therefore, it is clear that aspects like research and development (which is the most important) expenditure and corruption have a significant contribution in defining the potential of the EU economies in attracting FDI. On the other hand, it is also obvious that electricity production from renewable sources (targets proposed in the field of green energy, at the level of the EU are considered by some more than optimistic and therefore not-feasible) and the size of imports and exports (the influence of the common market of EU is obvious when referring to the importance of this variable) have very little impact on the FDI potential.

4.2. FDI Potential Index – Countries ranking

As several studies have suggested, the FDI activity tends to agglomerate in developed countries (Ernst and Young's attractiveness survey 2015, World Investment Report 2014 (WIR 2014), Groh and Wich 2012, Notre Europe 2003). Even though during the last decade the east European countries (EU members) have become more and more attractive, since they were accepted as EU members, they are not in a position to challenge the potential and the attractiveness of the countries from the EU15.

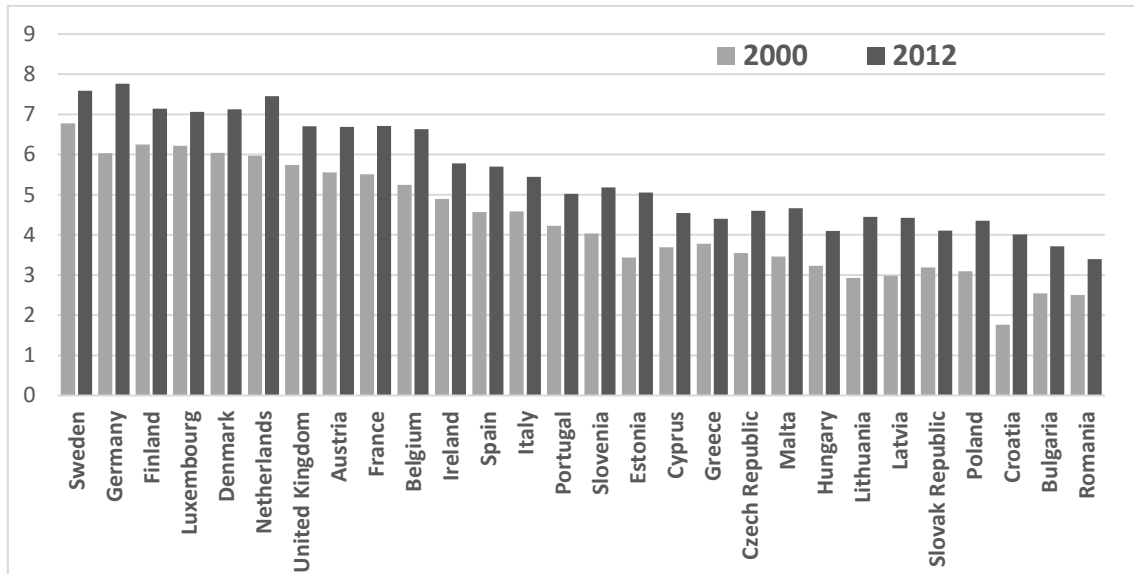


Figure 2. The ranking of the EU member states -FDI_{PI} scores in the 2000/2012

Source: Authors' work

According to our Index, the greatest FDI potential is concentrated, for the entire period in Sweden, Finland, Luxembourg, Denmark, Germany and the Netherlands. Until 2006 Sweden is ranked first and it is followed by Luxembourg, Finland and Denmark. Starting from 2004 Germany enters on an ascending trend, being ranked second in 2006 and first in 2007.

France, United Kingdom, Austria and Belgium follow the Scandinavian and German economies in terms of FDI attractiveness. In particular, according to our index, the United Kingdom presents the greatest potential, from this second group, for almost the entire period. From 2006-2007, France showed an increasing potential, surpassing during the last analysed period (2012) the UK.

Going further we have a third group of countries including Italy, Ireland, Spain, Portugal and Slovenia which are all, except Ireland, located on the southern flank of the European Union. The greatest potential, for the entire period is assigned by our index to the Irish economy. We also observe that while Italy was ranked over Spain at the beginning of the analysed period (2000-2001), the rankings have been reversed since 2002. During the entire period Estonia was increasing its potential, a phenomenon that might be somehow connected with the geographical proximity to the northern economies from the core group. The lower second part of the ranking is occupied for the entire period by countries like: the Czech Republic, Greece, Malta, Cyprus and Hungary. As was expected, Romania, Bulgaria and Croatia, the new members of the European Union, are ranked on the last positions over the entire period.

4.3. FDI Potential Index – A comparison with FDI_{PI}, FDI_{UN}, FDI_{GW}

In order to check the feasibility of our index we conducted a benchmark analysis with other indices measuring the country's FDI attractiveness. The analysis was conducted between our index and the FDI Inward Potential Index released by UNCTAD and the index proposed by Groh and Wich (2012).

In order to conduct this comparative analysis, we calculate the Spearman rank correlation coefficient at country level. The comparison was conducted for several years from the period 2000 – 2012, depending on the availability of data for each of the indices.

Table 5. Correlation coefficients between the three indices

	2000	2005	2006	2007	2008	2009	2011
FDI _{UN} vs FDI _{PI}	68.75%	91.52%	92.5%	89.71%	90.09%	87.03%	37.27%
FDI _{UN} vs FDI _{GW}					77.07%		
FDI _{PI} vs FDI _{GW}					79.53%		

Source: Authors' work

The correlation between our index and the FDI_{UN} is high for all the presented years excepting the one for 2011. Important to mention is the fact that the UNCTAD index is computed using the old methodology (as a simple average for 12 individual indicators) for the entire period, excepting the year 2011 when it was computed using the new methodology⁹ presented in WIR (2012)¹⁰. The correlation remains positive even for 2011 but it is significantly lower.

The Groh and Wich's Index only provides one value for 2008 (in the computation of their index they use data recorded for 2006, 2007 and 2008). However, in 2008 the three indexes are positively and highly correlated among themselves.

In 2000, the FDI_{UN} assigns higher ranks than our index for 12 of the economies which have become EU members starting from 2004. In our opinion this optimistic approach might be a better reflection of short-term attractiveness than of real potential (according to their macro-economic social and institutional situation).

From the Western economies: Belgium, Ireland and the United Kingdom are ranked at the top of the hierarchy for almost the entire period. It is a known fact that both Belgium and Ireland are targets for FDI which use those facilities as headquarters for companies operating in other EU member states, due to different incentives and facilities. As far as the United Kingdom is concerned, a possible explanation for its attractiveness might be the well-known economic and institutional stability of this country.

The ranks assigned using our potential index present a higher stability across time than those assigned using the FDI_{UN}. Furthermore the greatest difference is recorded for the period 2011/2009 which corresponds to the change in the methodology of the FDI_{UN} and therefore should be regarded as a consequence of the different methodology applied by UNCTAD rather than a lack of robustness in the our index (FDI_{PI}).

4.4. The tracking power of the proposed indices

In this subsection, we further evaluate the robustness of the constructed index by analysing comparatively the correlations between the rankings (for all 28 EU economies) provided by different indices and the rankings constructed using the value of the stock of FDI/capita. In order to provide an assessment of the tracking power of our index the presented correlation coefficients were computed using the indices for year (t) and the stock series for year (t+1).

The stock of FDI was selected rather than the inflow of FDI given that the latter presents a significantly higher variability having therefore little stability. A solution preferred sometimes by researchers is to compute the average or total flows for a certain number of years. In our opinion this option involves a high degree of subjectivity because the decision

regarding the number of periods included in computations is arbitrarily made. Moreover, taking into consideration the structure of the aggregate index, which is based on several macroeconomic indicators, large variations from one period to another are highly improbable. Thus, an aggregate index is more suitable for assessing the potential (attractiveness) for longer time periods than it is for assessing high variability for short time periods (perception indices are much more appropriate for such a task).

The indicator per capita was selected instead of the overall indicator due to the fact that the 28 economies included in the present analysis are of significantly different sizes. By selecting the per capita indicator we intended to increase the comparability between economies. Moreover per capita indicators are used to display the strength/intensity of a phenomenon and, in our opinion, are much more suitable for measuring the potential of an economy.

Table 6. The correlations between the FDI indices and the stock of FDI/capita

	2000	2005	2006	2007	2008	2009	2011
FDI _{PI}	0.6574	0.4997	0.5101	0.4444	0.4631	0.4466	0.4297
FDI _{PI} - equal weights	0.5753	0.3957	0.3530	0.2813	0.6563	0.3207	0.3060
FDI _{PI} -group equal weights	0.5933	0.4138	0.3749	0.2917	0.6951	0.3410	0.3109
FDI _{UN}	0.3508	0.4735	0.4373	0.4122	0.6267	0.4751	-0.0898
FDI _{GW}					0.1576		

Source: Author's work

The values of the coefficients listed in table 6 support the fact that the FDI_{PI} is the aggregate index with the best performance with the exception of 2009, that is however a period heavily influenced by the economic crisis. FDI_{PI} displays a superior performance to the FDI_{UN} also for the year 2011, when the index proposed by UNCTAD was constructed using the new methodology.

The FDI_{PI}, constructed using PCA displays better performance than the indices constructed using equal weights with the exception of 2008 that is again an outlier due to the international economic crisis. The preference for PCA weights makes, therefore, more valuable the additional work needed for constructing the aggregation methodology.

Summing up we can state that, taking into consideration the results presented, even though it is far from being a perfect alternative, our index can be considered a suitable tool for measuring the potential of the European economies in attracting FDI. Although we need to mention that the superior performance of our index might be explained by the fact that it is developed only for the EU economies when all other indices included in the analysis cover significantly larger sample of countries.

5. Conclusions

The paper can be included in the broader literature developed for the topic of FDIs and, more specifically, in the significantly narrower niche of research trying to develop aggregate indicators to measure the FDI attractiveness of a sample of economies.

We start from the FDI determinants proposed by UNCTAD in their methodology described in WIR2012 for the Inward FDI Potential Index. As a particularity, our study proposes a set of six new proxy indicators which can explain better the FDI potential of an EU economy. These variables measure some FDI determinants which are not included in the approach presented by UNCTAD, due to different limitations.

In constructing our index we also use a modified version of the methodology proposed by Nardo et al. (2005). We propose three aggregate indicators, using equal weights for all individual indicators, equal weights for each group of indicators and a more complex weighting system based on PCA loadings. Comparing the three indicators we find that the most performant alternative is the one constructed using PCA weighting system.

In order to check the quality of our index we compare it with the one proposed by UNCTAD and with another attractiveness indicator presented by Groh and Wich (2012). Our indicator proves to be very similar to the Inward FDI Potential Index of UNCTAD, computed using the old methodology and significantly less similar to the one computed using the new methodology.

Our index displays better performance in tracking the FDI potential of an economy, proxied by the stock of FDI/capita both as: the index proposed by UNCTAD and the index proposed by Groh and Wich. One potential explanation for the superior performance of our index might be represented by the fact that our index is specially tailored for the EU countries while the other indices cover significantly larger sample of countries.

As was expected, our results are in line with most of the literature and the reports published by prestigious international institutions, displaying a higher potential for the developed economies. While Sweden, Germany, Denmark, Netherlands and the United Kingdom are ranked in the first places over the entire period, Romania and Bulgaria close the rankings.

Even though, since 2004 the EU has enlarged three times its stock of FDI (expressed as percentage of world stock of FDI) has not increased significantly but has rather entered a negative trend starting 2008 and in the same time the BRICS countries and the USA are increasing their importance. The weak economic growth recorded at EU level (after the global economic crisis) and several socio-political and economic challenges that have affected several member states might be an explanation for the lower performance recorded by the EU in attracting new FDIs.

Given that the pattern of FDI flows modifies significantly from period to period under the influence of globalization and of the changes recorded in the development level of different economies the indicators need to be continuously monitored and optimized. Moreover, taking into consideration the two or three clusters of economies which can be created at the level of EU member states (using the economic development level) it would be valuable to develop some indicators which will be in ranking and describing the potential of economies from each class (such an approach is desirable due to the fact that the FDI determinants depend heavily on the development level of an economy and might have an increased practical usability).

Even though constructing such indicators is a laborious task, as a result of the large amount of information which needs to be gathered and processed, their importance needs to be analysed at macro level where they can be powerful and useful tools in assessing and even tracing the future evolution of FDI flows which are directionally connected with the economic development and prosperity of nations.

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³For a detailed description of the main determinants involved in the FDI location process see Chakrabati (2001), Clausing and Dorobantu (2005), Moosa (2000) and Acuncao et al. (2011). See Villaverde and Maza (2015) for an analysis of FDI at regional level in EU.

⁴Among surveys on this issue see Blonigen (2005) and Faeth (2009).

⁵It presents FDI as being a result of the existence of some production factors which are not internationally mobile.

⁶The previous methodology was based on a simple average of the scores (scores between 0 and 1) for 12 variables.

⁷Further alternative approaches of measurement of FDI are recently proposed by Rodríguez, et al. (2009) and Maza and Villaverde (2015).

⁸Literature proposes two alternatives (linear and geometric), due to the particularities of our data and as Nardo et al. 2005 suggested, the linear aggregation method is suited for indicators with the same measurement units and is also appropriate when the indicators with lower weights do not need to be further penalized.

⁹The new methodology proposed by WIR (2012) is presented in Box I.3.1, available in the report at page 30. The methodology proposes the inclusion of four main groups of determinants: market attractiveness, availability of low-cost labor and skills, presence of natural resources and enabling infrastructure. For all four groups of determinants the report proposes several proxy variables. In the final step, to obtain the overall index, the scores for the four determinants are combined using equal weights.

¹⁰For 2011 there are some significant changes in the ranks of some economies like: France, Poland, Romania, Hungary and Italy.