Economic Sentiment Indicators and Foreign Direct Investment:

Empirical Evidence from European Union Countries

ANDRZEJ CIEŚLIK
MAHDI GHODSI

Andrzej Cieślik is Professor at the Faculty of Economic Sciences University of Warsaw, Poland.
Mahdi Ghodsi is Economist at The Vienna Institute for International Economic Studies (wiiw).

Abstract

This paper studies the role of business sentiment in the decisions of multinational enterprises (MNEs) to undertake foreign direct investment (FDI) across European Union (EU) member states. Based on the knowledge-capital model, the study employs the Pseudo Poisson Maximum Likelihood (PPML) estimator and panel data to examine empirically the determinants of FDI across EU member states during the period 2003-2017. The empirical evidence suggests that better economic sentiment in an EU Member State induces MNEs to undertake FDI in that country, while worse economic sentiment in an EU member state motivates an MNE in that country to invest abroad.

Keywords: economic sentiment, factor endowments, foreign direct investment, multinational enterprise, market size, EU Member States

JEL classification: F21, F23

CONTENTS

TABLES AND FIGURES

Appendix

1. Introduction

Multinational enterprises (MNEs) are important actors in the ongoing process of globalisation in the world economy. Further, in the current digital era, and thanks to recent technological advances, frictions in transactions – in both trade and investment – are at their lowest. Yet from a microeconomic perspective, it takes quite a while for humans to build and yield effective economic outcomes based on their perceptions of their business environment, rational expectations, and cost optimisation. Nevertheless, consumer and business sentiment have proven to be good predictors of economic activity (Acemoglu and Scott, 1994; Benhabib and Spiegel, 2018).

An improvement in consumer sentiment usually reflects better future expectations by the consumer that would lead to higher final demand and consumption. Good business sentiment usually creates the mood of the business environment that induces investment in ongoing booming activity, which leads to higher economic growth in the future. In contrast, bad sentiment from a negative shock (e.g. political or election outcomes) in a market that has not yet matured in terms of its macroeconomic indicators would discourage investment and consumption in that market. However, investors in such a market would move their investments to other markets that have booming expectations and better sentiment.

The main goal of this paper is to study the role of economic sentiment in the decisions of MNEs to undertake foreign direct investment (FDI) across the European Union (EU) member states. Using the information available in the fdimarket database we test whether MNEs across the EU member states invest from a country that is experiencing a worsening of economic sentiment to another country with booming economic sentiment. For this purpose, we augment the long-run structural knowledge-capital (KC) model proposed by Markusen (2002, 2013) with the short run cyclical measures of economic sentiment.

Based on the augmented KC model, this study employs the Pseudo Poisson Maximum Likelihood estimator and panel data to examine empirically the determinants of FDI across EU member states during the period 2003-2017. In particular, in this paper we take into account the potential effects of economic sentiment for the host and partner countries in addition to traditional country characteristics such as market size, similarity and factor endowments. Moreover, in contrast to previous studies that had to rely on proxy variables for relative factor endowments, in this paper we use actual data on human capital endowments extracted from the Penn World Table 9.1 (Feenstra et al., 2015). The assembled empirical evidence suggests that better economic sentiment in an EU member state attracts MNEs to undertake FDI in that country, while worse economic sentiment in an EU member state motivates an MNE in that country to invest abroad.

The structure of this paper is as follows. The section below surveys the literature. The third section discusses the analytical framework and hypotheses development. In the fourth section, definitions and data sources for the empirical methodology are described. Finally, we present and discuss our estimation results in the fifth section. The paper concludes with final remarks and directions for future studies.

2. Literature review

While many theories have been proposed to explain the emergence of MNEs, two distinct reasons why a firm should internationalise production have been proposed in the theoretical literature: market seeking and efficiency seeking (Markusen, 2013). According to the first reason, MNEs are vehicles to overcoming distance and lowering the costs of access to foreign markets. Foreign direct investment (FDI) undertaken by MNEs to serve local markets is often called horizontal FDI. It refers to producing roughly the same goods and services abroad as in the home country. According to the second reason, firms internationalise production and become MNEs to get inputs at lower cost. FDI undertaken with the aim of reducing production costs is often called vertical FDI. It involves fragmenting production processes and locating each stage in a country where the factors used intensively in that particular stage are relatively cheap.

The first theoretical models of horizontal FDI were proposed by Krugman (1983) and Markusen (1984) and extended later by Horstmann and Markusen (1987), Brainard (1993a), Markusen and Venables (1998; 2000), Helpman et al. (2004), Sinha (2010), and Cieślik and Ryan (2012), to mention a few examples. At about the same time, Helpman (1984) and Helpman and Krugman (1985) proposed the first models of vertical FDI, where firms were able to choose the location of their headquarters and production facilities. Consequently, the next generation of models bridged horizontal and vertical motives for FDI into a single theoretical framework (Markusen, 2002; Bergstrand and Egger, 2007, 2013). In particular, Markusen (2002) proposed the unified knowledge-capital model of multinational enterprise in which firms can choose between exporting, horizontal or vertical FDI. One of the KC model's main contributions to the empirical literature on MNEs' location choice is that it has made it possible to differentiate between pure horizontal and vertical reasons for FDI with the use of endowment characteristics.[1]

Subsequently, Yeaple (2003) considered the possibility of firms combining both horizontal and vertical FDI via complex integration strategies that reflect the importance of transport costs and factor price differentials. In particular, in his model, low transport costs lead to the dominance of vertical FDI, and high costs lead to the dominance of horizontal FDI. Grossman et al. (2006) expanded the Yeaple (2003) model by including multiple stages of production and headquarters services to examine the equilibrium choices of firms that vary in their productivity levels. Grossman and Rossi-Hansberg (2008) developed a model of vertical FDI that focussed on offshoring in which the extent of offshoring depends on the efficiency of remote management and on wage differentials. Ramondo and Rodríguez-Clare (2013) built a calibrated general equilibrium model that extended the Eaton and Kortum (2002) framework to include multinational production and international technology transfer and combined horizontal and vertical FDI. Ekholm et al. (2007) developed a three-country model of export platform FDI to analyse the conditions under which firms use one country to produce for export back to the parent country, export to the rest of the world, or export to both. More recently, Tintelnot (2017) developed a quantifiable multicountry general equilibrium model, which tractably handles multinational firms that engage in export platform sales and that face fixed costs of foreign investment, in order to examine the determinants of

1 Therefore, we use the KC model as our analytical framework and describe it in detail in the next section.

multinational firms' location and production decisions and the welfare implications of multinational production.

Most empirical work on MNE activity has focused on US firms operating abroad as well as inward FDI in the US, while MNEs from other counties have received relatively less attention. The empirical studies on determinants of MNE activity were initiated by Brainard (1993b, 1997). She tested theoretical predictions derived from the models of both horizontally and vertically integrated MNEs. According to her findings most US MNEs were integrated horizontally and not vertically. Subsequently, her results were called into question by Carr et al. (2001) who estimated specifications directly derived from the more general model and found that US MNEs were integrated not only horizontally but also vertically. The importance of vertical FDI was confirmed later in follow up studies by Braconier et al. (2005), Davies (2008) and Bergstrand and Egger, (2013).[2]

Baltagi et al. (2007) estimated a "complex FDI" version of the knowledge-capital model of US outward FDI by various spatial panel data generalized moments (GM) estimators that were recently developed. They found that third-country effects were statistically significant, lending support to the theory of the existence of various modes of complex FDI. More recently, Ghodsi (2020) studied the relationship between technical barriers to trade and foreign direct investment. He finds that trade-restrictive technical barriers imposed by the host country induce more FDI that hints at tariff jumping motives of FDI.

This paper can be viewed as an extension of earlier papers studying FDI and MNEs in the EU using the KC model, such as the paper by Kristjánsdóttir (2010), Awokuse et al. (2012) and Stack et al. (2017). We argue that short-run drivers are important and therefore earlier studies that are based only on the KC model that use annual investment data are missing something important. Therefore, we complement the standard KC model that represents long-run, "structural" factors, such as home and host country factor endowments, with the economic sentiment indicators (ESIs) that represent short-run cyclical factors.

Survey-based sentiment data are usually studied with their application to times series analysis. Acemoglu and Scott (1994) used a measure of consumer confidence collected by a Gallup survey in 1974 to study rational expectations and their impact on long-term growth. Using Swedish business sentiment survey data, Hansson et al. (2005) ran a dynamic factor model applying a parsimonious vector autoregression (VAR) framework to forecast the growth of gross domestic product (GDP) at the aggregate level. In a similar framework, Slacalek (2005) found that the Michigan Index of Consumer Sentiment is a stable predictor of growth in aggregate consumption. He also discovered that one of the most effective individual questions for compiling this index is the expectation of unemployment. Kłopocka (2017) did a similar analysis for Poland. Wilms et al. (2016) studied the business survey conducted by the European Economic Research Institute (EUWIFO). Using the Granger Lasso technique, they found the most pertinent industries for predicting the German economy's future macroeconomic growth.

Hüfner and Schröder (2002) used four economic sentiment indicators, including the European Commission's ESI for Germany, and they compared the relationships of these indicators with the growth rate of German industrial production. Ifo business expectations, the Purchasing Managers' Index (PMI) and the ZEW Indicator of Economic Sentiment (ZEW) were other economic sentiment indicators in their

2 In the context of the European Union important examples of empirical studies of FDI determinants include Baltagi et al. (2007) and Martínez-San Román et al. (2016).

analysis, which significantly forecasts industrial production growth by six months, while the Economic Sentiment Indicator forecasts by only one month.

Cotsomitis and Kwan (2006) used the Consumer Confidence Indicator and Economic Sentiment Indicator provided by the European Commission and found that these indicators had limited capabilities in predicting the future path of household spending in nine old European Union member states. Clar et al. (2007) explored all six European indicators in the euro area during the period 1985-2002 by applying time series econometric models. The six indicators included were the Industrial Confidence Indicator, the Consumer Confidence Indicator, the Construction Confidence Indicator, the Retail Trade Confidence Indicator, the Services Confidence Indicator and their aggregated indicator ESI.

Lemmens et al. (2005) also used the same data for twelve EU member states and undertook a multivariate simultaneous approach to test the granger causality of these indicators on production levels. They found a statistically significant granger causality in seven out of twelve EU Members. Moreover, they also found cross-country granger causality, which stresses the necessity for a cross-country multivariate econometrics approach in analysing these indicators. Ghonghadze and Lux (2011) also used these data but combined maximum likelihood estimations with time series econometrics techniques such as the Autoregressive Moving Average model and the Autoregressive Fractionally Integrated Moving Average to analyse their forecasting dynamics. By applying a state space modelling with time-varying coefficients, Sorić (2018) found that the abrupt growth of the Consumer Confidence Indicator in eleven new EU member states prior to the financial crisis in 2008 indicated a psychological sentiment that stimulated the recession.

Gelper and Croux (2010) analysed three different aggregation methods to calculate the European ESI. They applied the simple weighting method used by the European Commission, the dynamic factor model (proposed by Stock and Watson, 2002) and the partial least square (frequently used in engineering and chemistry, Kotz and Johnson, 1982) to aggregate the five sentiment indicators (mentioned above) of the EU member states, to come to a final aggregated ESI at the EU level. In order to find the best aggregation method, they correlated the aggregated indicator with economic performance that was measured as industrial production growth at the EU level. In a VAR model suggested by den Haan (2000), where co-movement of industrial growth and economic sentiment was tested, they found that partial least square is the most suitable approach to aggregating the indicators into a single one. However, they argued that sentiment indicators cannot granger cause industrial production, and lagged values of industrial production would be sufficient predictors of the current values.

Using a similar VAR model, Taylor and MacNabb (2007) also analysed the co-movement of consumer and business confidence indicators with the GDP of four EU member states. They found that these indicators were good predictors of the turning points in the business cycles of these countries. Zanin (2010) also found co-movement between GDP and economic sentiment in a few EU member states. Van Aarle and Kappler (2012) also studied the impact of economic sentiment on business cycle fluctuations in the euro area by applying a VAR model. In particular, they found a strong impact of economic sentiment on output, retail sales, and employment during the period 1990-2011. They also found some evidence in the other direction of causality, meaning that economic conditions also strongly affected economic sentiment. This is in line with the findings of Ferreira et al. (2008). Ferreira et al. (2008) assumed economic sentiment as a direct measure of real economic activity and found that yield spreads influence future economic activity.

Although the literature is rich in articles which study the relationship between survey-based sentiments and the main economic indicators such as consumption, GDP, industrial production and employment, evidence of the impact of these survey-based indicators on general investment decisions, and in particular, on investment flows across countries, is still lacking. FDI is the suitable indicator to be analysed for such a research question. The reason for this is that with data on FDI one can find where the source of investment (home country) and the destination of investment (host country) are, and by controlling for the theoretical determining factors behind FDI on both sides, one can study the impact of sentiments on FDI.

As we are interested in the role of market conditions as reflected in the ESI on the decision-making process at the very micro level, we use data on aggregated firms' commitments to greenfield investment projects abroad as compiled in the fDiMarkets database[3]. While these data do not include the realised investment, they show the direct decision and announcement of firms investing in other countries. Therefore, this paper contributes to the literature by analysing how the ESI in both home and host countries affect the decision of firms to undertake FDI across the European Union.

[3] www.fdimarkets.com

3. Analytical framework and hypotheses development

In this paper we refer to the KC model developed by Markusen (2002, 2013) which combines horizontal and vertical motives into a single general equilibrium framework in which firms can choose between national, horizontal and vertical strategies.[4] The KC model allows profit-maximising national firms, as well as horizontally and vertically integrated multinationals, to emerge endogenously in equilibrium, depending on various combinations of home and host country characteristics.

The KC model is based on three main assumptions. First, it is assumed that creation and services of knowledge-based assets such as R&D can be geographically separated from production and supplied to subsidiaries by the headquarters at a relatively low cost. Second, it is assumed that headquarters' services are more human-capital intensive than production. Third, it is assumed that knowledge-based services have a joint-input characteristic, i.e. they can be simultaneously used by multiple production facilities, giving rise to economies of scale at the firm-level. The first two assumptions provide incentives for vertical FDI while the third assumption motivates horizontal investment.

The KC model is very difficult to solve analytically for two reasons. First, it requires solving a complex system of almost sixty equations and inequalities. Second, many of the relationships derived from this model are nonlinear and non-monotonic. Therefore, the majority of the results have to be obtained from numerical simulations. According to the results of these simulations, different country characteristics favour different firm types. For example, national firms exporting to each other's market will dominate when countries are similar in economic size and relative factor endowments and trade costs are low.

Horizontally integrated MNEs will be the dominant type when countries are similar in size, similar in relative labour endowments, total demand is high and trade costs are moderate to high. However, if countries are dissimilar in either size or in relative factor endowments, one country will be favoured as a location for both headquarters and production activities or one of these two activities. In particular, if countries are dissimilar in size but similar in relative skilled labour endowments, then national firms located in the large country will be favoured as they can avoid installing costly capacity in the smaller market.

Vertically integrated MNEs will dominate when countries have very different relative skilled labour endowments as there is an incentive to split the production process and locate headquarters in the human-capital abundant country and production in the labour-abundant country, unless trade costs are high. In particular, the incentive for vertical FDI is the strongest when the skilled-labour abundant country is small.

[4] The original KC model was extended in many directions. These extensions include, *inter alia*, studies by Bergstrand and Egger (2007, 2013), Markusen and Strand (2009), Markusen and Stähler (2011), and Chen *et al.* (2012). The most important of these extensions was the incorporation of physical capital in addition to human capital.

Although the majority of findings of the KC model are derived from numerical simulations, the model generates a number of empirically testable predictions that can be validated using statistical data for the EU. Therefore, our research hypotheses on the extent of multinational activity from home countries (where the parent MNE is located) obtained on the basis of the KC model can be formulated as follows:

Hypothesis 1: The bigger the combined absolute market size and the more similarity in market size between home and destination countries, the larger the extent of MNE activity as there is more horizontal FDI.

Hypothesis 2: The bigger the differences in relative factor endowments between home and destination countries, the larger the extent of MNE activity as there is more vertical FDI.

Hypothesis 3: The lower the investment costs between home and destination countries, the larger the extent of MNE activity as there is more of both horizontal and vertical FDI.

Hypothesis 4: Higher trade costs between home and destination countries encourage horizontal MNE activity so there should be more horizontal FDI, but these costs discourage vertical MNE activity so there should be less vertical FDI. The overall effect of trade costs is unclear and must be determined empirically.

In addition to the hypotheses obtained on the basis of the KC model, for which we included the aforementioned control variables, we include two main hypotheses regarding economic sentiment indicators. These hypotheses relate to the effects of the economic situation on FDI flows, and in particular the effect of consumer purchasing power in the home and host countries. Therefore, we expect that the anticipated improvement in the situation in the host country would result in increased FDI inflows, while improvement in the home country would make FDI less attractive. Therefore, it can be expected that:

Hypothesis 5: A higher value of economic sentiment indicator for the destination country encourages horizontal FDI as it indicates increased market size in this country.

Hypothesis 6: A lower value of economic sentiment indicator for the home country encourages outward FDI as there is less opportunity to sell more in the domestic market.

4. Data sources and empirical methodology

The theoretical KC framework described in the previous section predicts how MNE activity can be related to the host and home country characteristics on a bilateral basis. The horizontal and vertical motives present in the KC model can be validated using a panel of cross-country observations for the multinational firms coming from EU countries which invested in other EU countries during the period 2003-2017.[5] Verifying which investment motive better explains the cross-country pattern of MNE activity in the EU can be achieved by evaluating the signs and statistical significance of the estimated coefficients for these characteristics. In particular, similarity in economic size and factor proportions between EU member states are the key variables that allow for differentiating between different investment motives. A positive and statistically significant coefficient of the size similarity variable can be expected if the market access motive is important and an insignificant coefficient is expected otherwise. Alternatively, a positive and statistically significant coefficient of the measure of differences in relative factor endowments can be expected if the efficiency seeking motive is important and an insignificant coefficient is expected otherwise.

The equation to be estimated is as follows:

$$Y_{dot} = e^{\left[\begin{matrix}\beta_1 SIM_{dot}+\beta_2 H_{dot}^{diff}+\beta_3 SUM_{dot}+\beta_4 Trade_{dt}^{free}+\beta_5 Trade_{ot}^{free}+\beta_6 Inv_{dt}^{free}+\beta_7 Inv_{ot}^{free} \\ +\beta_8 Euro_{dt}+\beta_9 Euro_{ot}+\beta_{10}\ln REM_{dt}+\beta_{11}\ln REM_{ot}+\beta_{12} ESI_{dt}+\beta_{13} ESI_{ot}+\mu_{do}+\mu_t\end{matrix}\right]}\times\varepsilon_{dot}^{1} \quad (1)$$

where Y_{dot} is the selected dependent variable of FDI in destination country d from origin country o in year t, which could be divided into two main categories of total capital of pledged investment projects and total number of investment projects. Each of the two main categories includes a set of three indicators of all new greenfield investment projects, extensions of greenfield investment projects and all greenfield investment projects.

The similarity in relative country size SIM_{dot} is measured as the natural logarithm of the square of the difference in the real GDP of the two partner countries. The value of this variable is negatively related to similarity in country size and reaches its minimum when countries are of equal size. GDP similarity is calculated using data on real GDP at chain linked volumes and expressed in constant 2010 million euros for EU member states. This is Eurostat data.

Moreover, the MNE activity in the host country should increase with greater differences in factor proportions according to the vertical motive. Hence, the estimated coefficient of the factor proportion variables should be positive and statistically significant if the efficiency seeking motive is important. The differences in factor proportions between destination and partner countries are measured using the relative differences in human capital endowments of the two countries H_{dot}^{diff}. The differences in human capital endowments (H_{dot}^{diff}) are calculated using the human capital index, based on years of schooling

[5] The sample includes all 28 members of the EU during the whole period. The data are taken from fDiMarkets (www.fdimarkets.com, a division of Financial Times Ltd), and are based on media and company reports on individual investment projects (excluding the financial sector).

and returns to education. The data on human capital comes from the PennWorld Table (PWT) 9.1 available at www.ggdc.net/pwt.

In addition to factor proportion and GDP similarity, which constitute the most important part of our identification strategy, we also control for the potential effects of some other factors. In particular, we control for the summation of the home country's and destination country's GDP SUM_{dot}. According to the theoretical model surveyed in the previous section, the joint economic size of the country-pair should be positively related to the extent of MNE activity in the host country. Hence, we should expect a positive sign of the estimated parameter on the SUM_{dot} variable. In order to calculate the SUM_{dot} variable we use the real GDP data mentioned above.

Moreover, in order to control for costs related to trade and investment in both home and host countries, we include the trade freedom indices $Trade_{dt}^{free}$, $Trade_{ot}^{free}$ and the investment freedom index Inv_{dt}^{free}, Inv_{ot}^{free} of each destination and origin country. Freedom index data have been collected from the Heritage Foundation[6]. Investment regulations across the EU single market may differ by country, yielding various values for the investment freedom index. However, the imposition of trade policy measures across the EU single market is homogenous with respect to third countries. According to the definition of the Heritage Foundation, the trade freedom index is constructed using trade-weighted tariffs and non-tariff measures. While trade policy measures at the product level are the same across EU member states, import shares of each product differ across countries. This means that where the trade freedom index is the smallest, importers in that country choose products and import the largest values of imports with the lowest tariff. This can be done for instance by choosing imports from countries with which the EU has preferential trade agreements, or on which the EU imposes the lowest tariffs. Or it can be done by choosing substitutable differentiated products within the same sector that have lower tariffs. Therefore, what differs across EU members is how importers or MNEs choose the most cost-efficient imports with the lowest tariff. Since a major part of EU imports is intermediate imports, then, inputs of MNEs from their supply chains imported from the most cost-efficient trade routes shape global value chains within the EU.

$Euro_{dt}$ and $Eeuro_{ot}$ are respectively dummy variables indicating whether destination and origin countries are members of the euro area. The main explanatory variables, ESI_{dt} and ESI_{ot}, are respectively ESI for the destination country and origin country in each year. The data are gathered monthly by the European Commission - Directorate-General for Economic and Financial Affairs (DG ECFIN). Then simple averages over months are calculated to change the data into annual data compatible with other explanatory variables. ESI is the weighted average of five other sentiment indicators collected in monthly surveys from business owners and consumers. The five sentiment indicators are the Industrial Confidence Indicator, Consumer Confidence Indicator, Construction Confidence Indicator, Retail Trade Confidence Indicator and Services Confidence Indicator (see Clar et al,. 2007; and Ghonghadze and Lux, 2011). While these five indicators include negative and positive values showing confidence and sentiment, ESI is constructed so as to include only positive values.

Finally, in order to control for the business cycle and policy changes, such as joining the EU, individual time effects are included μ_t, and in order to control for the effects of distance-related trade costs we

[6] https://www.heritage.org/

include time-invariant country-pair fixed effects μ_{do}. These country-pair fixed effects control for endogeneity problems in the estimation (Yotov et al., 2016). And ε_{dot}^{1} is the robust error term.

Furthermore, to control for multilateral resistance terms, we follow two approaches. The first approach is following Wei (1996), Anderson and van Wincoop (2003), Head (2003), Baier and Bergstrand (2009), and Yotov et al. (2016), where a remoteness index is constructed as the GDP weighted distance of each of the two partner countries from the whole world. This variable for destination and origin is constructed as follows:

$$\ln REM_{dt} = \ln\left[\sum_{o} Dist_{do}\frac{GDP_{ot}^{output}}{\sum_{o} GDP_{ot}^{output}}\right] \tag{2}$$

$$\ln REM_{ot} = \ln\left[\sum_{d} Dist_{do}\frac{GDP_{dt}^{expenditure}}{\sum_{d} GDP_{dt}^{expenditure}}\right] \tag{3}$$

where $Dist_{do}$ is the geographical distance between destination and origin collected by CEPII (Maye and Zignago, 2011), GDP_{ot}^{output} is the output-side real GDP at chained PPPs (in mil. 2011 US$), and $GDP_{dt}^{expenditure}$ is expenditure-side real GDP at chained PPPs (in mil. 2011 US$) obtained from Penn World Table.

However, Head and Mayer (2014) criticize the use of the remoteness index and argue that it is far from the theoretical multilateral resistance. Therefore, Head and Mayer (2014) and Yotov et al. (2016) recommend using country-time fixed effects for each of the trading partners. However, the main variables of interest in this analysis are country specific, which will be excluded while including country-time fixed effects. To make the estimation of these variables feasible, the interaction of the two country-level variables and their division (Head and Mayer, 2014) will be used in separate robustness checks that also control for country-time fixed effects. The estimation specification for these robustness checks will be as follows:

$$Y_{dot} = e^{\left[\begin{matrix}\alpha_1 SIM_{dot}+\alpha_2 H_{dot}^{diff}+\alpha_3 SUM_{dot}+\alpha_4 Trade_{ot}^{free}\times Trade_{dt}^{free}+\alpha_5 Inv_{ot}^{free}\times Inv_{dt}^{free} \\ +\gamma_6 Euro_{dot}+\alpha_7 ESI_{ot}\times ESI_{dt}+\mu_{do}+\mu_{dt}+\mu_{ot}\end{matrix}\right]\times\varepsilon_{dot}^{2}} \tag{4}$$

$$Y_{dot} = e^{\left[\begin{matrix}\gamma_1 SIM_{dot}+\gamma_2 H_{dot}^{diff}+\gamma_3 SUM_{dot}+\gamma_4\frac{Trade_{ot}^{free}}{Trade_{dt}^{free}}+\gamma_5\frac{Inv_{ot}^{free}}{Inv_{dt}^{free}} \\ +\gamma_6 Euro_{dot}+\gamma_7\frac{ESI_{ot}}{ESI_{dt}}+\mu_{do}+\mu_{dt}+\mu_{ot}\end{matrix}\right]\times\varepsilon_{dot}^{3}} \tag{5}$$

where μ_{dt} and μ_{ot} are respectively destination-time and origin-time fixed effects controlling for multilateral resistances; $Euro_{dot}$ is a dummy variable indicating whether both countries are members of the euro area; ε_{dot}^{2} and ε_{dot}^{3} are the robust error terms.

Since the dependent variable contains non-negative values, taking the logarithm of the dependent variable would exclude the zero values of FDI, causing a sample selection bias in the estimations. In order to circumvent such a problem, the estimations are run using the Pseudo Poisson Maximum Likelihood (PPML) as proposed by Santos Silva and Tenreyro (2006) for gravity models (see also Head and Ries, 2008; Larch et al., 2019; Ghodsi, 2020) and incorporated in Stata by Santos Silva and Tenreyro (2006) and developed by Correia et al. (2019a, b) to deal with high-dimensional fixed effects.

Since there are zero values in the dependent variables, PPML is the most common technique used to estimate gravity (Yotov et al., 2016). Moreover, PPML is more robust against heteroscedasticity in the error term.

Table 1 / Definitions and summary statistics of dependent and explanatory variables

Variable	Definition	Mean	Std. dev.	Min	Max
$Y_{dot}^{K_{NEW}}$	Total capital pledged for New Greenfield investment	87.09628	281.7632	0	5490.251
$Y_{dot}^{K_{EXT}}$	Total capital pledged for Extension of Greenfield investment	22.4517	108.4378	0	4217.494
$Y_{dot}^{K_{TOT}}$	Total capital pledged for investment	111.9635	344.7127	0	6013.47
$Y_{dot}^{N_{NEW}}$	Total number of projects pledged for New Greenfield investment	1.653664	2.712646	0	12
$Y_{dot}^{N_{EXT}}$	Total number of projects pledged for Extension of Greenfield investment	0.4984216	1.352575	0	12
$Y_{dot}^{N_{TOT}}$	Total number of projects pledged for investment	2.203382	3.91402	0	27
SUM_{dot}	Log of summation of the two real GDPs Eurostat	12.01501	1.141737	8.487167	14.06955
SIM_{dot}	Logarithm of the squared difference in the real GDP of two partner countries	22.57965	3.291779	5.160434	26.99642
H_{dot}^{diff}	Logarithm of the difference in the human capital of two countries	-1.516156	1.105139	-8.750956	0.3258924
$Trade_{dt}^{free}$	Trade freedom index of destination	84.43525	4.924646	57.6	88
$Trade_{ot}^{free}$	Trade freedom index of origin	84.59104	4.319003	57.6	88
Inv_{dt}^{free}	Investment freedom index of destination	75.354	12.82284	30	95
Inv_{ot}^{free}	Investment freedom index of origin	76.83991	12.63989	30	95
ESI_{dt}	Economic Sentiment Indicator of destination	99.74509	9.001733	72.175	117.4833
ESI_{ot}	Economic Sentiment Indicator of origin	99.56758	8.965484	72.175	117.4833
$\ln REM_{dt}$	Destination remoteness index	7.105193	0.3152867	6.625914	7.86367
$\ln REM_{dt}$	Origin remoteness index	7.11535	0.3017075	6.623951	7.864215
$\frac{Trade_{ot}^{free}}{Trade_{dt}^{free}}$	Trade freedom index ESI of origin relative to destination country	1.003971	0.059085	0.7182045	1.392361
$\frac{Inv_{ot}^{free}}{Inv_{dt}^{free}}$	Investment freedom index of origin relative to destination country	1.053473	0.2733314	0.3333333	3
$\frac{ESI_{ot}}{ESI_{dt}}$	ESI of origin relative to destination country	1.001417	0.0800229	0.7378511	1.355287
$Trade_{ot}^{free} \times Trade_{dt}^{free}$	Division of trade freedom index of origin over destination	7154.859	675.4152	3640.32	7744
$Inv_{ot}^{free} \times Inv_{dt}^{free}$	Multiplication of investment freedom index of origin over destination	5869.723	1365.879	2500	9025
$ESI_{ot} \times ESI_{dt}$	Multiplication of ESI of origin over destination	9982.007	1574.846	5301.855	13693.66

Source: own elaboration

The definitions of explanatory variables and their summary statistics are summarised in Table 1 while the calculated values of the correlations between the variables used in the empirical study are reported in Table 2. As can be observed, explanatory variables do not have strong correlations with each other.

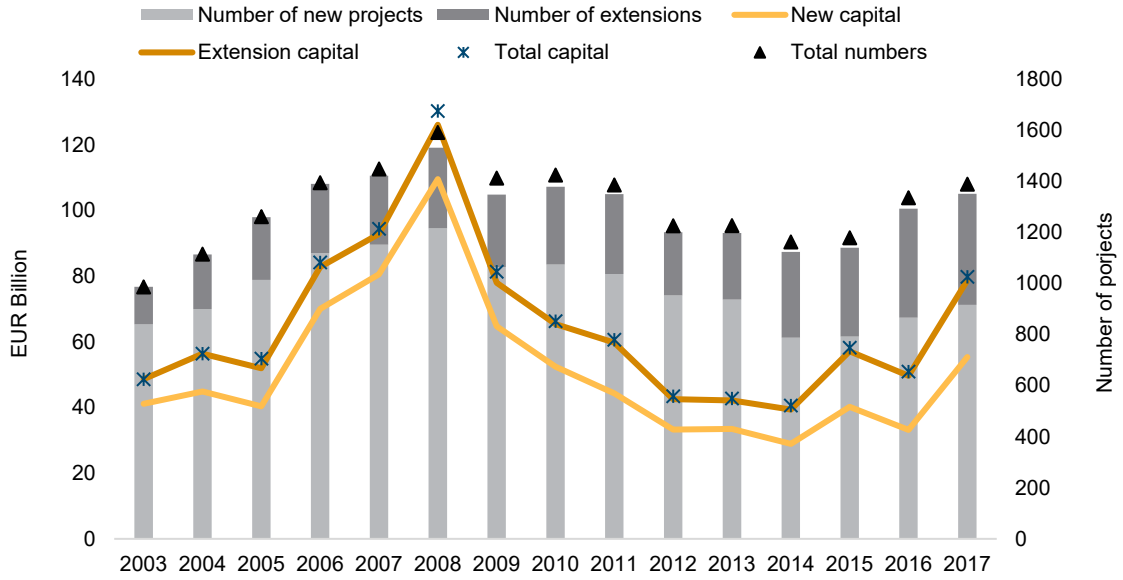
Table 2 / Pairwise correlations between variables

	$Y_{dot}^{K_{TOT}}$	SUM_{dot}	SIM_{dot}	H_{dot}^{diff}	$Trade_{dt}^{free}$	$Trade_{ot}^{free}$	Inv_{dt}^{free}	Inv_{ot}^{free}	ESI_{dt}	ESI_{ot}	$\ln REM_{dt}$	$\ln REM_{dt}$	$Trade_{ot}^{free} \times Trade_{dt}^{free}$	$Inv_{ot}^{free} \times Inv_{dt}^{free}$	$ESI_{ot} \times ESI_{dt}$	$\frac{Trade_{ot}^{free}}{Trade_{dt}^{free}}$	$\frac{Inv_{ot}^{free}}{Inv_{dt}^{free}}$	$\frac{ESI_{ot}}{ESI_{dt}}$
$Y_{dot}^{K_{TOT}}$	1																	
SUM_{dot}	0.2921	1																
SIM_{dot}	0.1547	0.8325	1															
H_{dot}^{diff}	0.0302	0.0902	0.0406	1														
$Trade_{dt}^{free}$	-0.0005	0.0721	0.049	-0.012	1													
$Trade_{ot}^{free}$	0.0209	0.0387	0.018	-0.0338	0.5828	1												
Inv_{dt}^{free}	-0.0014	0.1658	0.1324	0.0169	0.4768	0.2149	1											
Inv_{ot}^{free}	0.0856	0.0564	0.0373	-0.0348	0.1946	0.4743	0.0719	1										
ESI_{dt}	0.0062	-0.0212	-0.0097	-0.0122	-0.1376	-0.1103	-0.0112	-0.0046	1									
ESI_{ot}	0.0007	-0.0014	0.0073	-0.0088	-0.1174	-0.0864	0.0058	0.001	0.6274	1								
$\ln REM_{dt}$	-0.1869	-0.2935	-0.2214	0.1083	0.0134	-0.0711	0.0234	-0.3118	0.0037	-0.0104	1							
$\ln REM_{dt}$	-0.095	-0.3253	-0.2555	0.0705	-0.0767	0.0103	-0.2964	0.0388	-0.0018	0.0029	-0.0455	1						
$Trade_{ot}^{free} \times Trade_{dt}^{free}$	0.018	-0.0529	-0.0426	-0.0218	-0.6171	0.2734	-0.3511	0.2164	0.0631	0.0475	-0.0772	0.1021	1					
$Inv_{ot}^{free} \times Inv_{dt}^{free}$	0.051	-0.0774	-0.07	-0.0393	-0.3023	0.1147	-0.7258	0.5813	0.0155	-0.0023	-0.222	0.2349	0.4646	1				
$ESI_{ot} \times ESI_{dt}$	-0.0068	0.0214	0.0189	0.0059	0.0183	0.0262	0.0169	0.0039	-0.4426	0.4164	-0.0149	0.013	-0.013	-0.0188	1			
$\frac{Trade_{ot}^{free}}{Trade_{dt}^{free}}$	0.0087	0.0592	0.0355	-0.0268	0.9037	0.8735	0.3988	0.3674	-0.1386	-0.1138	-0.03	-0.041	-0.225	-0.1198	0.0248	1		
$\frac{Inv_{ot}^{free}}{Inv_{dt}^{free}}$	0.051	-0.0774	-0.07	-0.0393	-0.3023	0.1147	-0.7258	0.5813	0.0155	-0.0023	-0.222	0.2349	0.4646	1	-0.0188	-0.1198	1	
$\frac{ESI_{ot}}{ESI_{dt}}$	0.0057	-0.0145	-0.0026	-0.0116	-0.142	-0.1091	-0.0058	-0.0048	0.9008	0.9002	-0.0045	-0.0002	0.062	0.0073	-0.0165	-0.1406	0.0073	1

Source: own elaboration

Figure 1 shows the dynamics of greenfield FDI in the sample of analysis during the period 2003–2017. The majority of these announced investment projects are new projects. The total capital pledged for investment in the sample peaked in 2008. Intra EU-28 announced investment in this year reached EUR 130 billion in 1592 projects, out of which 1216 invested in new projects worth EUR 110 billion. After 2008, the amount of total pledged investment gradually declined until 2014. In 2017, total capital pledged for investment across the EU member states stood at EUR 80 billion covering 1389 projects. This suggests that the average capital per project in 2017 was EUR 24 million lower than the EUR 82 million capital per project in 2008.

Figure 1 / Dynamics of intra-EU foreign direct investment - 2003-2017



Source: fdimarket database, authors' elaboration

5. Empirical results

Our baseline estimation results for the amount of intra-EU pledged capital investment are reported in Table 3. In column (1) we show the estimation results obtained for total foreign capital invested. In Table A1 in the appendix, the stepwise inclusion of explanatory variables is presented. Statistics on Akaike information criteria (AIC) and Bayesian information criteria (BIC) in Table A1 for the model including ESI indicate a better fit of the FDI model when it includes these main variables. These results show that both economic sentiment indicators are statistically significant and display the expected signs. In particular, the estimated coefficient of the economic sentiment indicator for the destination country is positive and statistically significant at the 5% level, while the estimated coefficient of the economic sentiment indicator for the country of origin is negative and significant at the 1% level. This means that our empirical results are in line with our predicted relationships concerning horizontal FDI, i.e. the higher value of the economic sentiment indicator for the destination country is associated with increased FDI inflows, while the higher value of the economic sentiment indicator for the country of origin is associated with decreased FDI inflows into the destination country. This means that a one-unit improvement in the ESI of the destination stimulates the total capital pledged for investment by MNEs in the destination by about 0.79%. However, a one-unit improvement in the ESI of the origin of the MNEs would reduce the capital they pledge for investment in another EU country by about 1.4%. Therefore, the result indicates that MNEs in the EU single market move their capital from a country with worsening economic conditions measured by a lower ESI to a country with improving economic conditions measured by a higher ESI.

The majority of our control variables derived from the KC model display the expected signs and are statistically significant, albeit at different levels of statistical significance. This means that both horizontal and vertical motives are important for explaining FDI in the EU, although the horizontal motive seems to be stronger than the vertical one. In particular, the estimated coefficient of the combined GDP variable is positive and statistically significant at the 1% level which means that FDI increases with the combined market size of the destination country and the country of origin. The estimated coefficient of the squared GDP difference is negative and significant at the 5% level. This means that FDI decreases with increased differences in market size between countries. These results confirm the importance of horizontal market seeking motives for FDI in the EU.

At the same time, it can be noted that the estimated coefficient of the absolute difference in relative human capital endowments also displays a predicted positive sign and is statistically significant, albeit only at the 5% level. This means that bigger differences in human capital endowments between the country of origin and the destination country motivate vertical FDI aimed at efficiency seeking. Moreover, the estimated coefficient of the trade freedom index displays a negative sign but it is not statistically significant. This variable becomes statistically significant when remoteness index variables are excluded[7]. Moreover, this indicates that within the EU single market trade is open and thus, this variable

[7] These results excluding certain variables are available upon request.

cannot explain the amount of intra-EU capital flows. This result is further supported by the lack of statistical significance of the estimated coefficient of the trade freedom index for the country of origin.

Table 3 / PPML Models on Amount of Intra-EU Pledged Capital Investment with remoteness index – 2003-2017 – simultaneous regressions

Dep. Var.	Total Capital (1)	Capital on New Greenfield Projects (2)	Capital on Extending Greenfield Projects (3)
Log of summation of the two real GDPs	3.06***	3.07***	3.25***
	(0.61)	(0.65)	(1.14)
Log of squared difference in real GDP of two	-0.067**	-0.095***	0.018
	(0.029)	(0.034)	(0.037)
Log of absolute difference of two human capital	0.11**	0.14**	0.10
	(0.051)	(0.055)	(0.092)
Trade Freedom Index Destination	-0.013	-0.0081	-0.023
	(0.0083)	(0.0083)	(0.020)
Trade Freedom Index Origin	0.016	0.0078	0.030
	(0.016)	(0.016)	(0.042)
Investment Freedom Index Destination	0.015***	0.011***	0.035***
	(0.0038)	(0.0041)	(0.0078)
Investment Freedom Index Origin	-0.0099***	-0.0081*	-0.011
	(0.0038)	(0.0042)	(0.0083)
Destination's euro membership	-0.23	-0.45***	0.59*
	(0.17)	(0.15)	(0.33)
Origin's euro membership	0.17	0.14	1.96***
	(0.20)	(0.22)	(0.51)
Destination Remoteness Index	3.28*	1.52	3.94
	(1.69)	(1.88)	(3.17)
Origin Remoteness Index	6.28***	7.81***	0.93
	(1.60)	(1.82)	(2.91)
Economic Sentiment Indicator Destination	0.0079**	0.0034	0.020***
	(0.0037)	(0.0042)	(0.0072)
Economic Sentiment Indicator Origin	-0.014***	-0.016***	-0.0047
	(0.0052)	(0.0062)	(0.0088)
Constant	-98.8***	-95.8***	-77.7**
	(18.7)	(20.9)	(34.3)
Observations	8870	8750	5015
Pseudo R-squared	0.775	0.741	0.644
AIC	801587.7	735000.4	279778.5
BIC	801687.0	735099.4	279869.8
Year FE	Yes	Yes	Yes
Bilateral FE	Yes	Yes	Yes

Robust standard errors in parentheses * p<0.1; ** p<0.05; *** p<0.01

Finally, the estimated coefficient of the investment freedom index of the destination country is positive and statistically significant at the 1% level. This means that increased investment freedom with flexible legislation promoting FDI in the destination country encourages inward FDI due to the lower cost of investment. At the same time, the estimated coefficient of investment freedom for the country of origin is negative and statistically significant at the 1% level. This means that the lower cost of investment in the country of origin decreases FDI as it becomes more profitable to invest at home.

The remoteness index variables for both countries are statistically significant and positive following the literature. Therefore, the larger the remoteness of a country from the world, the higher should be bilateral FDI between the two countries that are distant from other economies. However, inclusion of these variables makes statistically insignificant some other control variables such as the log of the squared difference in real GDP of the two countries and the log of the absolute difference of two countries' human capital.

Table 4 / PPML Models on Number of Intra-EU Pledged Capital Investment Projects with remoteness index – 2003-2017 – simultaneous regressions

Dep. Var.	Total Capital	Capital on New Greenfield Projects	Capital on Extending Greenfield Projects
	(1)	(2)	(3)
Log of summation of the two real GDPs	2.28***	2.18***	2.15***
	(0.22)	(0.24)	(0.52)
Log of squared difference in real GDP of two	-0.0055	-0.017	0.042**
	(0.011)	(0.014)	(0.018)
Log of absolute difference of two human capital	0.023	0.020	0.036
	(0.018)	(0.020)	(0.036)
Trade Freedom Index Destination	-0.00075	-0.0019	0.0050
	(0.0036)	(0.0036)	(0.0086)
Trade Freedom Index Origin	0.0087	0.014**	-0.018
	(0.0063)	(0.0067)	(0.016)
Investment Freedom Index Destination	0.011***	0.011***	0.011***
	(0.0016)	(0.0016)	(0.0031)
Investment Freedom Index Origin	0.00074	-0.000044	0.0066**
	(0.0015)	(0.0016)	(0.0032)
Destination's euro membership	-0.26***	-0.35***	0.31**
	(0.059)	(0.061)	(0.14)
Origin's euro membership	0.10	0.14	0.45
	(0.10)	(0.11)	(0.35)
Destination Remoteness Index	2.26***	0.97	5.25***
	(0.66)	(0.71)	(1.40)
Origin Remoteness Index	7.57***	7.94***	4.79***
	(0.61)	(0.66)	(1.22)
Economic Sentiment Indicator Destination	0.0047***	0.0039***	0.0056*
	(0.0014)	(0.0015)	(0.0030)
Economic Sentiment Indicator Origin	-0.0011	-0.0023	0.0026
	(0.0016)	(0.0017)	(0.0035)
Constant	-98.2***	-90.8***	-99.8***
	(7.04)	(7.77)	(15.4)
Observations	8870	8750	5015
Pseudo R-squared	0.622	0.543	0.470
AIC	21523.6	19648.8	8533.3
BIC	21622.8	19747.9	8624.6
Year FE	Yes	Yes	Yes
Bilateral FE	Yes	Yes	Yes

Robust standard errors in parentheses * p<0.1; ** p<0.05; *** p<0.01

In columns (2) and (3) we report estimation results obtained separately for capital for new greenfield projects and capital for extending greenfield projects respectively. The estimated coefficient of the

economic sentiment index for the destination country is positive and statistically significant at the 5% level only for capital for extending greenfield projects. At the same time, the estimated coefficient of the economic sentiment index for the country of origin is negative in both cases, but it is statistically significant at the 1% level only for new greenfield projects. The majority of control variables predicted by the KC model displays the expected signs and are statistically significant for new greenfield projects while only some of them are significant for capital for extending greenfield projects.

When the destination country becomes a member of the euro area, the amount of capital pledged for investment in new greenfield projects decreases significantly statistically. Combining both coefficients of euro area membership of both countries in this specification is statistically significant at the 5% level, which results in a combined coefficient equal to -0.31. This suggests that when both countries are members of the euro area, the amount of capital pledged for investment in new projects decreases by about one third. The intuition behind this is that due to the single currency union, certainty about the bilateral exchange rate makes bilateral trade more attractive. Therefore, the amount of capital invested in greenfield projects decreases substantially. However, when both countries become members of this single currency zone, the amount of pledged investment for the extension of current projects increases. This could be due to the reduction in transactional and trade costs which stimulates vertical FDI for ongoing projects, and thus does not lead to initiating new greenfield projects. Membership in the euro area does not have any statistically significant effect on total capital pledged for investment for all types of projects. This could be mainly because of an opposing impact of euro area membership for greenfield projects versus brownfield projects.

In Table 4 we investigate the robustness of our estimation results using an alternative measure of MNE activity – the number of intra-EU pledged capital investment projects. The particular columns of Table 4 are the direct counterparts of the columns of Table 3. It can be noted that in all columns the estimated coefficient of the economic sentiment index for the destination country displays a positive sign and is statistically significant, albeit at different levels of significance, similar to the results reported in Table 3. However, the estimated coefficient of the economic sentiment index for the country of origin is never statistically significant, which is different from the results reported in Table 3. This suggests that the ESI at the home of the MNE matters most for the intensive margin of their intra-EU FDI rather than their extensive margin.

As further robustness tests, in Table 5 and Table 6 we report estimation results for the amount of intra-EU pledged capital investment and the number of intra-EU pledged capital investment projects respectively using the lagged values of our explanatory variables. The estimation results look similar to the results reported in Tables 3 and 4. From the results of Tables 4, 6, and A5, one can observe that MNEs originating in EU member states that have a higher trade freedom index invest in a greater number of projects across other EU countries. EU members are part of the EU single market, and thus their imposed tariffs on each good imported from outside the EU are the same across member states. The tariff rate imposed on intra-EU trade is also zero. Therefore, the results indicate that countries that import goods with lower tariffs and non-tariff barriers are more cost efficient, which is also reflected in a higher trade freedom index (i.e., import-weighted tariff and non-tariff measures). Thus, MNEs in such countries can shape their supply chains better outside the EU, which also allows them to have more investment projects within the EU.

Table 5 / PPML Models on Amount of Intra-EU Pledged Capital Investment with remoteness index – 2003-2017 – lagged independent variables

Dep. Var.	Total Capital (1)	Capital on New Greenfield Projects (2)	Capital on Extending Greenfield Projects (3)
Log of summation of the two real GDPs	2.43***	2.07***	3.05**
	(0.66)	(0.70)	(1.27)
Log of squared difference in real GDP of two	-0.025	-0.020	-0.050
	(0.031)	(0.031)	(0.075)
Log of absolute difference of two human capital	0.15***	0.18***	0.16*
	(0.049)	(0.055)	(0.091)
Trade Freedom Index Destination	0.0075	0.0049	0.029
	(0.0091)	(0.0095)	(0.024)
Trade Freedom Index Origin	0.026*	0.024	-0.0010
	(0.016)	(0.017)	(0.046)
Investment Freedom Index Destination	0.015***	0.013***	0.020***
	(0.0037)	(0.0043)	(0.0066)
Investment Freedom Index Origin	-0.014***	-0.014***	-0.0067
	(0.0041)	(0.0049)	(0.0089)
Destination's euro membership	-0.16	-0.37**	0.42
	(0.18)	(0.16)	(0.34)
Origin's euro membership	0.38*	0.33	1.84***
	(0.22)	(0.25)	(0.49)
Destination Remoteness Index	4.52**	2.78	4.12
	(1.86)	(2.12)	(3.23)
Origin Remoteness Index	6.69***	7.53***	3.06
	(1.80)	(1.98)	(3.54)
Economic Sentiment Indicator Destination	0.0058	0.0085*	-0.0041
	(0.0041)	(0.0049)	(0.0071)
Economic Sentiment Indicator Origin	-0.018***	-0.021***	-0.0011
	(0.0058)	(0.0071)	(0.0086)
Constant	-104.8***	-93.8***	-88.1**
	(21.5)	(23.9)	(42.4)
Observations	8140	8028	4635
Pseudo R-squared	0.777	0.744	0.640
AIC	749447.0	682801.0	267207.3
BIC	749545.1	682898.9	267297.5
Year FE	Yes	Yes	Yes
Bilateral FE	Yes	Yes	Yes

Robust standard errors in parentheses * p<0.1; ** p<0.05; *** p<0.01

Table 6 / PPML Models on Number of Intra-EU Pledged Capital Investment Projects with remoteness index – 2003-2017 – lagged independent variables

Dep. Var.	Total Capital	Capital on New Greenfield Projects	Capital on Extending Greenfield Projects
	(1)	(2)	(3)
Log of summation of the two real GDPs	2.01***	1.91***	1.80***
	(0.24)	(0.26)	(0.54)
Log of squared difference in real GDP of two	0.0042	-0.0030	0.029
	(0.013)	(0.014)	(0.021)
Log of absolute difference of two human capital	0.047**	0.037	0.089**
	(0.021)	(0.023)	(0.037)
Trade Freedom Index Destination	0.0057	0.0039	0.0098
	(0.0035)	(0.0036)	(0.0084)
Trade Freedom Index Origin	0.012**	0.016**	-0.0026
	(0.0061)	(0.0066)	(0.015)
Investment Freedom Index Destination	0.012***	0.011***	0.015***
	(0.0016)	(0.0016)	(0.0030)
Investment Freedom Index Origin	-0.00053	-0.0015	0.0042
	(0.0016)	(0.0017)	(0.0033)
Destination's euro membership	-0.24***	-0.31***	0.15
	(0.063)	(0.064)	(0.14)
Origin's euro membership	0.14	0.16	0.63*
	(0.11)	(0.11)	(0.36)
Destination Remoteness Index	2.40***	1.07	5.08***
	(0.68)	(0.73)	(1.46)
Origin Remoteness Index	7.56***	8.35***	3.21**
	(0.63)	(0.68)	(1.28)
Economic Sentiment Indicator Destination	0.0041***	0.0045***	0.0012
	(0.0014)	(0.0016)	(0.0029)
Economic Sentiment Indicator Origin	-0.0020	-0.0032*	0.0017
	(0.0016)	(0.0018)	(0.0034)
Constant	-96.6***	-91.7***	-83.8***
	(7.38)	(7.99)	(16.7)
Observations	8140	8028	4635
Pseudo R-squared	0.623	0.543	0.473
AIC	20049.9	18261.5	8047.9
BIC	20148.0	18359.3	8138.0
Year FE	Yes	Yes	Yes
Bilateral FE	Yes	Yes	Yes

Robust standard errors in parentheses * p<0.1; ** p<0.05; *** p<0.01

Table 7 / PPML Models on Amount of Intra-EU Pledged Capital Investment with country-time fixed effects – 2003-2017 – simultaneous regressions

	Equation 4; division of origin's variable over destination's			Equation 5; multiplication of origin's variable and destination's		
Dep. Var.	**Total Capital**	**Capital on New Greenfield Projects**	**Capital on Extending Greenfield Projects**	**Total Capital**	**Capital on New Greenfield Projects**	**Capital on Extending Greenfield Projects**
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
Log of summation of the two real GDPs	2.32**	2.10**	3.88**	2.35**	2.15**	4.00**
	(0.94)	(1.04)	(1.96)	(0.94)	(1.04)	(1.96)
Log of squared difference in real GDP of two	-0.017	-0.059*	0.097**	-0.018	-0.061*	0.10**
	(0.027)	(0.032)	(0.041)	(0.027)	(0.032)	(0.041)
Log of absolute difference of two human capital	-0.048	-0.0025	0.046	-0.047	-0.0041	0.060
	(0.040)	(0.043)	(0.073)	(0.040)	(0.043)	(0.073)
Trade Freedom Index	14.6	10.5		-0.0023	-0.0016	
	(16.7)	(15.4)		(0.0030)	(0.0028)	
Investment Freedom Index	-2.35***	-2.60***	-3.57**	0.00053***	0.00052***	0.0010***
	(0.76)	(0.80)	(1.68)	(0.00017)	(0.00018)	(0.00037)
Both countries' Euro membership	0.39*	0.36	-0.10	0.38*	0.36	-0.11
	(0.21)	(0.23)	(0.45)	(0.21)	(0.23)	(0.45)
Economic Sentiment Indicator	-11.6**	-7.72	-22.7*	0.0011**	0.00074	0.0024*
	(5.04)	(5.31)	(12.6)	(0.00053)	(0.00056)	(0.0013)
Constant	-24.3	-20.0	-21.6	-22.5	-19.8	-81.4***
	(20.8)	(20.3)	(29.3)	(26.1)	(25.9)	(28.7)
Observations	8424	8301	4054	8424	8301	4054
Pseudo R-squared	0.857	0.838	0.757	0.857	0.838	0.758
AIC	492330.3	446059.3	170481.4	492360.1	446377.7	170059.9
BIC	492386.6	446115.5	170525.5	492416.4	446433.9	170104.1
Destination-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Origin-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Bilateral FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses * p<0.1; ** p<0.05; *** p<0.01

Table 7 presents the results of estimations of the amount of capital pledged for investments using equations 4 and 5 that include country-time fixed effects. Inclusion of these additional fixed effects improves the fitness of the models, which is reflected in relatively larger R-squares. Since country-time fixed effects are collinear with the country-level variables such as ESI, in the first panel to the left, the division of these variables of origin by that of the destination are included; and in the right panel, the interaction of these variables is used in the estimations. The origin's ESI divided by the destination's ESI has a negative coefficient that is statistically significant for all types of projects at the 5% level. This indicates that when the ESI of origin increases relative to the ESI of the destination by 1%, the amount of capital pledged by MNEs in the origin country to undertake FDI in the destination country should decrease by approximately 99%[8]. This also suggests that the widening of the gap of ESI between the origin and home country may lead to a lower amount of capital pledged for investment. However, the multiplication of ESI of the two countries has a positive coefficient that is statistically significant at 5%. Therefore, when the economic conditions in both countries improve in the short run, which is reflected in a higher ESI, one should expect even greater intra-EU FDI.

Table 8 presents the results of estimations of the number of projects pledged to be invested across EU member states while including country-time fixed effects controlling for multilateral resistance. ESI no longer has any significant coefficient across these models. This suggests again that ESI matters mostly for the intensive margin of intra-EU FDI rather than for the extensive margin.

Furthermore, one can still find positive coefficients of the summation of the two real GDPs across different models for the amount of capital but not for the number of projects. However, the log of squared difference in real GDP of two countries has statistically significant and positive coefficients for the number of projects. The log of absolute difference of two countries' human capital affects the number of projects rather than the amount of investment. The trade freedom index is again statistically insignificant. This can suggest that there exists no meaningful difference in trade freedom of countries across the EU single market that can potentially affect FDI. However, the investment freedom index varies substantially across the countries of the EU, which can significantly influence intra-EU FDI. According to the results of the left panel of Table 7 and Table 8, when freedom of investment in the destination country deteriorates in comparison with freedom of investment in the origin country, then both the amount of investment and number of projects should be smaller. However, according to the results of the right panel of these two tables, one can also find that when freedom of investment in both origin and destination deteriorates, one can expect a lower amount of investment and a smaller number of projects.[9]

---

[8] That is equal to ((exp(-11.6))-1)*100. This marginal effect is significantly large because as the summary statistics in Table 1 shows, the mean of all relative variables is close to unity with a very small standard deviation. This indicates that the values for destination and origin are close to each other, and their relative change is very marginal. Therefore, when the main variable of one country decreases and another increases, a large change can induce a significant change in the dependent variable.

[9] Finally, we check the robustness of our results by employing an alternative estimation method. In addition to the PPML results in table A7 in the appendix, we also report the estimation results obtained using the GMM estimator that controls for the endogeneity bias in the estimations. However, the dependent variable is included in logarithm. The sentiment indicators remain statistically significant and display the expected signs. This means that these additional estimations confirm the importance of including them. The control variables derived from the KK model are mostly not significant but this is not surprising in the estimation in which the lagged value of the dependent variable is taken into account. This means that the effect of these variables is already accommodated by the lagged value of the dependent variable.

Table 8 / PPML Models on Number of Intra-EU Pledged Capital Investment Projects with country-time fixed effects – 2003-2017 – simultaneous regressions

	Equation 4; division of origin's variable over destination's			Equation 5; multiplication of origin's variable and destination's		
Dep. Var.	**Total Capital**	**Capital on New Greenfield Projects**	**Capital on Extending Greenfield Projects**	**Total Capital**	**Capital on New Greenfield Projects**	**Capital on Extending Greenfield Projects**
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
Log of summation of the two real GDPs	0.084	0.052	1.10	0.098	0.073	1.11
	(0.41)	(0.46)	(0.96)	(0.41)	(0.46)	(0.96)
Log of squared difference in real GDP of two	0.040***	0.029**	0.068***	0.040***	0.029*	0.068***
	(0.011)	(0.015)	(0.022)	(0.011)	(0.015)	(0.022)
Log of absolute difference of two human capital	-0.032**	-0.019	-0.071**	-0.032**	-0.019	-0.069**
	(0.016)	(0.019)	(0.033)	(0.016)	(0.019)	(0.033)
Trade Freedom Index	6.80	8.01		-0.0010	-0.0012	
	(7.74)	(8.69)		(0.0014)	(0.0015)	
Investment Freedom Index	-1.12***	-1.29***	-1.17	0.00023***	0.00025***	0.00031*
	(0.37)	(0.39)	(0.78)	(0.000077)	(0.000084)	(0.00016)
Both countries' Euro membership	-0.039	-0.016	-0.15	-0.041	-0.017	-0.16
	(0.094)	(0.10)	(0.23)	(0.094)	(0.10)	(0.23)
Economic Sentiment Indicator	1.96	3.62	-7.41	-0.00021	-0.00040	0.00080
	(2.25)	(2.49)	(5.45)	(0.00024)	(0.00026)	(0.00056)
Constant	-7.93	-10.3	-6.46	7.43	11.0	-25.4*
	(9.35)	(10.4)	(13.8)	(11.7)	(13.3)	(13.7)
Observations	8424	8301	4054	8424	8301	4054
Pseudo R-squared	0.653	0.576	0.484	0.653	0.576	0.484
AIC	19051.4	17562.4	7335.7	19052.1	17563.9	7335.0
BIC	19107.7	17618.6	7379.8	19108.5	17620.1	7379.1
Destination-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Origin-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Bilateral FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses * p<0.1; ** p<0.05; *** p<0.01

6. Conclusions

The main goal of this paper was to study the role of business sentiment in the decisions of MNEs to undertake foreign direct investment (FDI) across the European Union (EU) member states. The European Sentiment Indicator (ESI) surveyed and compiled by the DG ECFIN of the European Commission was the main variable of interest for measuring business sentiment. This study used the Pseudo Poisson Maximum Likelihood estimator and panel data to empirically examine the determinants of FDI across EU member states during the period 2003-2017. The estimated specification of the empirical model was based on the knowledge-capital (KC) model. In this model, a larger ESI captures the good economic conditions perceived by business which is translated into lower investment costs. This suggests that better conditions in a country increase the extent of multinational involvement. The results also acknowledge this hypothesis and suggest that better economic conditions in an EU member state as measured by a larger ESI motivate MNEs to undertake FDI in that country. More capital is invested and a larger number of projects are undertaken in a country with a larger ESI. In addition, a worsening economic condition in an EU member state, as measured by a lower ESI, motivates MNEs in that country to invest in another EU member state. Moreover, the assembled empirical evidence points to a stronger horizontal motive, rather than a vertical motive, as the primary reason for undertaking FDI in the EU by multinational firms based in other EU member states.

References

Acemoglu, D., & Scott, A. (1994). Consumer confidence and rational expectations: Are agents' beliefs consistent with the theory?. The Economic Journal, 104(422), 1-19.

Anderson, J. E., & Van Wincoop, E. (2003). Gravity with gravitas: A solution to the border puzzle. American economic review, 93(1), 170-192.

Awokuse, T. O., Maskus, K. E., & An, Y. (2012). Knowledge capital, international trade, and foreign direct investment: A sectoral analysis. Economic Inquiry, 50(3), 707-723.

Baltagi, B.H., Egger, P., Pfaffermayr, M. (2007). Estimating models of complex FDI: Are there third-country effects?, Journal of Econometrics, 140(1), 260-281.

Baier, S. L., & Bergstrand, J. H. (2009). Estimating the effects of free trade agreements on international trade flows using matching econometrics. Journal of international Economics, 77(1), 63-76.

Bellemare, M.F. and Wichman, C.J. (2020). Elasticities and the inverse hyperbolic sine transformation. Oxford Bulletin of Economics and Statistics, 82(1), 50-61.

Benhabib, J., & Spiegel, M. M. (2018). Sentiments and economic activity: Evidence from US states. The Economic Journal, 129(618), 715-733.

Bergstrand, J.H., Egger, P. (2007). A knowledge and physical capital model of international trade flows, foreign direct investment and multinational enterprises, Journal of International Economics, 73(2), 278-308.

Bergstrand, J.H., Egger, P. (2013). Shouldn't physical capital also matter for multinational enterprise activity?, Review of International Economics, 21(5), 945–965.

Bloningen, B.A., Davies, R.B., & Head, K. (2003). Estimating the knowledge capital model of the multinational enterprise: Comment, American Economic Review, 93(3), 980-994.

Braconier, H., Norback, H.P.J, Urban, D. (2005). Reconciling the evidence on the knowledge-capital model, Review of International Economics, 13(4), 770-786.

Brainard, L.S. (1993a). A Simple Theory of Multinational Corporations and Trade with a Trade-Off Between Proximity and Concentration. *National Bureau of Economic Research Working Paper Series*. https://doi.org/10.3386/w4269.

Brainard, S. L. (1993b). An Empirical Assessment of the Factor Proportions Explanation of Multinationals Sales, NBER Working Paper 4580. National Bureau of Economic Research, Cambridge, MA.

Brainard, L.S. (1997). An empirical assessment of the proximity concentration tradeoff between multinational sales and trade, *American Economic Review*, 87(4), 520-544.

Carr D.L., Markusen J.R., Maskus K.E. (2001). Estimating the knowledge capital model of the multinational enterprise, *American Economic Review* 91(3), 693-708.

Chen, Y., Horstmann, I.J., Markusen, J.R. (2012). Physical capital, knowledge capital, and the choice between FDI and outsourcing, Canadian Journal of Economics, 45(1), 1-15.

Cieślik, A., Ryan M., (2012). Productivity Differences and Foreign Market Entry in an Oligopolistic Industry. Open Economies Review 23(3), 531–57. https://doi.org/10.1007/s11079-011-9204-6.

Clar, M., Duque, J. C., & Moreno, R. (2007). Forecasting business and consumer surveys indicators–a time-series models competition. Applied Economics, 39(20), 2565-2580.

Correia, S., Guimarães, P., & Zylkin, T. (2019). ppmlhdfe: Fast Poisson estimation with high-dimensional fixed effects, arXiv. org.

Correia, S., Guimarães, P., & Zylkin, T. (2019). Verifying the existence of maximum likelihood estimates for generalized linear models. arXiv preprint arXiv:1903.01633.

Cotsomitis, J. A., & Kwan, A. C. (2006). Can consumer confidence forecast household spending? Evidence from the European commission business and consumer surveys. Southern Economic Journal, 597-610.

Davies, R.B. (2008). Hunting high and low for vertical FDI, Review of International Economics, 16(2), 250-267.

Den Haan, W. J. (2000). The comovement between output and prices. Journal of Monetary Economics, 46(1), 3-30.

Ekholm, K. Forslid,R. Markusen J.R. (2007). Export-Platform Foreign Direct Investment, Journal of the European Economic Association, 5(4), 776-795, https://doi.org/10.1162/JEEA.2007.5.4.776

Feenstra, R. C., Inklaar, R., & Timmer, M. P. (2015). The next generation of the Penn World Table. American economic review, 105(10), 3150-82.

Ferreira, E., Martínez Serna, M. I., Navarro, E., & Rubio, G. (2008). Economic sentiment and yield spreads in Europe. European Financial Management, 14(2), 206-221.

Gelper, S., & Croux, C. (2010). On the construction of the European economic sentiment indicator. Oxford Bulletin of Economics and Statistics, 72(1), 47-62.

Ghodsi, M. (2020). How do technical barriers to trade affect foreign direct investment? Tariff jumping versus regulation haven hypotheses. Structural Change and Economic Dynamics, 52, 269-278.

Ghonghadze, J., & Lux, T. (2011). Modelling the dynamics of EU economic sentiment indicators: an interaction-based approach. Applied Economics, 44(24), 3065-3088.

Grossman, G., Helpman, E. and Szeidl, A. (2006). Optimal Integration Strategies for the Multinational Firm, Journal of International Economics 70: 216–238.

Grossman, G. and Rossi-Hansberg, E. (2008). Trading Tasks: A Simple Theory of Offshoring, American Economic Review 98(5): 1978–1997.

Hansson, J., Jansson, P., & Löf, M. (2005). Business survey data: Do they help in forecasting GDP growth?. International Journal of Forecasting, 21(2), 377-389.

Head, K. (2003), 'Gravity for beginners', mimeo, University of British Columbia.

Head, K., & Mayer, T. (2014). Gravity equations: Workhorse, toolkit, and cookbook. In Handbook of international economics (Vol. 4, pp. 131-195). Elsevier. https://doi.org/10.1016/B978-0-444-54314-1.00003-3

Head, K., & Ries, J. (2008). FDI as an Outcome of the Market for Corporate Control: Theory and Evidence. Journal of International Economics, 74(1), 2-20.

Helpman, E. (1984). A Simple Theory of International Trade with Multinational Corporations. Journal of Political Economy 92: 451–71. doi:10.1086/261236.

Helpman, E. (1987). Imperfect competition and international trade: Evidence from fourteen industrial countries, Journal of the Japanese and International Economies 1(1), 62-81.

Helpman, E., Krugman, P. (1985). Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition and the International Economy. Cambridge: The MIT Press. https://doi.org/10.1016/0022-1996(86)90014-0.

Helpman, E., Melitz, M., Yeaple, S . (2004). Export versus FDI with Heterogeneous Firms. American Economic Review 94: 300–16. https://doi.org/10.1257/000282804322970814.

Horstmann, I., Markusen, J. (1987). Strategic Investments and the Development of Multinationals. International Economic Review 28: 109–21. https://doi.org/10.2307/2526862.

Hüfner, F. P., & Schröder, M. (2002).Forecasting Economic Activity in Germany - How Useful are Sentiment Indicators? (September 15, 2002). ZEW Discussion Paper No. 02-56. Available at SSRN: https://ssrn.com/abstract=339141 or http://dx.doi.org/10.2139/ssrn.339141

Kłopocka, A. M. (2017). Does consumer confidence forecast household saving and borrowing behavior? Evidence for Poland. Social indicators research, 133(2), 693-717.

Kotz, S., Johnson, H. L., & Read, C. B. (1982). Encyclopedia of statistical sciences (No. 519.5 E5).

Kristjánsdóttir, H. (2010). Foreign Direct Investment: The Knowledge-capital Model and a Small Country Case. Scottish Journal of Political Economy, 57(5), 591-614.

Krugman, P. (1983). The 'new theories' of international trade and multinational enterprise. In *The Multinational Corporation in the 1980s*. Edited by Charles Kindleberger and David Audretsch. Cambridge: MIT Press, pp. 57–73.

Lansbury, M., Pain N., Smidkova, K. (1996). Foreign direct investments in Central Europe since 1990: An econometric study, National Institute Economic Review 156, 104-113.

Larch, M., Wanner, J., Yotov, Y. V., & Zylkin, T. (2019). Currency unions and trade: A PPML re-assessment with high-dimensional fixed effects. Oxford Bulletin of Economics and Statistics, 81(3), 487-510.

Lemmens, A., Croux, C., & Dekimpe, M. G. (2005). On the predictive content of production surveys: A pan-European study. International Journal of Forecasting, 21(2), 363-375.

Markusen, J. (1984). Multinationals, Multi-Plant Economies, and the Gains from Trade. *Journal of International Economics* 16: 205–26. https://doi.0rg/10.1016/S0022-1996(84)80001-X.

Markusen, J.R. (2002). Multinational firms and the theory of international trade, MIT Press.

Markusen, J.R. (2013). Multinational firms, In: D. Bernhofen, R. Falvey, D. Greenaway, & U. Kreickemeier (eds.), Palgrave Handbook of International Trade. Palgrave Macmillan.

Markusen, J.R., Stähler, F. (2011). Endogenous market structure and foreign market entry, Review of World Economics, 147(2), 195-215.

Markusen, J.R., Strand, B. (2009). Adapting the knowledge-capital model of the multinational enterprise to trade and investment in business services, World Economy, 32(1), 6-29.

Markusen, J.R., Venables, A. (1998). Multinational Firms and the New Trade Theory. Journal of International Economics 46: 183–203. https://doi.0rg/10.1016/S0022-1996(97)00052-4.

Markusen, J.R., Venables, A. (2000). The Theory of Endowment, Intra-Industry and Multi-National Trade. Journal of International Economics 52: 209–34. https://doi.0rg/10.1016/S0022-1996(99)00055-0.

Mayer, T., & Zignago, S. (2011). Notes on CEPII's distances measures: The GeoDist database.

Ramondo, N. and A. Rodríguez-Clare (2013). Trade, multinational production, and the gains from openness, Journal of Political Economy, 121(2), 273–322.

Silva, J. S., & Tenreyro, S. (2006). The log of gravity. The Review of Economics and statistics, 88(4), 641-658.

Sinha, U.B. (2010). Strategic Licensing, Exports, FDI, and Host Country Welfare. Oxford Economic Papers 62: 114–31. https://doi.0rg/10.1093/oep/gpp014.

Slacalek, J. (2005). Analysis of indexes of consumer sentiment. German Insititute for Economic Research Working Paper. http://slacalek.com/research/sla06sentiment/sla06sentiment.pdf

Sorić, P. (2018). Consumer confidence as a GDP determinant in New EU Member States: a view from a time-varying perspective. Empirica, 45(2), 261-282.

Stack, M.M., Ravishankar G., Pentecost, E. (2017). Foreign direct investment in eastern European countries: Determinants and performance, Structural Change and Economic Dynamics, 41, 86-97.

Stock, J. H., & Watson, M. W. (2002). Forecasting using principal components from a large number of predictors. Journal of the American statistical association, 97(460), 1167-1179.

Taylor, K., & McNabb, R. (2007). Business cycles and the role of confidence: evidence for Europe. *Oxford Bulletin of Economics and Statistics*, 69(2), 185-208.

Tintelnot F. (2017). Global Production with Export Platforms, Quarterly Journal of Economics, 132(1), 157-209, https://doi.org/10.1093/qje/qjw037

Van Aarle, B., & Kappler, M. (2012). Economic sentiment shocks and fluctuations in economic activity in the euro area and the USA. Intereconomics, 47(1), 44-51.

Wei, S. J. (1996). Intra-national versus international trade: how stubborn are nations in global integration? (No. w5531). National Bureau of Economic Research.

Wilms, I., Gelper, S., & Croux, C. (2016). The predictive power of the business and bank sentiment of firms: A high-dimensional Granger Causality approach. European Journal of Operational Research, 254(1), 138-147.

Yeaple, S. (2003). The complex integration strategies of multinationals and cross country dependencies in the structure of foreign direct investment, Journal of International Economics, 60(2): 293–314.

Yotov, Y. V., Piermartini, R., Monteiro, J. A., & Larch, M. (2016). An advanced guide to trade policy analysis: The structural gravity model. Geneva: World Trade Organization. https://vi.unctad.org/tpa/web/vol2/vol2home.html

Zanin, L. (2010). The Relationship between changes in the Economic Sentiment Indicator and real GDP growth: a time-varying coefficient approach. Economics Bulletin, 30(1), 837-846.

Appendix

Table A1 / Stepwise inclusion of variables in PPML Models on amount of intra-EU pledged capital investment of all projects with remoteness index – 2003-2017 – simultaneous regressions

Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)
Log of summation of the two real GDPs	2.31***	3.12***	3.14***	3.02***	3.01***	3.06***
	(0.57)	(0.62)	(0.62)	(0.62)	(0.61)	(0.61)
Log of squared difference in real GDP of two	-0.088***	-0.071**	-0.072**	-0.072**	-0.073**	-0.067**
	(0.029)	(0.031)	(0.031)	(0.030)	(0.030)	(0.029)
Log of absolute difference of two human capital	0.17***	0.10**	0.11**	0.11**	0.11**	0.11**
	(0.052)	(0.052)	(0.052)	(0.050)	(0.051)	(0.051)
Destination Remoteness Index		3.55**	3.75**	2.67	2.65	3.28*
		(1.69)	(1.73)	(1.68)	(1.72)	(1.69)
Origin Remoteness Index		6.64***	5.91***	7.45***	6.96***	6.28***
		(1.47)	(1.57)	(1.58)	(1.61)	(1.60)
Trade Freedom Index Destination			-0.011	-0.010	-0.011	-0.013
			(0.0087)	(0.0083)	(0.0083)	(0.0083)
Trade Freedom Index Origin			0.0079	0.0087	0.0088	0.016
			(0.015)	(0.015)	(0.015)	(0.016)
Investment Freedom Index Destination				0.015***	0.014***	0.015***
				(0.0038)	(0.0038)	(0.0038)
Investment Freedom Index Origin				-0.0058*	-0.0059*	-0.0099***
				(0.0035)	(0.0035)	(0.0038)
Destination's euro membership					-0.26	-0.23
					(0.16)	(0.17)
Origin's euro membership					0.18	0.17
					(0.20)	(0.20)
Economic Sentiment Indicator Destination						0.0079**
						(0.0037)
Economic Sentiment Indicator Origin						-0.014***
						(0.0052)
Constant	-21.6***	-103.9***	-100.2***	-102.7***	-99.0***	-98.8***
	(7.44)	(18.2)	(18.4)	(18.7)	(18.9)	(18.7)
Observations	8870	8870	8870	8870	8870	8870
Pseudo R-squared	0.768	0.771	0.771	0.773	0.773	0.775
AIC	825384.4	814070.6	813428.5	807350.4	806367.1	801587.7
BIC	825412.7	814113.2	813485.2	807421.3	806452.2	801687.0
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Bilateral FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses * p<0.1; ** p<0.05; *** p<0.01

Table A2 / Stepwise inclusion of variables in PPML Models on amount of intra-EU pledged capital investment on new Greenfield projects with remoteness index– 2003-2017 – simultaneous regressions

Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)
Log of summation of the two real GDPs	2.02***	2.95***	2.99***	2.90***	2.95***	3.07***
	(0.60)	(0.67)	(0.67)	(0.67)	(0.66)	(0.65)
Log of squared difference in real GDP of two	-0.11***	-0.096***	-0.098***	-0.097***	-0.100***	-0.095***
	(0.033)	(0.036)	(0.036)	(0.035)	(0.035)	(0.034)
Log of absolute difference of two human capital	0.19***	0.12**	0.13**	0.13**	0.13**	0.14**
	(0.056)	(0.056)	(0.056)	(0.055)	(0.055)	(0.055)
Destination Remoteness Index		1.74	1.78	1.14	0.89	1.52
		(1.89)	(1.91)	(1.87)	(1.93)	(1.88)
Origin Remoteness Index		8.22***	7.72***	8.85***	8.11***	7.81***
		(1.71)	(1.83)	(1.81)	(1.83)	(1.82)
Trade Freedom Index Destination			-0.0078	-0.0068	-0.0073	-0.0081
			(0.0086)	(0.0082)	(0.0082)	(0.0083)
Trade Freedom Index Origin			0.0012	0.0013	0.0010	0.0078
			(0.016)	(0.016)	(0.016)	(0.016)
Investment Freedom Index Destination				0.011***	0.010**	0.011***
				(0.0042)	(0.0042)	(0.0041)
Investment Freedom Index Origin				-0.0037	-0.0038	-0.0081*
				(0.0038)	(0.0038)	(0.0042)
Destination's euro membership					-0.46***	-0.45***
					(0.16)	(0.15)
Origin's euro membership					0.15	0.14
					(0.21)	(0.22)
Economic Sentiment Indicator Destination						0.0034
						(0.0042)
Economic Sentiment Indicator Origin						-0.016***
						(0.0062)
Constant	-17.5**	-99.9***	-96.7***	-99.6***	-92.9***	-95.8***
	(7.67)	(19.9)	(20.4)	(20.4)	(21.1)	(20.9)
Observations	8750	8750	8750	8750	8750	8750
Pseudo R-squared	0.734	0.738	0.738	0.739	0.739	0.741
AIC	754212.3	743279.8	743045.7	740541.1	738649.0	735000.4
BIC	754240.6	743322.3	743102.3	740611.8	738733.9	735099.4
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Bilateral FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses * p<0.1; ** p<0.05; *** p<0.01

Table A3 / Stepwise inclusion of variables in PPML Models on amount of intra-EU pledged capital investment on expansion of projects with remoteness index– 2003-2017 – simultaneous regressions

Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)
Log of summation of the two real GDPs	3.44***	3.48***	3.43***	3.42***	3.31***	3.25***
	(1.16)	(1.17)	(1.14)	(1.13)	(1.13)	(1.14)
Log of squared difference in real GDP of two	-0.0012	0.010	0.0093	0.0099	0.014	0.018
	(0.039)	(0.040)	(0.040)	(0.037)	(0.037)	(0.037)
Log of absolute difference of two human capital	0.098	0.090	0.089	0.093	0.095	0.10
	(0.093)	(0.095)	(0.096)	(0.093)	(0.091)	(0.092)
Destination Remoteness Index		4.65	4.94	2.50	3.32	3.94
		(2.97)	(3.01)	(3.14)	(3.17)	(3.17)
Origin Remoteness Index		-0.78	-1.58	1.09	2.10	0.93
		(2.32)	(2.69)	(2.92)	(2.96)	(2.91)
Trade Freedom Index Destination			-0.011	-0.017	-0.017	-0.023
			(0.022)	(0.020)	(0.020)	(0.020)
Trade Freedom Index Origin			0.013	0.019	0.021	0.030
			(0.041)	(0.040)	(0.041)	(0.042)
Investment Freedom Index Destination				0.029***	0.031***	0.035***
				(0.0073)	(0.0073)	(0.0078)
Investment Freedom Index Origin				-0.0094	-0.0092	-0.011
				(0.0077)	(0.0076)	(0.0083)
Destination's euro membership					0.45	0.59*
					(0.32)	(0.33)
Origin's euro membership					1.90***	1.96***
					(0.50)	(0.51)
Economic Sentiment Indicator Destination						0.020***
						(0.0072)
Economic Sentiment Indicator Origin						-0.0047
						(0.0088)
Constant	-40.4***	-67.7**	-63.5**	-66.9*	-80.3**	-77.7**
	(15.3)	(29.8)	(30.5)	(34.7)	(34.9)	(34.3)
Observations	5015	5015	5015	5015	5015	5015
Pseudo R-squared	0.634	0.635	0.635	0.641	0.642	0.644
AIC	287842.3	287308.6	287202.9	282593.4	281510.2	279778.5
BIC	287868.4	287347.7	287255.1	282658.6	281588.4	279869.8
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Bilateral FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses * p<0.1; ** p<0.05; *** p<0.01

Table A4 / Stepwise inclusion of variables in PPML Models on number of all projects of intra-EU pledged investment with remoteness index – 2003-2017 – simultaneous regressions

Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)
Log of summation of the two real GDPs	1.69***	2.28***	2.25***	2.32***	2.33***	2.28***
	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)
Log of squared difference in real GDP of two	-0.018*	-0.0068	-0.0069	-0.0051	-0.0070	-0.0055
	(0.011)	(0.010)	(0.010)	(0.011)	(0.011)	(0.011)
Log of absolute difference of two human capital	0.060***	0.022	0.021	0.023	0.023	0.023
	(0.019)	(0.019)	(0.019)	(0.018)	(0.018)	(0.018)
Destination Remoteness Index		2.07***	2.26***	2.25***	2.19***	2.26***
		(0.62)	(0.63)	(0.65)	(0.66)	(0.66)
Origin Remoteness Index		7.42***	7.42***	8.55***	7.89***	7.57***
		(0.57)	(0.58)	(0.59)	(0.61)	(0.61)
Trade Freedom Index Destination			0.00052	0.00085	0.00020	-0.00075
			(0.0038)	(0.0036)	(0.0036)	(0.0036)
Trade Freedom Index Origin			0.0086	0.0080	0.0080	0.0087
			(0.0061)	(0.0062)	(0.0062)	(0.0063)
Investment Freedom Index Destination				0.011***	0.010***	0.011***
				(0.0016)	(0.0016)	(0.0016)
Investment Freedom Index Origin				0.0012	0.0012	0.00074
				(0.0014)	(0.0014)	(0.0015)
Destination's euro membership					-0.27***	-0.26***
					(0.059)	(0.059)
Origin's euro membership					0.10	0.10
					(0.10)	(0.10)
Economic Sentiment Indicator Destination						0.0047***
						(0.0014)
Economic Sentiment Indicator Origin						-0.0011
						(0.0016)
Constant	-19.6***	-94.0***	-95.7***	-105.5***	-100.3***	-98.2***
	(2.86)	(6.37)	(6.58)	(6.79)	(6.98)	(7.04)
Observations	8870	8870	8870	8870	8870	8870
Pseudo R-squared	0.615	0.620	0.620	0.621	0.621	0.622
AIC	21852.7	21599.0	21601.1	21551.3	21529.9	21523.6
BIC	21881.1	21641.6	21657.9	21622.2	21614.9	21622.8
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Bilateral FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses * p<0.1; ** p<0.05; *** p<0.01

Table A5 / Stepwise inclusion of variables in PPML Models on number of all new Greenfield projects of intra-EU pledged investment with remoteness index – 2003-2017 – simultaneous regressions

Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)
Log of summation of the two real GDPs	1.57***	2.18***	2.14***	2.19***	2.21***	2.18***
	(0.23)	(0.23)	(0.24)	(0.24)	(0.24)	(0.24)
Log of squared difference in real GDP of two	-0.024*	-0.016	-0.017	-0.015	-0.018	-0.017
	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)	(0.014)
Log of absolute difference of two human capital	0.051**	0.019	0.019	0.020	0.020	0.020
	(0.021)	(0.021)	(0.021)	(0.020)	(0.020)	(0.020)
Destination Remoteness Index		0.62	0.94	0.88	0.85	0.97
		(0.67)	(0.68)	(0.70)	(0.71)	(0.71)
Origin Remoteness Index		8.06***	7.91***	9.12***	8.23***	7.94***
		(0.60)	(0.62)	(0.64)	(0.66)	(0.66)
Trade Freedom Index Destination			-0.0014	-0.00059	-0.0012	-0.0019
			(0.0038)	(0.0037)	(0.0036)	(0.0036)
Trade Freedom Index Origin			0.014**	0.013**	0.013**	0.014**
			(0.0065)	(0.0066)	(0.0066)	(0.0067)
Investment Freedom Index Destination				0.011***	0.010***	0.011***
				(0.0016)	(0.0016)	(0.0016)
Investment Freedom Index Origin				0.00067	0.00072	-0.000044
				(0.0015)	(0.0015)	(0.0016)
Destination's euro membership					-0.37***	-0.35***
					(0.061)	(0.061)
Origin's euro membership					0.14	0.14
					(0.11)	(0.11)
Economic Sentiment Indicator Destination						0.0039***
						(0.0015)
Economic Sentiment Indicator Origin						-0.0023
						(0.0017)
Constant	-18.2***	-87.4***	-89.0***	-98.6***	-92.2***	-90.8***
	(2.98)	(6.93)	(7.20)	(7.54)	(7.70)	(7.77)
Observations	8750	8750	8750	8750	8750	8750
Pseudo R-squared	0.536	0.541	0.541	0.542	0.543	0.543
AIC	19926.7	19722.7	19722.6	19684.5	19651.4	19648.8
BIC	19955.0	19765.2	19779.2	19755.3	19736.4	19747.9
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Bilateral FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses * p<0.1; ** p<0.05; *** p<0.01

Table A6 / Stepwise inclusion of variables in PPML Models on number of all expanding Greenfield projects of intra-EU pledged investment with remoteness index – 2003-2017 – simultaneous regressions

Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)
Log of summation of the two real GDPs	1.87***	2.09***	2.12***	2.32***	2.28***	2.15***
	(0.50)	(0.50)	(0.51)	(0.51)	(0.51)	(0.52)
Log of squared difference in real GDP of two	0.015	0.032*	0.033*	0.037**	0.040**	0.042**
	(0.017)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Log of absolute difference of two human capital	0.073*	0.040	0.040	0.041	0.038	0.036
	(0.037)	(0.036)	(0.036)	(0.036)	(0.035)	(0.036)
Destination Remoteness Index		4.53***	4.22***	4.89***	5.35***	5.25***
		(1.30)	(1.32)	(1.39)	(1.40)	(1.40)
Origin Remoteness Index		3.02***	3.43***	4.32***	5.02***	4.79***
		(1.03)	(1.11)	(1.15)	(1.20)	(1.22)
Trade Freedom Index Destination			0.0059	0.0049	0.0064	0.0050
			(0.0087)	(0.0086)	(0.0086)	(0.0086)
Trade Freedom Index Origin			-0.015	-0.016	-0.017	-0.018
			(0.016)	(0.016)	(0.016)	(0.016)
Investment Freedom Index Destination				0.0093***	0.0100***	0.011***
				(0.0030)	(0.0030)	(0.0031)
Investment Freedom Index Origin				0.0060**	0.0060**	0.0066**
				(0.0030)	(0.0030)	(0.0032)
Destination's euro membership					0.28**	0.31**
					(0.14)	(0.14)
Origin's euro membership					0.44	0.45
					(0.35)	(0.35)
Economic Sentiment Indicator Destination						0.0056*
						(0.0030)
Economic Sentiment Indicator Origin						0.0026
						(0.0035)
Constant	-24.0***	-79.8***	-80.1***	-94.7***	-102.9***	-99.8***
	(6.52)	(13.1)	(14.0)	(14.7)	(15.2)	(15.4)
Observations	5015	5015	5015	5015	5015	5015
Pseudo R-squared	0.468	0.469	0.469	0.470	0.470	0.470
AIC	8559.4	8540.1	8542.7	8535.0	8532.7	8533.3
BIC	8585.4	8579.2	8594.9	8600.2	8610.9	8624.6
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Bilateral FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses * p<0.1; ** p<0.05; *** p<0.01

Table A7 / GMM Models on intra-EU pledged investment with remoteness index – 2003-2017

Dep. Variable:	Capital	Capital GF	Capital BF	Nr. of projects	Nr. of projects GF	Nr. of projects BF
Lagged dependent variable	0.23**	0.034	0.23**	0.41***	0.061**	0.017
	(0.094)	(0.024)	(0.11)	(0.12)	(0.027)	(0.033)
Log of summation of the two real GDPs	0.32**	0.87***	0.20	0.13	0.17**	0.13**
	(0.15)	(0.24)	(0.12)	(0.099)	(0.071)	(0.050)
Log of squared difference in real GDP of two	0.051	-0.027	0.0081	0.020	0.0062	-0.0036
	(0.040)	(0.039)	(0.035)	(0.017)	(0.013)	(0.010)
Log of absolute difference of two human capital	-0.055	0.13	0.033	0.012	0.11	-0.0014
	(0.19)	(0.40)	(0.18)	(0.072)	(0.078)	(0.051)
Destination Remoteness Index	-0.23	0.80	0.12	0.74	-0.17	0.22
	(0.28)	(2.07)	(0.46)	(0.82)	(0.94)	(0.78)
Origin Remoteness Index	-0.65**	-0.12	-0.60*	-0.69	-0.30	-0.097
	(0.29)	(2.01)	(0.36)	(0.70)	(1.06)	(0.70)
Trade Freedom Index Destination	-0.15**	-0.13	-0.0063	-0.035	-0.0046	-0.026
	(0.075)	(0.078)	(0.16)	(0.040)	(0.033)	(0.088)
Trade Freedom Index Origin	0.073	0.14*	-0.0049	-0.0054	-0.014	0.012
	(0.075)	(0.077)	(0.16)	(0.039)	(0.030)	(0.089)
Investment Freedom Index Destination	-0.021	0.049*	-0.046	-0.013	0.00099	-0.013
	(0.018)	(0.026)	(0.034)	(0.0082)	(0.013)	(0.0088)
Investment Freedom Index Origin	0.062***	0.011	0.064*	0.028***	0.0076	0.021**
	(0.021)	(0.026)	(0.037)	(0.0082)	(0.014)	(0.0089)
Destination's euro membership	-0.57	-2.86**	-0.90	0.22	-0.36	-0.31
	(0.67)	(1.17)	(0.84)	(0.33)	(0.33)	(0.50)
Origin's euro membership	0.62	2.07*	0.99	-0.12	0.50	0.24
	(0.68)	(1.21)	(0.94)	(0.32)	(0.32)	(0.49)
Log distance	-0.41**	-1.37*	-0.13	-0.57**	-0.44**	-0.18
	(0.16)	(0.81)	(0.15)	(0.28)	(0.20)	(0.24)
Colony	0.25	-1.95	-0.047	0.0013	0.24	-0.22
	(0.38)	(3.88)	(0.31)	(1.09)	(0.30)	(0.24)
Common language	-0.0047	-0.11	0.43	0.054	0.48*	0.38
	(0.35)	(2.58)	(0.34)	(0.84)	(0.28)	(0.28)
Contiguity	0.97***	-1.31	0.73**	-0.62	-0.69	-0.11
	(0.34)	(1.94)	(0.29)	(0.61)	(0.65)	(0.82)
Economic Sentiment Indicator Destination	0.048*	0.10**	0.14***	0.013	0.012*	0.025**
	(0.028)	(0.044)	(0.050)	(0.0088)	(0.0073)	(0.011)
Economic Sentiment Indicator Origin	-0.059**	-0.11**	-0.14***	-0.016*	-0.013*	-0.023*
	(0.027)	(0.047)	(0.053)	(0.0087)	(0.0069)	(0.012)
Constant		-6.92	1.93			-0.27
		(12.7)	(5.99)			(3.29)
Observations	10368	10368	10368	10368	10368	10368
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
AR(1) p-value	0	0	0	0	0	0
AR(2) p-value	0.110	0.089	0.647	0.021	0.696	0.697
Hansen test of overid. Restrictions p-value	0.221	0.118	0.491	0.463	0.118	0.426

Robust standard errors in parentheses * p<0.1; ** p<0.05; *** p<0.01
Following Bellemare and Wichman (2020), the dependent variable is transformed into hyperbolic sine as it has zero values.
Lagged dependent variable, Log of summation of the two real GDPs, and Log of squared difference in real GDP of two are included as GMM instruments.
Time-invariant gravity variables, remoteness index of each country, and year fixed effects are included as instrument for IV equations.

IMPRESSUM

Herausgeber, Verleger, Eigentümer und Hersteller:
Verein „Wiener Institut für Internationale Wirtschaftsvergleiche“ (wiiw),
Wien 6, Rahlgasse 3

ZVR-Zahl: 329995655

Postanschrift: A 1060 Wien, Rahlgasse 3, Tel: [+431] 533 66 10, Telefax: [+431] 533 66 10 50
Internet Homepage: www.wiiw.ac.at

Offenlegung nach § 25 Mediengesetz: Medieninhaber (Verleger): Verein "Wiener Institut für Internationale Wirtschaftsvergleiche", A 1060 Wien, Rahlgasse 3. Vereinszweck: Analyse der wirtschaftlichen Entwicklung der zentral- und osteuropäischen Länder sowie anderer Transformationswirtschaften sowohl mittels empirischer als auch theoretischer Studien und ihre Veröffentlichung; Erbringung von Beratungsleistungen für Regierungs- und Verwaltungsstellen, Firmen und Institutionen.