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The Trade-FDI Nexus: Evidence from the European Union

Economics Department

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Abstract

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Keywords: International Trade; FDI; Gravity model; Home Bias; Border Effect; European Union

JEL classification: F10; F14; F15, F21

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ABSTRACT

The objective of this paper is to examine the relationship between international trade and Foreign Direct Investment (FDI) empirically. It analyses whether the reduction of trade barriers over time has increased FDI for the particular case of the European Union (EU) during the period from 1995 to 2009. To analyze this issue the authors estimate in first place the European Border Effect by means of a gravity equation. Once the border effect is obtained we test whether there is a positive (complementary) or negative (substitution) relationship between this border effect and the FDI within the European countries. A gravity model for trade and FDI is estimated using the Poisson pseudo-maximum likelihood. The results suggest that there is a positive and decreasing border effect up to 2007 while it turns upward for 2008 and 2009, offsetting the previous decline. For the particular case of the EU, commercial integration and FDI reinforce each other, thus being complements rather than substitutes. In addition to trade integration measures, this paper also analyzes the potential role of other traditional determinants of FDI, as the market size of the host country and the cost differential among home-host economies. Cost differentials are not as relevant as the possibility of gaining market share which leads us to conclude that in the EU the FDI pattern follows a market-seeking strategy rather than a cost-efficient model.

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1. INTRODUCTION

The opening decade of the 21st century has witnessed a remarkable increase of flows between countries, both in terms of trade and of investment. A favourable economic climate during the first part of the decade and a widespread trend among firms towards the geographical reorganization of production have been some of the reasons underlying this pattern.

Not surprisingly, the global stock of inward Foreign Direct Investment (FDI mounted from US$ 7.5 trillion in 2000 to US$ 19 trillion in 2010, its share in world GDP rising from 23% in 2000 to over 31% in 2010. In turn, trade in goods and services has grown from US$ 16 trillion in 2000 to over US$ 37 trillion in 2010. The ratio world trade to GDP has increased 10 percentage points (from 49% in 2000 to 59%) during the first decade of the 21st century (UNCTAD, 2010a, 2011a).

The financial and economic crisis of the second half of the decade, however, has induced a turning point in the upward trend of trade and FDI. Thus, inward FDI flows fell 15% in 2008, 37% in 2009 and increased only by a modest 5% in 2010. The total amount of FDI inflows was 37% lower in 2010 than in 2007. (UNCTAD, 2010b, 2011b)

Trade has also decreased during the economic crisis. After a significant slowdown in 2008, the volume of world trade dropped by over 13% in 2009, this fall representing its greatest decline since World War II. However, the volume of world merchandise trade registered a 14 per cent increase in 2010, which roughly offset its decline in 2009.

The expansion in international trading and investment activities has coincided over time with an increase in the number of Regional Economic Integration Agreements (RIAs) and with a further deepening in the removal of restrictions on factor movements. For the particular case of the European Union –and in addition to the 1992 Single European Act, which fully liberalized the internal mobility of goods, services, capital and people, and an extension in 1995– other important landmarks in the 21st century have been the implementation of the single currency in 2002 and subsequent enlargements in 2004 and 2007.

This paper focuses on two particular aspects of the integration process of the European economy. First, it analyses to what extent the institutional steps mentioned above correspond in effect to a more integrated over time EU, as far as trade is concerned. For this purpose the paper proposes and estimates an indicator of trade integration, the so-called border effect or home bias. Second, it assesses the connection between trade integration and FDI flows within the EU. The home bias is the effect whereby consumers prefer domestic to foreign goods of similar characteristics. Its presence in even highly integrated areas has been regarded as one of the six major puzzles in international economics (Obstfeld and Rogoff, 2001). The path breaking contribution of Mccallum (1995), which used a gravity model as his framework of analysis and found a substantial degree of home bias in the Canadian-USA trade, was followed by other pieces of research covering OCDE countries (Wei, 1996, 1998), the EU (Nitsch, 2000; Chen, 2004; Quian, 2007) and the border effect between the regions that encompass specific countries (Combes et al., 2005; Gil Pareja et al., 2005; Wolf, 2009; Llano et al., 20011; Esteban et al., 2012.

The size of the home bias, as documented by these and other papers, is still a matter of controversy, and according to some authors (Helliwell, 1998; Anderson and Wincoop, 2003; Liu et al., 2010) it is heavily contingent upon the methodology employed for its estimation and the variables included. Wei (1996, 1998) found a home bias of 10 for the OCDE countries whereas Nitsch reported a value of 11.3 for EU countries.

Econometric analyses of this issue have become more sophisticated over time. Santos-Silva and Tenreyro (2006) have replaced the original log linear estimations of the gravity model by an equation in multiplicative form and propose Poisson Pseudo-Maximum Likelihood estimation (PPML). This approached has also been used by Llano et al (2011), while Dias (2010, 2011) employs a non linear specification.

The literature has not reached a consensus yet on the sign of the connection between trade and FDI. On a priori grounds, it is reasonable to assert that trade and FDI are alternative ways of serving a foreign market, thus the correlation being negative. As a matter of fact, some early empirical studies highlighted the existence of a substitution relationship between trade and FDI (Mundell, 1957, Graham, 1996; Bayoumi and Lipworth, 1997; Nakamura and Oyama, 1998). Contrarily to this view, though, other contributions argue that FDI and trade are complements rather than substitutes (Pfaffermayer, 1996; Brainard, 1997; Brenton et al, 1999; Balasubramanyam et al, 2002, Egger and Pfaffermayer, 2004a, 2004b; Cuadros et al, 2004; Alguacil et al, 2008; Neary, 2009; Martinez et al, 2012a). Furthermore, another group o papers has found both types of relationship, of complementarity and of substitution, between trade and FDI (Goldberg and Klein, 1999; Blonigen, 2001, Head and Ries, 2001, Swenson, 2004; Fillat-Castejón et al, 2008). These authors find that trade and FDI are complements in aggregate terms whereas depending on the industry analysed, they can behave either as substitutes or complements.

The remainder of the paper is as follows. Section 2 presents a discussion of our conceptual framework along with a brief summary of the data and the empirical specifications considered in this paper. We report our findings in the third section and conclude with policy implications and possible extensions.

2. EMPIRICS

2.1. GRAVITY MODEL

The gravity equation applied to trade, in its simplest form (Tinbergen, 1962) states that the volume of trade between any two countries is positively correlated with the economic volumes of the exporter and importer countries and negatively associated with natural or artificial trade resistance (Anderson, 1979; Bergstrand, 1985; Deardorff, 1998; Anderson and Van Wincoop, 2003). In addition, this framework is also appropriate to estimate FDI models (Eaton and Tamura, 1996; Graham, 1996; Brenton et al, 1999).

According to Anderson and Van Wincoop (2003), the gravity equation for trade is specified as follows

$$x_{ijt} = \frac{y_{it} y_{jt}}{y_t^w} \left(\frac{t_{ij}}{P_{it} P_{jt}} \right)^{1-\sigma} \qquad (1)$$

where x_{ijt} measures exports from the exporter i country to the importer j country in year t. y_{it} and y_{jt} are the gross domestic product of the exporter and importer countries. y_t^w is the world GDP. t_{ij} stands for the bilateral trade barrier between country i and country j. Price indices P_{it} and P_{jt} are, in the terminology of Anderson and Van Wincoop (2003), "multilateral resistance" variables since they depend on all bilateral resistances t_{ij}. The authors caution that these multilateral resistances may not be observable and therefore cannot be interpreted more generally as consumer price indices.

Analogous to the gravity equation for trade showed above, a similar expression for FDI can be derived directly from economic theory. In effect, theoretical foundations for the gravity equation applied to FDI can be found, among others, in Brainard (1997), Markusen and Maskus (2002), Bergstrand and Egger (2007), and Kleinert and Toubal (2010).

The gravity equations for FDI considered in this paper are the ones proposed by Kleinert and Toubal (2010) for the horizontal and vertical models respectively:

$$AS_{ijt} = s_{it}\left(\tau D_{ij}^{\eta_1}\right)^{(1-\sigma)(1-\varepsilon)} m_{jt} \quad (2)$$

where AS_{ijt} measures the aggregate sales of foreign affiliates[1] from i firms j in year t. s_{it} is the home country's supply capacity and m_{jt} is the host country j's market capacity. Distance costs, $\tau D_{ij}^{\eta_1}$, are an increasing function of geographical distance between i and j with τ being unit distance costs and $\eta_1 > 0$.

$$AS_{ijt} = \delta(1-\mu)\left(y_{it} + y_{jt}\right) g_2\left(y_{jt}/y_{it}\right) f\left(\tau_{ij}^{Z}\right) g_1\left(\frac{S_{it}/\left(S_{it}+S_{jt}\right)}{L_{it}/\left(L_{it}+L_{jt}\right)}\right) \quad (3)$$

where AS_{ijt} measures the aggregate sales of foreign affiliates from i firms j in year t. $g_2\left(y_{it}/y_{jt}\right)$ is a function of the income ratio, τ_{ij}^{Z} is a function of distance costs, and $g_1\left(\frac{S_{it}/\left(S_{it}+S_{jt}\right)}{L_{it}/\left(L_{it}+L_{jt}\right)}\right)$ is a function of relative factor endowment ratio between country i and country j.

[1] Although this specification of the gravity model is intended to analyse sales of foreign affiliates, it also may be used to account for FDI (See Bergstrand and Egger, 2007).

2.2. DATA

The OECD in their Structural Analysis Dataset (STAN) and International Direct Investment database provides data on bilateral exports and bilateral foreign direct investment, respectively. Disaggregated bilateral exports data is measured in current US dollars for each of the 23 industries considered while FDI data is provided on aggregate bases and also measured in current US dollars. The GDPs in real terms and US dollars are taken from the National Accounts Dataset provided by the OECD. Bilateral trade flows and FDI series have been deflated using the GDPs deflactors taken from the National Accounts Dataset as well.

In order to account for the “countries’ imports from themselves” data, which are necessary to estimate the home bias effect, we have followed Wei (1996) computing this variable for each industry and country as the difference between total production of goods and exports to the rest of the world. Data on these variables have been also extracted from the STAN Datasets and deflated using GDPs deflactors.

Data provided by the *Centre d´Etudes Prospectives et d´Informations Internationals* (CEPII) is used to account for bilateral and intra-national distances and also to account for adjacency and language dummies. Bilateral geodesic distances are calculated following the great circle formula, which uses latitudes and longitudes of the most important cities/agglomerations (in terms of population) in each country. The internal distance of a country, which is a proxy of the average distance between producer and consumers in a country is calculated using the area-based formula proposed by Head and Mayer (2002)[2]. Language variable takes value 1 if two

[2] $D_{ii} = 0.67\sqrt{\frac{Area}{\Pi}}$

countries share the same official language, adjacency variable measure whether two countries are contiguous –share land border–.

Relative factor endowments, needed to estimate the FDI models, have been constructed using data on skilled[3] and total employment from the Yearbook of Labour Statistics published by the international labour organization (ILO).

Other variables such as the Corruption Perception Index or Trade Freedom Indices are provided by Transparency International and The Heritage Foundation respectively.

2.3. EMPIRICAL FRAMEWORK

In the first part of this section, to estimate the border effect by means of a gravity equation, data on bilateral trade for 23 sectors of activity among 19 European countries[4] over the period 1995 to 2009 has been used. We follow Gourieroux, et al. (1984a, 1984b) and Santos-Silva and Tenreyro (2006) to estimate a Poisson Pseudo-Maximum Likelihood model (PPML). This estimation technique is robust to different patterns of heteroskedasticity and provides a natural way to deal with zeros in our data[5].

The standard log-linear specification of the gravity model has important disadvantages over a non-linear specification. Santos-Silva and Tenreyro (2006) show that in the presence of heteroskedasticity in the error term, the parameters of

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[3] Skilled employment is defined as the sum of occupational categories 1 (legislators, senior officials and managers), 2 (professionals) and 3 (technicians and associate professionals) from the ISCO-88 classification.

[4] Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Belgium-Luxembourg (considered jointly), Poland, Portugal, Spain, Slovakia, Sweden and the United Kingdom.

[5] Panel dataset has 111,780 observations (23-sectors x 18-exporting countries x 18-importing countries x 15-years) of which 4,463 are zero.

log-linearized models estimated by OLS lead to biased estimations of the true elasticities since the log-linearization of the dependent variable changes the properties of the error term, which becomes correlated with the explanatory variables in the presence of heteroskedasticity (the Jensen's inequality). In addition, log-linearization is not compatible with the presence of zero values in the dependent variable. Empirically, the PPML method estimates the parameters by entering the dependent variable in levels while the independent ones are expressed in natural logarithms.

Thus, the gravity equation for trade to be estimated is as follows:

$$x_{ijkt} = \beta_0 + \beta_1 \ln(y_{it}) + \beta_2 \ln(y_{jt}) + \beta_3 \ln(Dist_{ij}) + \beta_4 (D_{ij}) + \beta_5 (Home_t) + \\ + \eta_i + \eta_j + \eta_k + \eta_t + \varepsilon_{ijkt} \qquad (4)$$

where: x_{ijkt} are the k-sector bilateral exports from country i to country j in year t. y_{it} and y_{jt} are the GDPs of countries i and j, respectively. $Dist_{ij}$ stands for the bilateral trade barrier between country i and country j (the bilateral distance) and D_{ij} captures different characteristics of exporter and importer countries such as sharing a common language or land border, being an island or landlocked. $Home_t$ is a dummy variable which takes value 1 for intra-national trade and 0 otherwise.

Additionally, the model includes origin and destination (η_i, η_j) as well as industry and time (η_k, η_t) fixed effects in order to account for the unobserved price indices or "multilateral resistance" mentioned by Anderson and Van Wincoop (2003)[6]. ε_{ijkt} refers to the error term.

[6] Since the multilateral resistance terms are not observable, it is common practice to use importer and exporter fixed effects to replace the resistance terms; an approach that according to Feenstra (2002) gives consistent estimates and is easy to implement.

On an *a priori* basis, bilateral exports from country i to country j are supposed to show a positive relation with the economic sizes of both countries; as well as sharing special characteristics such as language or a common land border are supposed to reduce transaction costs and consequently foster bilateral trade. The bilateral distance between them should act as a barrier to trade so it should exhibit a negative sign.

For the purpose of this paper, the key parameters in equation (4) are those corresponding to the dummy for $Home_t$ since we can recover yearly border effects from their point estimates. The exponential of the coefficient of $Home_t$, is the ratio of intra-national trade to international trade for certain year, country or industry, after controlling for size of GDP, distance, language, adjacency…[7] Therefore, small estimates for the home dummies indicate a lower relative weight of intra-national trade and thus an increase in the importance of international trade in the countries, industries or years of the sample, i.e., greater trade integration.

The next step is to test whether trade integration, measured as the inverse of the evolution of home bias, is correlated with FDI. In order to do so, we construct a trade integration variable based on the previously estimates of home bias. Firstly we normalize the home bias estimates (equalizing 1995's to one). The reason for doing this is to eliminate the size of the estimates since it depends crucially on the measure of intra-national distances used in the estimation (see Wei (1996) for a very good example). Once we have normalized the coefficients, we calculate their inverse to obtain our measure of trade integration ($Integra$).

[7] See, among others, McCallum (1995), Helliwell (1996), Wei (1996), Nitsch (2000), Wolf (2009), Chen (2004) and Liu et al. (2010) for further explanation.

By means of the estimation of the gravity models for FDI presented in equations (2) and (3) we may now test Trade-FDI relationship. Analogous to the earlier case a PPML model is used (Kleinert and Toubal, 2010).

The gravity equations for FDI to be estimated are as follows:

$$FDI_{ijt} = \alpha + \beta_1 \ln(y_{it}) + \beta_2 \ln(y_{jt}) + \beta_3 \ln(Dist_{ij}) + \beta_4 \ln(Integra_t) + \\ + \eta_i + \eta_j + \eta_t + \varepsilon_{ijt} \quad (5)$$

$$FDI_{ijt} = \alpha + \beta_1 \ln(y_{it}) + \beta_2 \ln(y_{jt}) + \beta_3 \ln(Dist_{ij}) + \beta_4 \ln(Integra_t) + \\ + \beta_5 \ln(y_{it} + y_{jt}) + \beta_6 RFE_{ijt} + \eta_i + \eta_j + \eta_t + \varepsilon_{ijt} \quad (6)$$

where: FDI_{ijt} are the bilateral investment flows from country i to country j in year t in real terms. y_{it} and y_{jt} are the GDPs of countries i and j, respectively. $Dist_{ij}$ stands for the bilateral distance between home and host countries. $Integra_t$ is the previously constructed trade integration variable and RFE_{ijt} is the relative factor endowment ratio, defined as $ln(S_{it}/(S_{it} + S_{jt})) - ln(L_{it}/(L_{it} + L_{jt}))$. Additionally, the model includes origin, destination and time (η_i, η_j, η_t) fixed effects. ε_{ijkt} refers to the error term.

According to Kleinert and Toubal (2010) equation (5) is derived from the horizontal FDI models while equation (6) refers to the vertical FDI model. The horizontal models predict the coefficients for home and host country GDP to be one and the distance coefficient (β_3) to be negative. Meanwhile, vertical models predict the coefficient of the sum of the GDPs (β_5) and the coefficient β_1 (home GDP) to be negative and β_2 (host GDP) to be positive. Distance coefficient is predicted to be negative and the coefficient of relative factor endowment (RFE) should be positive.

3. RESULTS

3.1. GRAVITY MODEL FOR TRADE

The study of the evolution of the average home bias over the period considered can offer very important insights about the change in intra-European trade openness and may be used to evaluate the performance of the Single Market and the effects of the new internal trade liberalization policies. If border effects decline over time, it means that intra-national trade becomes less important relative to international trade and, therefore, that preference for domestically produced goods as opposed to foreign ones declines along the period considered–other things equal–. This analysis could be considered as a measure of commercial integration (Qian, 2007; Martinez et al, 2012b).

Table 1 reports the estimates using different specifications of the gravity equation (4). The first column exhibits the standard gravity equation where the economic size of exporter and importer countries and the distance between them are considered. Column two includes dummy variables for adjacency and language respectively to capture the transaction costs. In the last two columns other dummies are included to denote the effects on bilateral trade depending on being an island or landlocked, either for the exporter and importer countries.

As shown in Table 1, in all specifications, the basic gravity explanatory variables are highly significant and the coefficients have the expected signs. The GDP coefficients are positive, distance has a negative effect on trade flows, language and adjacency estimates are positive, this is, sharing a common language or border promote trade by reducing transaction costs. Finally, island and landlocked show different point estimates (sign) and significance levels when time fixed effects are included in addition to origin-year and destination-year fixed effects. *A priori* expectations for these coefficients are not straightforward; on the one hand, being an island or landlocked reduce potential exports due to transport limitations. On the other hand, they may raise bilateral exports due to the increase in the multilateral resistances. Results obtained are not conclusive in this regards since coefficients vary in sign and significance across specifications. These changes may be due to the fact that only 2 countries out of 19 (Ireland and the United Kingdom) are islands and solely 4 out of 19 are landlocked (Austria, Czech Rep., Hungary and Slovakia). Moreover, except for the United Kingdom, their economic size and their relative commercial proportion are small.

In order to retrieve the border effect from the estimations we should calculate the exponential of the point estimate of the $Home$ variable. That is, taking forth column and year 2009 ($Home_{2009} = 2.689$), on average, a European country traded 14.7 times ($\exp\hat{}(2.689) = 14.71$) more with itself than with another European partner.

According to the estimations presented in table 1, the average overall border effect shows a net increase of around 3% from 1995 to 2009 for the EU-19 countries (see table 2). Point estimates for the border effects in column 1 show lower values than in the rest of columns; however, since this is a very basic model where some relevant variables are omitted, those coefficients may be biased. Once dummy variables are included, and different fixed effects are considered, the border effects rise but show comparable values across specifications.

TABLE 1. GRAVITY EQUATION FOR TRADE WITH YEARLY BORDER EFFECTS.

VARIABLES	(1)		(2)		(3)		(4)	
Ln (Y_i)	1.000**	(0.064)	1.049**	(0.082)	1.203**	(0.070)	1.201**	(0.064)
Ln (Y_j)	1.099**	(0.061)	1.156**	(0.072)	1.284**	(0.075)	1.144**	(0.083)
Ln ($Dist_{ij}$)	-1.389**	(0.017)	-0.941**	(0.021)	-0.9360**	(0.021)	-0.971**	(0.022)
Adjacency			0.554**	(0.033)	0.596**	(0.032)	0.594**	(0.034)
Common Language			1.031**	(0.039)	1.018**	(0.039)	1.040**	(0.040)
$Island_i$					1.779**	(0.212)	-1.349**	(0.168)
$Island_j$					-2.597**	(0.288)	-0.530*	(0.239)
$Landlocked_i$					2.598**	(0.174)	0.476*	(0.191)
$Landlocked_j$					-2.340**	(0.269)	-2.966**	(0.311)
$Home_{1995}$	1.720**	(0.064)	2.623**	(0.071)	2.626**	(0.071)	2.667**	(0.093)
$Home_{1996}$	1.864**	(0.058)	2.776**	(0.066)	2.741**	(0.066)	2.757**	(0.068)
$Home_{1997}$	1.947**	(0.058)	2.858**	(0.066)	2.818**	(0.066)	2.835**	(0.068)
$Home_{1998}$	1.941**	(0.060)	2.848**	(0.067)	2.811**	(0.067)	2.825**	(0.069)
$Home_{1999}$	1.973**	(0.060)	2.878**	(0.067)	2.844**	(0.067)	2.862**	(0.069)
$Home_{2000}$	2.053**	(0.060)	2.959**	(0.067)	2.916**	(0.067)	2.935**	(0.069)
$Home_{2001}$	2.079**	(0.062)	2.979**	(0.069)	2.975**	(0.069)	2.997**	(0.071)
$Home_{2002}$	2.043**	(0.062)	2.951**	(0.069)	2.909**	(0.069)	2.928**	(0.070)
$Home_{2003}$	1.879**	(0.061)	2.786**	(0.068)	2.743**	(0.068)	2.760**	(0.070)
$Home_{2004}$	1.766**	(0.063)	2.671**	(0.069)	2.631**	(0.069)	2.654**	(0.071)
$Home_{2005}$	1.719**	(0.063)	2.631**	(0.069)	2.588**	(0.069)	2.602**	(0.071)
$Home_{2006}$	1.667**	(0.064)	2.580**	(0.071)	2.539**	(0.070)	2.554**	(0.072)
$Home_{2007}$	1.592**	(0.064)	2.484**	(0.071)	2.474**	(0.070)	2.479**	(0.072)
$Home_{2008}$	1.627**	(0.078)	2.510**	(0.083)	2.503**	(0.082)	2.508**	(0.084)
$Home_{2009}$	1.758**	(0.080)	2.649**	(0.083)	2.664**	(0.082)	2.689**	(0.084)
# Observations	109,932		109,953		109,881		109,400	
R^2	0.881		0.882		0.883		0.882	

Source: Own elaboration.

Notes: Poisson pseudo-maximum likelihood estimation. The dependent variable is the real bilateral exports from country *i* to country *j*. Clustered robust standard errors in parentheses. *, ** denote significant at the 5% and 1% level, respectively. Industry fixed effects and year-specific exporter and importer fixed effects are included in all the regressions (Feenstra, 2002). The last column also includes time fixed effects.

In all the specifications a very similar pattern arises for the border effect estimates and three stages may be easily identified. In a first stage they show increasingly higher values until 2001. A second period, from 2002 to 2007 is characterised by a sharp decline in border effects. Finally, the border effect increases again in the last two years of analysis. Up to 2001, border effects increase by around 40 per cent in the EU; while there seems to be a commercial integration for the period from 2001 to 2007, when the decline averages, again, the 40%. The increase in the last two years goes from 18 to 23 per cent, being especially important in 2009 when the border effect increased by 14 to 19 per cent from the previous year depending on the specification considered.

TABLE 2. ESTIMATED BORDER EFFECTS.

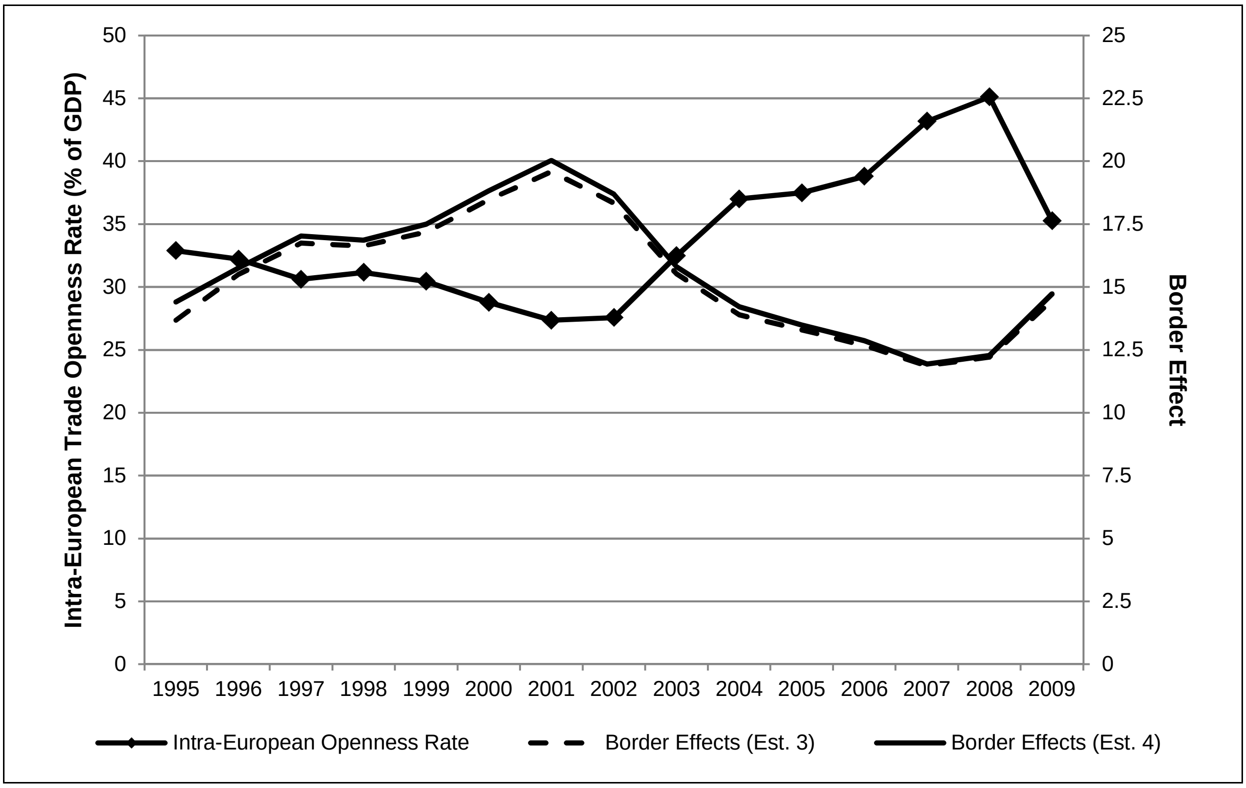
YEAR \ ESTIMATION	(1)	(2)	(3)	(4)
1995	5.58	13.78	13.68	14.40
1996	6.45	16.05	15.50	15.75
1997	7.01	17.43	16.74	17.03
1998	6.97	17.25	16.63	16.86
1999	7.19	17.78	17.18	17.50
2000	7.79	18.71	18.47	18.82
2001	8.00	19.67	19.59	20.03
2002	7.71	19.13	18.34	18.69
2003	6.55	16.22	15.53	15.80
2004	5.85	14.45	13.89	14.21
2005	5.58	13.89	13.30	13.49
2006	5.30	13.20	12.67	12.86
2007	4.91	11.99	11.87	11.93
2008	5.09	12.30	12.21	14.28
2009	5.80	14.14	14.45	14.72

Source: Own elaboration.
Notes: Estimated Border Effects are calculated as the exponential of the β-estimates for the *home* variables in table 1 $\left(\exp\text{^}(Home_t)\right)$. Columns are presented in the same order as in table 1.

Results obtained from the evolution of the border effects are in line with the evolution of the intra-European trade openness rate (figure 1). We have calculated the intra-European trade openness rate as the weighted-average of the countries openness rate with the rest of countries in the sample, using countries' GDP participation as weight. Border effects from the third and fourth columns of table 1 have been included in the figure.

From 1995 to 2002 we observe a decline in the openness rate. This decline is due to the fact that although exports and imports grew in those years they evolved at a slower pace than GDP. This period corresponds to greater border effects. From 2002 to 2008 the situation turned around, intra-European trade grew faster than GDPs and the openness rate experienced a large growth from 27% of GDP in 2002 to more than 45% in 2008. The border effect, meanwhile, faced a decline of around 40% –from 20, to 12 in 2007–. Finally, intra-European trade experienced a sharp decline between 2008 and 2009 reflected in a decline of the openness rate by 10 points. As shown in figure 1, the estimated border effects follow an opposite pattern that intra-European openness rate. This is the case for the whole period except for year 2008 when the openness rate was still growing while the border effects, instead declining, started to raise as well.

FIGURE 1. YEARLY BORDER EFFECTS AND INTRA-EUROPEAN TRADE OPENNESS.



Source: Own elaboration. Data on exports, imports and GDP are from the OECD. Border Effects shown refers to columns three and four of table 2.

Once the border effects have been estimated, the next stage is to construct our commercial integration variable. As it was mentioned above, this is a two steps process; firstly, we normalized the border effects by doing 1995's equals to one. Then, we compute the inverse to obtain the integration variable. By means of these transformations we avoid the possibility of a size bias (Wei, 1996) and we get a variable easily interpretable. Table 3 details the home bias results from column 4 in table 1 and shows how the commercial integration variable has been constructed as stated above.

TABLE 3. ESTIMATED BORDER EFFECTS AND COMMERCIAL INTEGRATION.

Year	Border Effect $exp(\beta_n)$	Annual Rate of Growth *(%)*	Rate of Growth from 1995 *(%)*	Normalized Border Effect (nBE)	***Commercial Integration*** $(\boldsymbol{nBE})^{-1}$
1995	14.39	--	--	1	**1**
1996	15.75	9.42	9.42	1.09	**0.92**
1997	17.03	8.11	18.29	1.18	**0.85**
1998	16.86	-0.99	17.12	1.17	**0.85**
1999	17.50	3.77	21.53	1.22	**0.82**
2000	18.82	7.57	30.73	1.31	**0.76**
2001	20.03	6.40	39.10	1.39	**0.72**
2002	18.69	-6.67	29.82	1.30	**0.77**
2003	15.80	-15.46	9.75	1.10	**0.91**
2004	14.21	-10.058	-1.29	0.99	**1.01**
2005	13.49	-5.07	-6.29	0.94	**1.06**
2006	12.86	-4.69	-10.68	0.89	**1.12**
2007	11.93	-7.23	-17.14	0.83	**1.20**
2008	12.28	2.94	-14.70	0.85	**1.18**
2009	14.72	19.84	2.22	1.02	**0.98**

Source: Own elaboration.
Notes: Estimated Border Effects shown correspond to those presented in column 4 of tables 1 and 2.

For the purpose of this paper we have also addressed the border effect issue from a country point of view by estimating the country-specific evolution of the home bias over the period considered. Estimated border effects and commercial integration variables for each country are presented in table A2 and figure A1 in the appendix[8].

3.2. Gravity model for FDI. The Trade-FDI Nexus

We analyse the impact of intra-European trade integration on the bilateral FDI flows within the nineteen European countries using the gravity model specifications discussed above. Tentatively figures A2 and A3 in the appendix show the correlation between commercial integration, computed as the inverse of the border effects estimates, and FDI inflows and outflows respectively. More specifically, FDI for a reporting country accounts for the logarithm of the aggregate flows to/from the rest of the European countries in the sample. Both figures suggest a positive relationship between FDI and Commercial Integration. Thus, we may expect *a priori* positive estimates for the integration variables in the estimation of the gravity model for FDI.

The results of these regressions are presented in table 4. The results presented in columns 1 and 3 correspond to the horizontal model shown in equation (5). Estimates regarding home and host GDP are in line with earlier results from gravity equations and are significant at 1% level. However, the horizontal (proximity-concentration) model suggests that the coefficients on both GDP variables should be equal to one. Yet, this is not supported by the data. The restriction on both coefficients equals to unity is rejected at the 1% level in columns 1 and 3. We have included the corruption perception index (CPI) from Transparency International as a control variable. We do find significant impact of this index –for the host country– on

[8] Complete estimation results are available from the authors upon request.

bilateral FDI flows. Higher CPI scores means less perception of corruption. This significant impact highlights the sensitiveness of investors to corruption, even among the European Union where countries are supposed to score good corruption indexes.

TABLE 4. GRAVITY EQUATION FOR FDI.

VARIABLES	(1)		(2)		(3)		(4)	
ln (Y_i)	0.644**	(0.077)	1.033**	(0.194)	0.572**	(0.076)	0.746**	(0.162)
ln (Y_j)	0.617**	(0.083)	0.987**	(0.164)	0.583**	(0.087)	0.742**	(0.154)
ln ($Dist_{ij}$)	-1.289**	(0.134)	-1.213**	(0.134)	-0.813**	(0.108)	-0.804**	(0.102)
EU Integration	1.904*	(0.829)	1.870*	(0.842)				
$Integration_i$					0.525**	(0.085)	0.494**	(0.086)
$Integration_j$					0.267**	(0.076)	0.259**	(0.076)
ln ($Y_i + Y_j$)			-0.816*	(0.354)			-0.751*	(0.294)
RFE_{ij}			2.082*	(0.821)			0.627	(0.589)
CPI_j	0.254**	(0.043)	0.307**	(0.043)	0.189**	(0.045)	0.209**	(0.047)
# Observations	3030		3030		3030		3030	
R^2	0.285		0.283		0.344		0.344	
Test *ln*(Y*i*)=*ln*(Y*j*)=1	52.91**		0.10		129.56**		3.27	
p-value	*(0.000)*		*(0.949)*		*(0.000)*		*(0.195)*	
Test *ln*(Y*i*+Y*j*)=1			26.25**				35.82**	
p-value			*(0.000)*				*(0.000)*	

Source: Own elaboration.
Notes: Poisson pseudo-maximum likelihood estimation. The dependent variable is the real bilateral FDI flows from country *i* to country *j*. Clustered robust standard errors in parentheses. *, ** denote significantly different from 0 at 5% and 1% levels, respectively. Home country, host country and time fixed effects are included in all the regressions.

We include the relative factor endowment (RFE) and the sum of GDPs variables in columns 2 and 4. The introduction of these two variables accounts for the vertical FDI model (factor-proportions model) presented in equation (6). Again, as in columns 1 and 3, GDP and distance variables remain unchanged regarding sign and significance level as well as the corruption variable. The vertical model predicts that the coefficient for the sum of GDPs to be one; this particular is rejected by the data at the 1% level of significance since coefficients obtained shows a negative and significant relationship. The prediction of the vertical model regarding to relative factor endowments is that FDI should increase in the high-skilled labour abundance of the home country, relative to the host country. Evidence from the data is mixed and inconclusive. While it may exert a positive impact in specification (2), specification (4) shows a coefficient not significantly different form zero. In the case of the European countries, home and host economic structures and human capital endowments are quite similar so it is understandable that this measure will show mixed evidence for this group of countries.

Finally and what is more interesting for the purpose of this paper, commercial integration variables are included in all the regressions to account for the Trade-FDI nexus. In column 1 and 3 the average commercial integration is suggested while in columns 2 and 4 we consider the home and host country trade integration variables separately. Results indicate a complementary relationship between intra-European trade and FDI. This result is supported by the data in the four specifications considered. The estimated coefficients are positive and statistically significant at 5% in the cases of the average commercial integration variable. The evidence from the home and host country variables is even stronger.

4. CONCLUSIONS

The empirical analysis carried out in this paper states that commercial integration, captured by the evolution of the home bias, and FDI within the European Union during 1995-2009 exhibit a positive correlation, thus displaying a relationship of complementarity. The results also point out that cost differentials, for the country sample considered, are not as relevant as the possibility of gaining market share.

The gravity equation for trade points out a positive and decreasing, up to 2007, border effect, which means that in spite of the establishment of the Single Market Act there is still a bias in favor of domestic goods. This bias, in the case of the EU, is probably caused by informal trade barriers, features related to marginal propensity to consume and the degree of substitution between goods.

Our findings support the idea that policies targeted to promote further consolidations of the European Single Market –removing informal trade barriers, promoting liberalization and reducing bureaucracy–, may have positive effects, not only regarding the commercial performance of the EU but also helping to intensify FDI flows among the European countries, and indirectly, stimulating economic growth.

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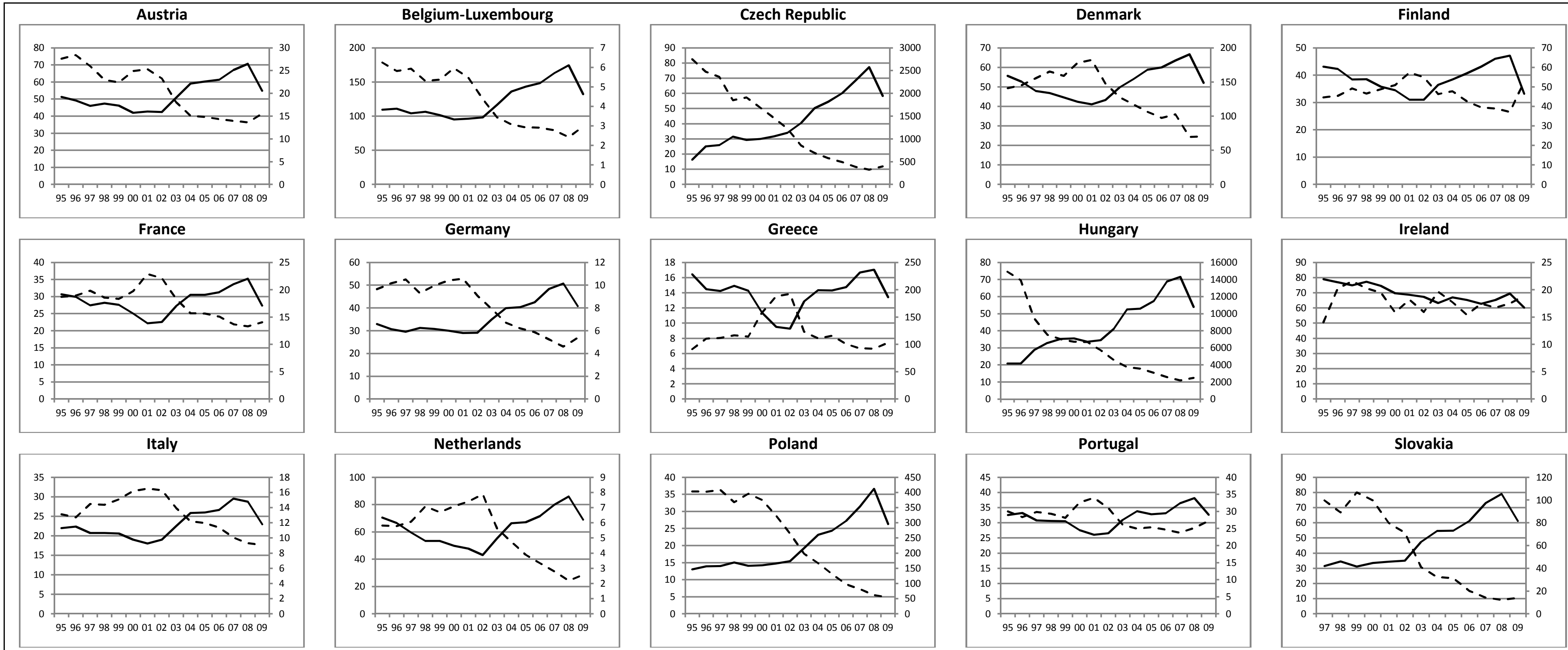
APPENDIX

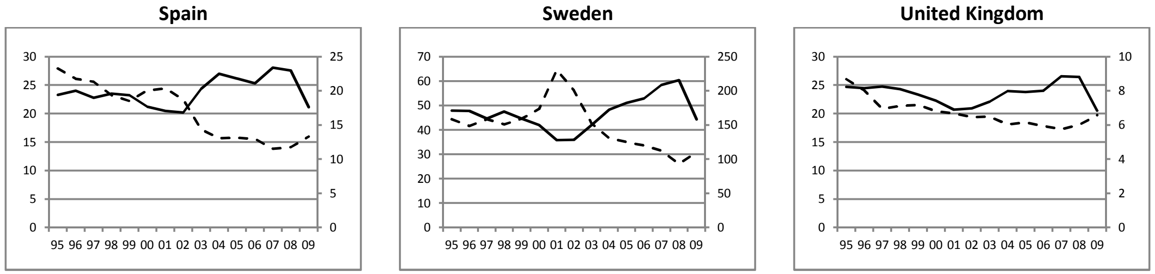
TABLE A1. SECTORS OF ACTIVITY.

1	Agriculture, forestry and fishing	13	Fabricated metal products
2	Mining and quarrying	14	Machinery and equipment n.e.c
3	Food, beverages and tobacco	15	Office, accounting and computing machinery
4	Textiles, leather and footwear	16	Electrical machinery and apparatus n.e.c
5	Wood and cork	17	Radio TV communication equipment
6	Pulp paper, printing and publishing	18	Medical precision and optical instrument
7	Coke, refined petroleum and nuclear fuel	19	Motor vehicles, trailers and semi-trailers
8	Chemical excluding pharmaceuticals	20	Shipbuilding
9	Pharmaceuticals	21	Aircraft and spacecraft
10	Rubber and plastics	22	Railroad and transport equipment n.e.c
11	Non-metallic products	23	Manufacturing n.e.c and recycling
12	Basic metals		

Source: Own elaboration

FIGURE A1. BORDER EFFECT AND INTRA-EUROPEAN OPENNESS RATE EVOLUTION



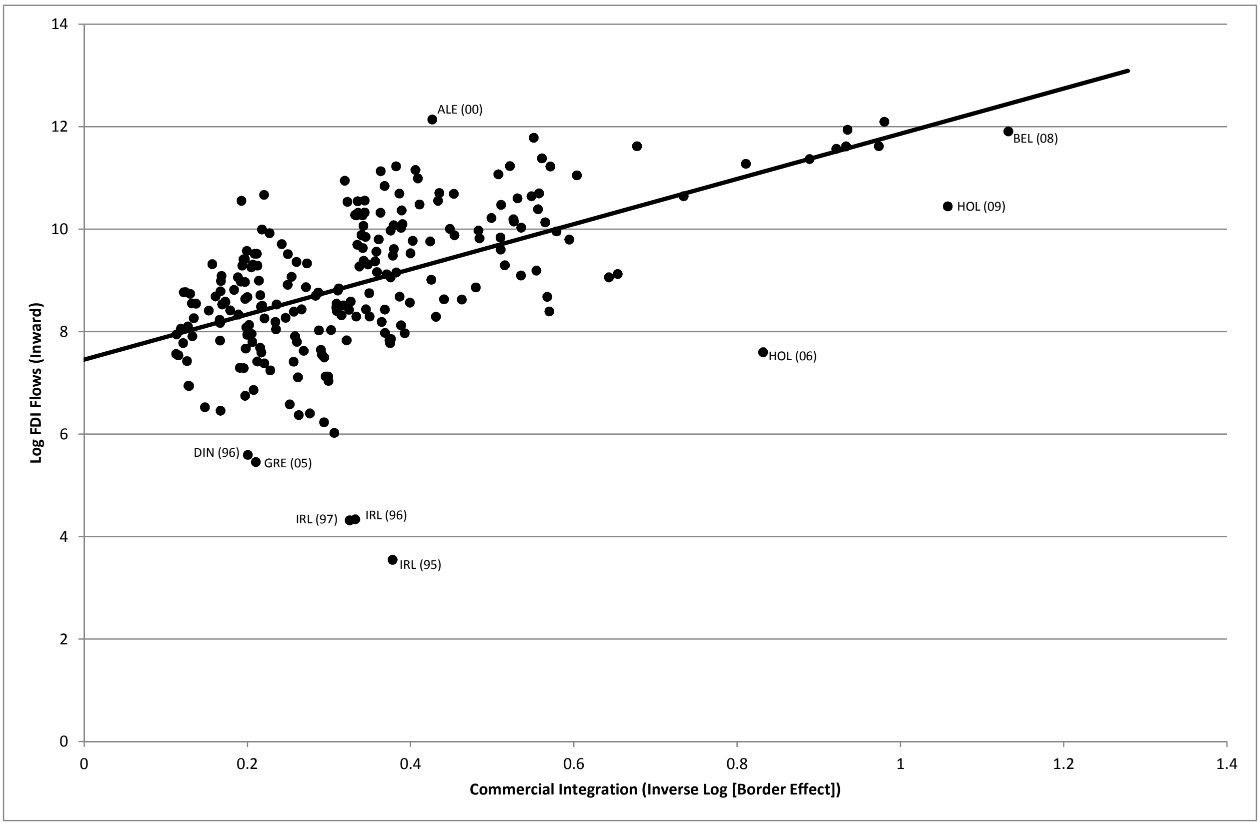


Notes: Solid lines account for the country's intra-European Openness Rate while the dotted ones represent the estimated border effect. Left vertical axes are the reference for the openness rate (in percentage). Right vertical axes are the scale for the border effect.

Data on exports, imports and GDP are from the OECD. Border Effects have been estimated by means of the gravity equation.

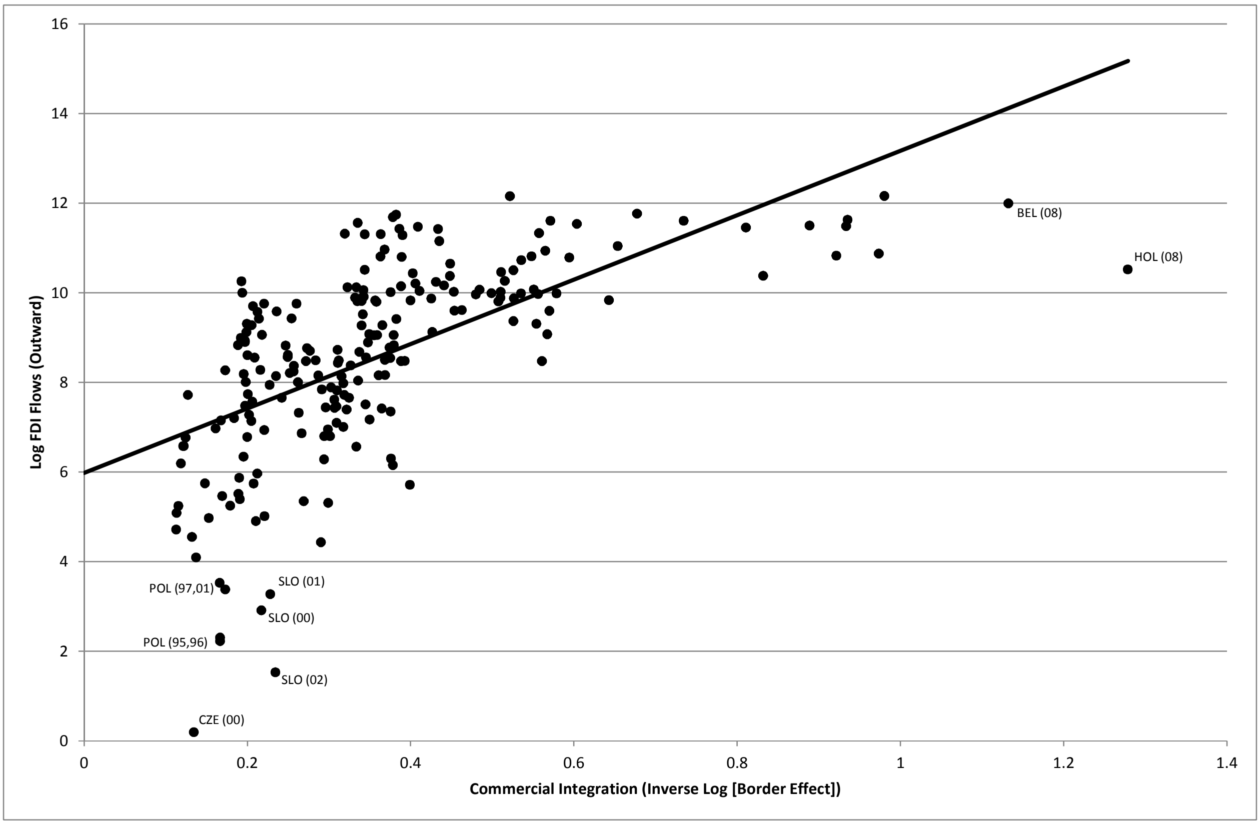
Source: Own elaboration

FIGURE A2. INWARD FDI FROM EU-19 AND COMMERCIAL INTEGRATION



Source: Own elaboration

FIGURE A3. OUTWARD FDI TO EU-19 AND COMMERCIAL INTEGRATION



Source: Own elaboration