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Abstract

This paper intends to combine two fields in the economic literature by examining empirically the FDI pattern –horizontal versus vertical– within the European Union and the relevance of trade integration as a potential determinant of investment flows over the period 1995-2009. We capture trade integration by estimating the magnitude and evolution of the home bias or border effect rather than by using other indicators such as the openness rate or the existence of tariffs and non-tariff barriers. We find that, for the particular case of the EU, it is not possible to strictly discriminate between horizontal or vertical FDI. The market-seeking strategy appears to be more important than factor-proportion related motivations; however, the robust relationship of complementarity between trade integration and FDI provides at least one argument in support of vertical FDI and suggests that the vertical model cannot be dismissed entirely.

JEL-Code: F100, F140, F150, F210.

Keywords: international trade, FDI, gravity model, home bias, border effect, European Union.

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1. Introduction.

Trade and investment flows among countries have experienced a remarkable expansion over the first decade of the 21st century. A favourable economic climate during the first part of the decade alongside with a widespread trend among firms towards the geographical reorganization of production are some of the reasons underlying this behaviour.

Trade in goods and services grew from US\$ 16 trillion in 2000 to over US\$ 37 trillion in 2010. The ratio world trade to GDP increased in 10 percentage points (from 49% in 2000 to 59% in 2010) during the first decade of the 21st century (UNCTAD, 2010a, 2011a). 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 2010¹.

To what extent are these increases in trade and FDI linked? The answer to this question is not straightforward. If trade and FDI are alternative ways whereby multinational firms (MNEs) serve foreign markets, the expected correlation between trade and FDI will be negative. If, instead, the majority of MNEs fragment production and locate the various stages in different countries seeking cost reductions, FDI and trade will display a positive association. Ultimately, the connection between trade and FDI flows will be heavily contingent on the kind of operational model adopted by MNEs.

The empirical evidence available on this issue is still not conclusive, since different pieces of research have found links between trade and FDI of either sign.

This paper intends to contribute to this debate by analysing this issue for the particular case of the European Union. More specifically, the aim of this paper is twofold, first to find the FDI model that better describes the pattern of foreign investment within the EU and, secondly, to study specifically the nexus between commercial integration and FDI. To this end, we have used an alternative measure, the evolution of the home bias, to capture commercial integration within the EU.

In order to pursue these goals, we exploit the information contained in an unbalanced panel comprising data for 19 EU economies by means of a gravity model with bilateral country-level data over the period 1995-2009.

¹ The Great Recession, obviously, has affected trade and FDI flows negatively. After a slowdown in 2008, the volume of world trade dropped by over 13% in 2009, the greatest decline since World War II. World merchandise trade, however, increased 14% in 2010. FDI flows fell 15% in 2008, 37% in 2009 and increased only by a modest 5% in 2010 (UNCTAD, 2010b, 2011b).

In our view, the European Union provides a very interesting sample for the purpose of this investigation. The European countries encompass a highly integrated area, also characterized by a large increase of trade and investment flows in the first years of the 21st century. European trade (imports + exports) in value terms grew 112% along the last decade, reaching a maximum of 11.7 trillion dollars in 2008. EU-19 FDI inflows, in turn, almost tripled from 2004 to 2007, reaching a maximum of 825.3 billion dollars². Furthermore, the EU generates a relatively large share of world trade and FDI, around 40%.

Our methodological approach is novel in two different ways. First, we circumscribe our study to the analysis of intra-European FDI and trade flows since data available show that the majority of FDI and trade within the EU come from other EU economies. In effect, FDI with origin and destination within the EU accounted for 66% of the total inflows; in turn, 64% of total EU exports moved within the EU-19, while for imports the percentage was about 60% on average over 1995-2009. Thus, using intra-European data will allow us to draw an accurate picture regarding the idiosyncrasy of the FDI-trade nexus within the EU. Second, and following Balta and Delgado (2009), we employ a relatively original measure for trade integration: the evolution of the home bias³. In order to capture commercial integration, studies have traditionally used variables such as the openness rate or the evolution of tariffs or dummies which reflect the fact of a country pertaining to a trade zone. However, the use of tariffs in our study is not possible as the EU is a customs union. Moreover, dummies capture the fact of some countries belonging to a trade agreement but they do not provide information on the members' performance within that framework. In our view, the use of the home bias may help reflect more accurately the *de facto* effectiveness and success of the commercial integration phenomena in general, and of the EU as a highly integrated area in particular.

Home biases may be employed within both a static and a dynamic approach. A home bias close to zero in a given moment of time suggests an almost perfect commercial integration. The evolution over time of the home bias, in turn, informs about the changes in the degree of commercial integration. An observed reduction in the home bias evidences a higher level of commercial integration. Notwithstanding these ideas, we have

² Again, the Great Recession had a negative impact on these figures. During 2008 and 2009, European trade experienced a 20% decline. EU 19 investment flows fell by 37% in 2008 and by an additional 32% in 2009.

³ 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 the international economics (Obstfeld and Rogoff, 2001). A substantial number of studies has measured this phenomenon and highlighted its importance; for further discussion see Martinez et al. (2012b).

also employed the openness rate in our empirical analysis, thus carrying out a straightforward robustness test of the appropriateness of the home bias.

The remainder of the paper is organized as follows. In section 2 we present a brief review of the empirical and theoretical literature. Section 3 describes the data and offers a descriptive analysis. Section 4 explains our conceptual framework and the empirical specifications considered in this paper. We report our results in section 5. In the last section of the paper we conclude with policy implications and possible extensions for future work.

2. A brief review of the literature.

The choice of one or more appropriate locations for their plants abroad is a fundamental issue for MNEs. Usually, MNEs pursue different goals - often linked to their particular business model – when making these strategic decisions, and can be classified in distinct categories accordingly. Some of the first theoretical contributions which tackled this topic can be traced back to the 70s and early 80s (Caves, 1971; Dunning, 1973; Hymer, 1976; Buckley and Casson, 1976). Dunning classified the motivations driving foreign investment placements in four types, in a well-known taxonomy: strategic asset seeking, resource seeking, market seeking, and efficiency seeking.

The literature in the 80s and 90s, in an intuitively appealing classification, suggested that FDI activities could follow horizontal or vertical models. Horizontal firms choose to locate their plants in specific countries or regions with the purpose of serving those markets, and hence produce the same good (or a slightly different version of it) in each country or region⁴. These are known as proximity-concentration models (Brainard, 1997; Helpman et al, 2004; Bevan and Estrin, 2004; Neary, 2009). Vertical firms, instead, try to minimize production costs by separating the different stages of production and placing them at the most favorable locations in terms of resource endowments⁵. These are known as factor-proportion models. (Helpman, 1984; Helpman and Krugman, 1985; Bergstrand, 1989; Brainard, 1997).

The sign of the correlation between trade and FDI for each country or region will depend upon the type of model adopted by the majority of firms operating in it. By and large, the setup adopted by horizontal firms may be considered as an alternative to exports; therefore, the FDI flows associated to these firms usually behave as a substitutive of

⁴ Thus, these firms maximize proximity to customers. Usually (but not necessarily) they could also be able to profit from scale economies. In many occasions they will confront a tradeoff between proximity to customers and concentration of production intended to exploit scale economies.

⁵ Decisions in this regard will be driven by the availability and costs of inputs at each potential site.

trade. Vertical MNEs, in turn, bring about trade flows among the different stages of the value chain, thus being complementary with trade.

The distinction between horizontal and vertical firms is not always straightforward, though, since both types of models may coexist. At the end of the 90s, Markusen and Venables (1998), Carr et al (2001) and Markusen and Maskus (2002) designed the so called Knowledge-Capital model, which combined horizontal and vertical features. This model is based on three key assumptions (Carr et al., 2001): a) innovation and production activities can be undertaken at different venues; b) R+D activities are intensive in skilled labor; c) their outcomes can be incorporated into production at a low cost. In this setting, firms will behave as vertical MNEs when placing R+D and production in separated venues, according to factor costs, and as horizontal companies when locating production close to the markets intended to be served.

Other approaches, often coming from the field of the New Economic Geography, have explored alternative factors driving firms' decisions⁶. Especially pertinent for the purpose of this paper is the contribution of Head and Mayer (2004), which stressed market potential, understood as the set of customers that can be accessed from a particular venue, as an important determinant for investment location.

The sign of the connection between trade and FDI has also been addressed empirically. Some studies have found a substitution relationship between trade and FDI (Mundell, 1957, Graham, 1996; Carstensen and Toubal, 2004). Other contributions, instead, document that FDI and trade behave as complements rather than substitutes (Pfaffermayer, 1996; Brainard, 1997; Brenton et al, 1999; Balasubramanyam et al, 2002; Egger and Pfaffermayer, 2004a, 2004b; Alguacil et al, 2008; Neary, 2009; Martinez et al, 2012a). Furthermore, other papers (Goldberg and Klein, 1999; Blonigen, 2001, Head and Ries, 2001, Swenson, 2004; Turkcan, 2007; Fillat-Castejón et al, 2008), have found both types of relationship between trade and FDI, suggesting that trade and FDI perform as complements when using country level data whereas, depending on the particular industry where they operate, the relationship can be positive or negative. In terms of the empirical evidence available, therefore, the literature has not reached a consensus yet on the sign of the connection between trade and FDI.

3. Descriptive analysis of the data.

This section will provide a first characterization of the data employed in our empirical analysis. Table 1 displays the proportion of total EU-19 trade and FDI flows which takes

⁶ For an excellent review of FDI determinants see Blonigen (2005).

place within the EU economies. It is apparent from the Table that the own EU market is key for the EU-19 commercial and FDI activity. Around 64% of EU exports and 60% of EU imports have their destination or origin in other European countries. On average, also about 62% of European inward FDI flows come from other EU economies. Above and beyond these figures, the evolution of trade shows a very stable pattern up to 2005, ranging around 65% and 62% of the total for exports and imports, respectively. In 2005, though, the European interdependency regarding trade declined by 3 percentage points and finally, in 2009, it diminished notably –7% and 5% for exports and imports, respectively–.

In turn, the importance of EU countries when acting as hosts of European FDI exhibits an important increase from 1995 –when they account for 44% of total EU inward FDI– to 2005 – when 80% of inward FDI came from other European economies–. During the last years of the period the trend changes and intra-European FDI suffers a downturn, with only 53% of total FDI flows coming from other European countries.

Table 1. Intra-European participation in total EU-19 trade and FDI

	<i>Exports</i>	<i>Imports</i>	<i>Trade</i>	<i>Inward FDI</i>
1995	65.096	63.405	64.268	44.570
1996	64.292	63.002	63.661	52.145
1997	63.992	62.527	63.276	55.912
1998	65.496	63.252	64.389	52.346
1999	66.834	63.283	65.066	61.815
2000	65.438	60.401	62.906	76.125
2001	65.595	61.345	63.474	79.723
2002	65.223	62.675	63.967	78.891
2003	65.816	62.903	64.373	74.173
2004	65.874	62.107	63.997	80.482
2005	65.198	60.257	62.709	80.057
2006	62.217	57.058	59.604	72.690
2007	62.306	58.227	60.251	67.504
2008	62.007	56.907	59.424	62.610
2009	55.389	51.606	53.496	53.917

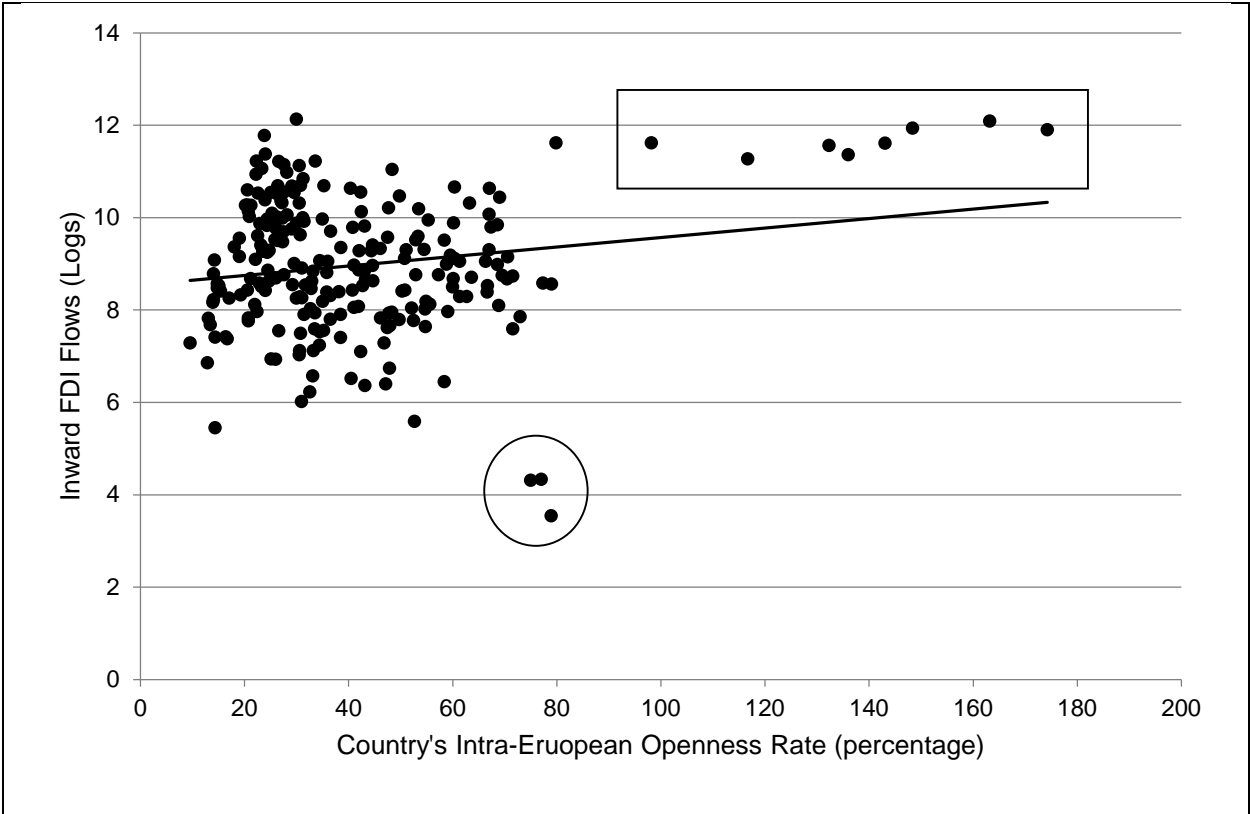
Source: Own elaboration.

Notes: Figures denote the percentage of EU-19 total exports, imports and inward FDI flows that take place among the EU-19 countries.

On a priori grounds it is not clear to what extent the fluctuations in trade and FDI flows are interrelated. In this sense, Figure 1 displays a scatter plot of inward FDI flows (measured in natural logarithms) against the intra-European Openness rate. Each point accounts for the pair inward FDI–Openness rate for a country in a certain year. The Figure

suggests a positive correlation between both variables, but this is very reliant upon the inclusion of Belgium and Luxembourg in the Figure (points for Benelux are located inside the square at the upper right corner); moreover, it is easy to identify another group of outliers (inside the circle), corresponding in this case to Ireland in 1995, 1996 and 1997. The rest of dots do not appear to follow a definite pattern: the trend line would be horizontal if Benelux was removed from the sample. The connection between trade and FDI within Europe, thus, is not straightforward.

Figure 1. FDI-Openness relationship



Source: Own elaboration.

Data used in this study come mainly from the OECD. The International Direct Investment database provides data on bilateral foreign direct investment. FDI data is documented on an aggregate basis and measured in current US dollars. Data on bilateral exports, disaggregated by industries, are computed by the OECD in its Structural Analysis database (STAN). The GDPs in real terms and US dollars are taken from the OECD National Accounts Dataset. The FDI and Exports series have been deflated using the GDPs deflators included in the National Accounts Dataset. Data provided by the *Centre d'Etudes Prospectives et d'Informations Internationales* (CEPII) is employed to account for other variables included in our analysis, such as adjacency, common language and

bilateral distances. 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.

Relative Factor Endowments ratios (RFE) have been constructed using data on skilled⁷ and total employment from the Yearbook of Labour Statistics published by the International Labour Organization (ILO). Finally, the Corruption Perception Index elaborated by Transparency International is included in the specifications as an institutional control variable. This index ranks from 0 (high perception of corruption) to 10 (low corruption).

Table 2 presents the descriptive statistics of the main variables used in the study.

Table 2. Descriptive Statistics

<i>Variables</i>	<i>Obs.</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min.</i>	<i>Max.</i>
FDI Inflows _{ij}	2982	1787.795	6409.471	0.000	132651
Ln (GDP _i)	4590	12.854	1.034	10.969	14.845
Ln (Distance _{ij})	4590	6.980	0.640	4.952	8.121
Ln (RFE _{ij})	4590	-0.003	0.135	-0.556	0.440
Ln (GDP _i +GDP _j)	4590	13.783	0.831	11.817	15.405
CPI _j	4505	6.911	1.909	2.990	10.000
Ln (EU Openness)	4590	3.516	0.148	3.309	3.809
Ln (Openness _i)	4556	3.613	0.548	2.228	5.160
Exports _{ij}	119232	1612.938	2.59e+04	0.000	2.10e+06

Source: Own elaboration.

Notes: All variables in real terms. Bilateral FDI inflows and Exports are in levels (millions 2005US\$).

4. Home bias estimation and empirical specification for FDI.

As stated above, the objectives of the paper are to investigate the sign of the relationship between trade and FDI flows within the EU by using the evolution of the home bias as an alternative measure of commercial integration, and to analyse the FDI pattern for the countries in our sample. Next, we shall present the results obtained when estimating the home bias and afterwards we shall describe the analysis pursued in order to understand the FDI pattern within the EU, employing as one of the key variables precisely the home bias computed before.

⁷ 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.

4.1. Estimation of the Home Bias for the European Union (EU-19).

Different variables, such as the openness rate or the evolution in tariffs, have been used by the literature to measure commercial integration. Some contributions suggest that the performance of the home bias can be used as a measure of trade openness (Balta and Delgado, 2009). We have chosen to employ this last indicator since it may capture other dimensions (informal barriers, preferences) that ultimately determine commercial integration, and which are not included in alternative measures. In effect, the home bias measures the difference between the external and the internal (i.e. domestically oriented) trade of each country, thus capturing all factors which affect consumers' decisions in favor of domestic good and services as opposed to those produced in other countries.

The home bias has received a remarkable deal of attention in the literature. 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), the EU (Nitsch, 2000; Chen, 2004; Qian, 2007; Martinez et al. 2012b) and regions (Combes et al., 2005; Wolf, 2009; Llano et al., 20011).

In its simplest form (Tinbergen, 1962), the gravity equation states that the volume of trade between any two countries is positively correlated with the economic size of the exporter and importer countries and negatively associated with the distance between them. Further extensions have introduced natural or artificial trade resistances (Anderson, 1979; Bergstrand, 1985; Anderson and Van Wincoop, 2003).

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

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

where x_{ij} 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 barriers or resistances (t_{ij}).

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

$$x_{ijkt} = \beta_0 + \beta_1 \ln(y_{it}) + \beta_2 \ln(y_{jt}) + \beta_3 \ln(Dist_{ij}) + \beta_4 (D_{ij}) + \beta_5 (Home_t) + \eta_i + \eta_j + \eta_k + \eta_t + \varepsilon_{ijkt} \quad (2)$$

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 the exporter and importer countries such as sharing a common language or land border, being an island or being 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)⁸. ε_{ijkt} refers to the error term.

We have estimated the border effect by means of a gravity equation employing data on bilateral trade for 23 sectors of activity⁹ among 19 European countries¹⁰ over the period 1995 to 2009. We employ a Poisson Pseudo-Maximum Likelihood model (PPML), proposed by Santos-Silva and Tenreyro (2006), in order to overcome the disadvantages of a log-linear specification of the gravity model. These authors showed that, in the presence of heteroskedasticity in the error term, the parameters of log-linearized models estimated by OLS lead to biased estimations of the true elasticities. In addition, log-linearization is incompatible with the existence of zeros in the dependent variable. The PPML method estimates the parameters by entering the dependent variable in levels while the independent ones are expressed in natural logarithms, thus providing a natural way to deal with zeros in the data¹¹.

On an *a priori* basis, bilateral exports from country i to country j are supposed to show a positive correlation with the economic sizes of both countries. Sharing special characteristics such as language or a common land border reduce transaction costs and

⁸ Since the multilateral resistance terms are not observable, it is a common practice to use importer and exporter fixed effects to replace them; this approach, according to Feenstra (2002), provides consistent estimates and is easy to implement.

⁹ See table A1 in the appendix.

¹⁰ Austria, Benelux (Belgium-Luxembourg), Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Poland, Portugal, Slovakia, Spain, Sweden, and United Kingdom.

¹¹ Panel dataset has 111,780 potential observations (23-sectors x 18-exporting countries x 18-importing countries x 15-years) of which 4,463 are zero.

consequently foster bilateral trade. The bilateral distance between countries i and j should act as a barrier to trade and hence exhibit a negative sign.

For the purpose of this paper, the key parameters in equation (2) 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 a certain year, country or industry, after controlling for the size of GDP, distance, language, adjacency and others¹². Therefore, small point estimates for the home dummies indicate a low relative weight of intra-national trade and thus a large relevance of international trade for the correspondent countries, industries or years of the sample, and substantial trade integration (Qian, 2007; Balta and Delgado, 2009; Martinez et al, 2012b). If border effects diminish over time, it means that intra-national trade becomes less important relative to international trade and hence preference for domestically produced goods, as opposed to foreign ones, declines over the period considered, other things equal.

We have estimated two types of Home Bias (HB). First, we compute the HB for the entire EU-19 sample over the years 1995-2009 in order to capture the size of the EU commercial integration as a whole. Second, we compute the HB for each country to help understand how individual HBs affect bilateral flows of FDI among EU countries. Table A2 in appendix reports the original estimations using different specifications of the gravity equation (2).

As shown in Table A2, in all specifications, the basic gravity explanatory variables are highly significant and the coefficients have the expected signs. In order to compute the border effect from the estimations we take the exponential of the point estimate of the *home* variable¹³.

Table 3 summarizes the evolution of the border effects obtained from the estimations reported in the appendix and for different model specifications.

¹² See, among others, McCallum (1995), Helliwell (1996), Wei (1996), Nitsch (2000), Wolf (2009), Chen (2004) and Liu et al. (2010) for further explanation.

¹³ For example, to calculate the HB for 2009, we use the estimation at the fourth column and year 2009 ($Home_{2009}=2.689$); this figure means that, on average, a European country traded 14.7 times ($\exp^{2.689}=14.71$) more with itself than with another European partner.

Table 3. Evolution of the home bias

<i>Estimation</i>	<i>Baseline</i>	<i>Adjacency and Language dummies</i>	<i>Island and Landlocked dummies</i>	<i>Full model with time fixed effects</i>
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 A2 (\exp^{Home_i}). Columns are presented in the same order as in table A2.

The first column exhibits the results from the standard gravity equation where the economic size of the exporter and importer countries and the distance between them are considered. Calculations reported in Column 2 include dummy variables for adjacency and language. The last two columns display results from equations that include other potentially important features for trade, as being an island or landlocked, either for the exporter and importer countries¹⁴. The average overall border effect shows a net increase of around 3% from 1995 to 2009 for the EU-19 countries. Point estimates for the border effects in column 1 show lower values than in the rest of columns; however, since this is a very simple model where some likely 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 display comparable values across specifications. A very similar pattern over time arises for the border effect estimates in all the specifications, suggesting three sub-periods. In the first one, 1995-2001, the values of the HB grow over time around 40%. A second sub-period, from 2002 to 2007, is characterised by a sharp decline in border effects, also close to 40%; finally, the border

¹⁴ See Martinez et al. (2012b) for further discussion on the coefficients and their interpretation.

effect mounts again in the last two years of analysis, between 18% and 23%, this increase being especially important in 2009 when the border effect augments between 14% and 19% from the previous year, depending on the specification considered. These results fit remarkably well the picture which arises from the descriptive analysis of the data.

We have also computed the evolution of the border effect from a country point of view by estimating the country-specific evolution of the home bias over the period considered. Estimated border effects and intra-European openness rate¹⁵ for each country are presented in Figure 2.

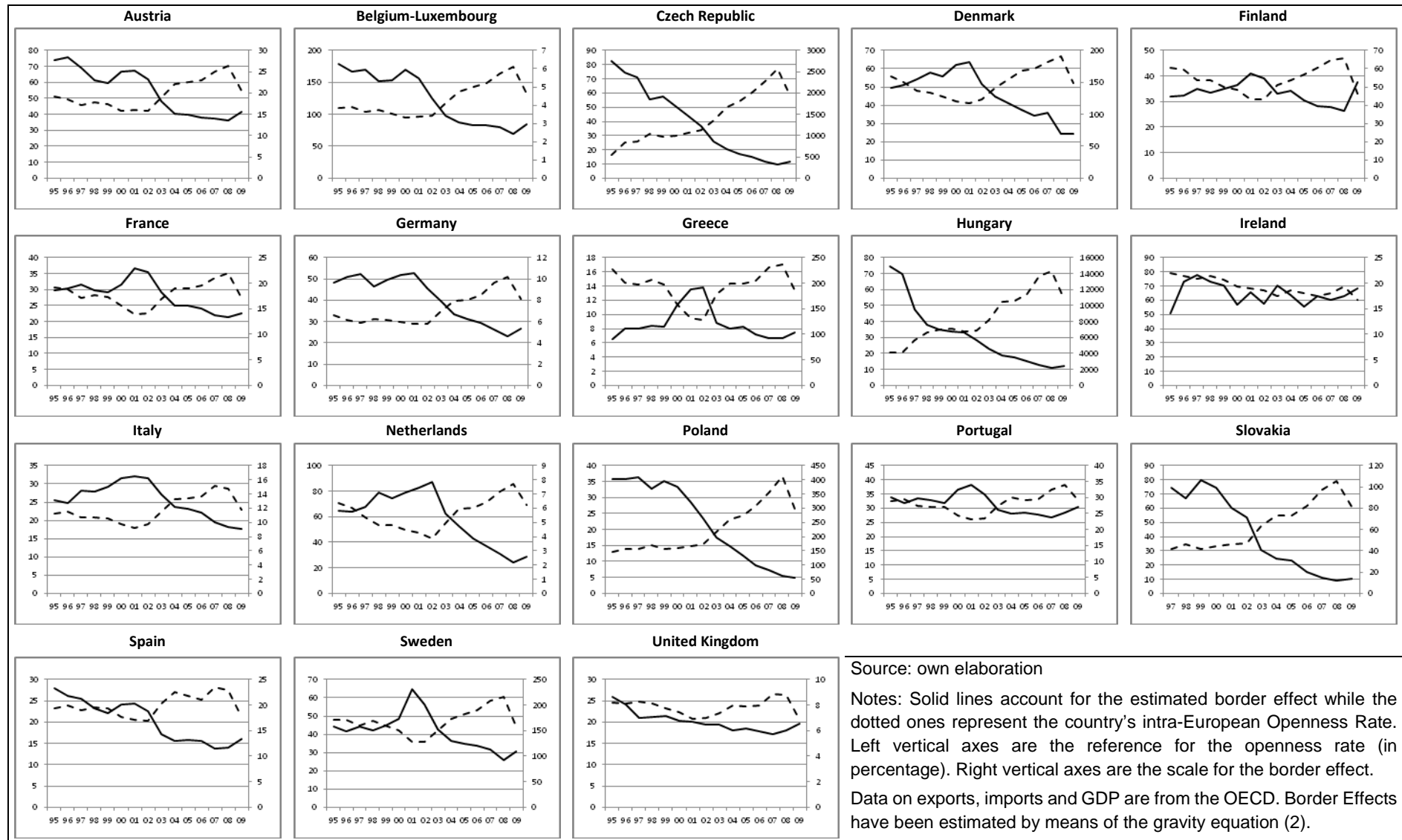
The results offer a different picture depending on the country but we can also observe common trends. In general terms, a clear decrease of the border effect in 15 out of the 19 countries considered can be seen. When sub-periods are analyzed, twelve economies show an increase of the home bias until 2001-2002, followed by a sharp fall afterwards. Similarly, estimates show a rise of the border effect, for all countries, in 2009.

The analysis by individual countries suggests that the Central and Eastern European economies (Poland, Czech Republic, Hungary and Slovakia) exhibit the highest values for the border effect, with Hungary ranking on the first position; these figures indicate, in turn, that exports from these countries to the rest of countries in the sample in 1995 were small relative to the domestic demand. The decline of the HB over time is remarkable, and can be traced back to the process of EU enlargement and the subsequent possibilities of accession to a larger market. Estimates for Slovakia and Poland at the end of the period, for example, are comparable to those of France, Italy or Spain.

Benelux and the Netherlands exhibit the lowest levels of the home bias. Moreover, the border effect in these countries has decreased significantly along the period. Germany and the UK also display a large level of trade integration compared to the rest of the EU-19. Some of the peripheral countries, such as Finland, Ireland, Greece and Portugal, make up another group of similar characteristics, with similar levels of the HB and with an evolution over time which ends up in a slightly higher border effect at the end of the period with respect to 1995. The remaining countries in the sample (Austria, Denmark, France, Italy, Spain and Sweden) show a clear downward trend in the HB, with Sweden and Denmark displaying higher home bias values within the sub-group. The openness rate shows a behavior which is almost perfectly the inverse of the home bias.

¹⁵ Intra-European Openness Rate is computed as exports plus imports to/from the rest of the EU-19 divided by GDP.

Figure 2. Country specific home bias and intra-European openness rate



4.2. Gravity model for FDI.

In this subsection we present the empirical specification employed to ascertain which kind of model reflects better the behaviour of FDI flows within EU-19. To discriminate among the different FDI models, the theoretical literature establishes that the main determinants underlying location choices can be summarized in the following: size and market potential in the home and host countries, the difference in resource endowments between the home and host countries, and the distance between both countries. In turn, the potential of the host market may be contingent on aspects such as the degree of macroeconomic stability and the quality of institutions. These ideas can be easily accommodated within the framework proposed by Kleinert and Toubal (2010); these authors design a FDI gravity model which allows to include additional variables such as the trade protection indexes (see Carr et al, 2001; and Braconier et al, 2005; as well). This paper employs this basic setup, but proposes a novel approach to build the trade indicators from the estimation of the home bias or border effect.

Some papers have shown that the rationale behind the gravity equation for trade can also be employed to model the determinants of FDI (Eaton and Tamura, 1996; Graham, 1996; Brenton et al, 1999). Empirical studies that adapted the gravity equation for trade to FDI can be found, among others, in Brainard (1997), Markusen and Maskus (2002) and Bergstrand and Egger (2007). More in particular, Kleinert and Toubal (2010) provide the theoretical foundations for the application of the gravity equation to foreign affiliates' sales¹⁶. This theoretical approach serves as a benchmark to develop a gravity equation that could be modified to test for horizontal and vertical FDI models. For the proximity-concentration model –horizontal– the theoretical specification will be as follows:

$$fdi_{ijt} = y_{it} (\tau D_{ij}^{\eta_1})^{(1-\sigma)(1-\varepsilon)} y_{jt} \quad (3)$$

where fdi_{ijt} measures the aggregate FDI flows from country i to country j in year t . y_{it} is the home country GDP in real terms, which proxies for its supply capacity, and y_{jt} is the host country GDP in real terms, which accounts for its market potential. Distance costs, $\tau D_{ij}^{\eta_1}$, are an increasing function of geographical distance between i and j with τ being unit distance costs of the iceberg type and $\eta_1 > 0$.

¹⁶ 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).

The vertical model for FDI flows can be characterized as:

$$fdi_{ijt} = \delta(1 - \mu)(y_{it} + y_{jt})g_2(y_{jt}/y_{it})f(\tau_{ij}^Z)g_1\left(\frac{S_{it}/(S_{it}+S_{jt})}{L_{it}/(L_{it}+L_{jt})}\right) \quad (4)$$

Where fdi_{ijt} measures again the aggregate FDI flows from country i to country j in year t . $g_2(y_{jt}/y_{it})$ is a function of the income ratio, τ_{ij}^Z is a function of the distance costs, and $g_1\left(\frac{S_{it}/(S_{it}+S_{jt})}{L_{it}/(L_{it}+L_{jt})}\right)$ is a function of the relative factor endowment ratio between country i and country j . The labor shares are computed as the proportion of the home country skilled labor in total skilled labor of the two countries, $S_i/(S_i + S_j)$, and the share of the home country unskilled labor, $L_i/(L_i + L_j)$.

Equations (3) and (4) provide the baseline specification and can be transformed into empirical models to be estimated as follows:

$$fdi_{ijt} = \alpha + \beta_1 \ln(y_{it}) + \beta_2 \ln(y_{jt}) + \beta_3 \ln(Dist_{ij}) + \beta_4 \ln(Home\ Bias_t) + \beta_5 CPI_{jt} + \eta_i + \eta_j + \eta_t + \varepsilon_{ijt} \quad (5)$$

$$fdi_{ijt} = \alpha + \beta_1 \ln(y_{it}) + \beta_2 \ln(y_{jt}) + \beta_3 \ln(Dist_{ij}) + \beta_4 \ln(Home\ Bias_t) + \beta_5 \ln(y_{it} + y_{jt}) + \beta_6 RFE_{ijt} + \beta_7 CPI_{jt} + \eta_i + \eta_j + \eta_t + \varepsilon_{ijt} \quad (6)$$

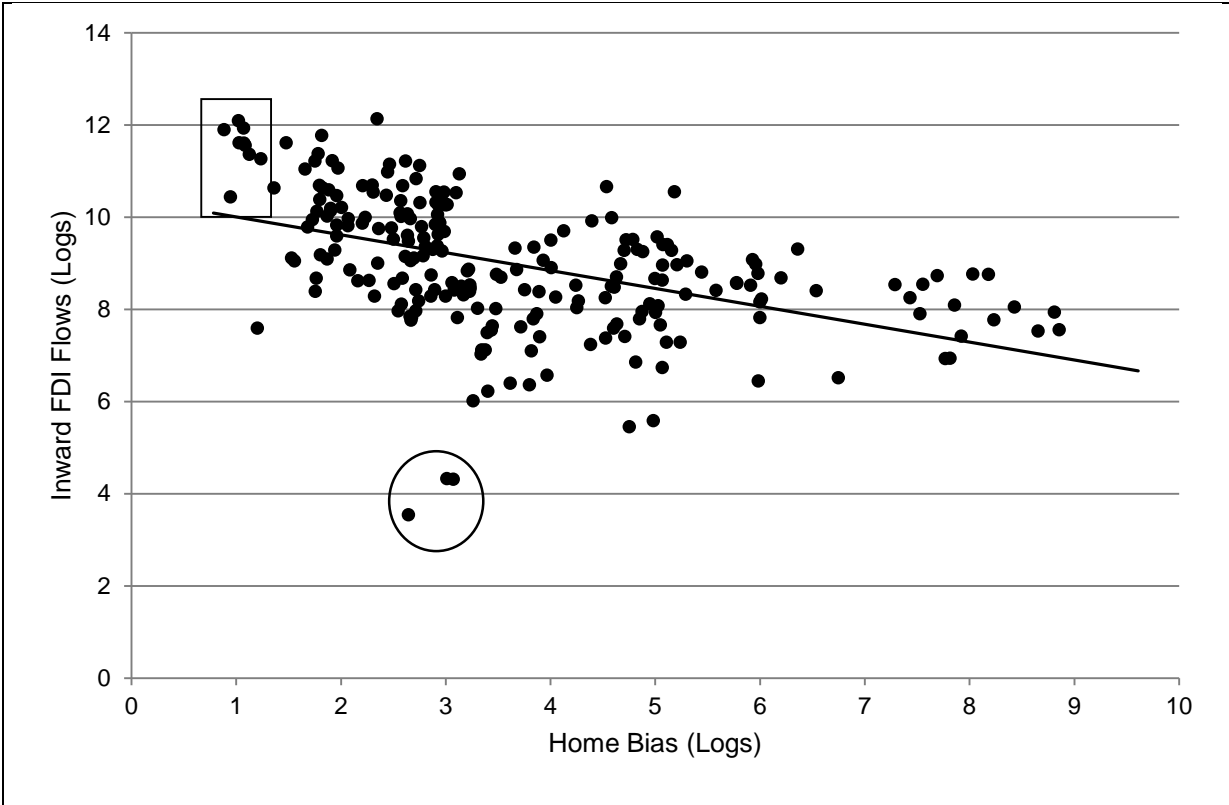
Equation (5) above corresponds to horizontal FDI models while equation (6) refers to vertical schemes. fdi_{ijt} are the bilateral investment flows from country i to country j in year t . y_{it} and y_{jt} are the GDPs of countries i and j , respectively. $Dist_{ij}$ stands for the bilateral distance between home and host countries. The $Home\ Bias_t$ is estimated by using a gravity model, as detailed above; its evolution over time reflects the degree of trade integration between the home and host country. RFE_{ijt} is the relative factor endowment ratio, defined as $\ln(S_{it}/(S_{it} + S_{jt})) - \ln(L_{it}/(L_{it} + L_{jt}))$. CPI_{jt} is the Corruption Perception Index from Transparency International and proxies for the degree of institutional environment. Additionally, the model includes origin, destination, and time (η_i, η_j, η_t) fixed effects. ε_{ijt} refers to the error term.

With respect to the estimation methodology, we have used bilateral data from a panel of 19 European countries for the period 1995-2009. Following Santos-Silva and Tenreyro (2006) again, we have employed a Poisson Pseudo-Maximum Likelihood model (PPML).

5. Results.

This section discusses the results obtained when trying to capture the impact of intra-European trade integration on the bilateral FDI flows within the nineteen European countries, using the gravity model specifications discussed above. Figure 3 shows the correlation between the Home Bias and FDI inflows. More specifically, FDI for a reporting country accounts for the logarithm of the aggregate flows from the rest of the European countries in the sample. The figure suggests a negative relationship between FDI and the Home Bias. Thus, we may expect negative coefficients in the estimation of the gravity model for FDI. As we did in Figure 1, we have also identified the Benelux (right upper corner square) and Ireland in 1995, 1996 and 1997 (circle). It is apparent that, when using the Home Bias as an index of trade, the connection between commercial integration and FDI within Europe (see Figure 3) appears clearer and more definite than when the openness rate is employed as in Figure 1.

Figure 3. FDI–Home Bias relationship



Source: Own elaboration.

Table 4 presents the estimation results from equations (5) and (6). The dependent variable is the real FDI inflows to country j from country i , being country j the reporting one.

The first two columns of Table 4 present the simplest horizontal and vertical FDI models. Point estimates regarding home and host GDPs display positive and significant values in both columns. The structural models in Kleinert and Toubal (2010) suggest that for the case of the horizontal model, the coefficients on both GDP variables should be equal to one¹⁷. However, our results show that the restriction of both coefficients being equal to unity is rejected at the 1% level (see column 1). Furthermore, according to Kleinert and Toubal, the structural vertical model predicts a negative value for the home country GDP estimate, which, as it can be observed, is not supported by our estimations either. Regarding column 2, the structural vertical model also suggests that the variable *market demand for goods* (proxied by the sum of GDPs) should present an estimate equal to unity and the relative factor endowment ratio (RFE) should be positive¹⁸. In these two cases our empirical results present mixed evidence. While the sum of GDPs is negative and significant at the 10% level, the RFE ratio displays a positive and significant coefficient. In all cases, estimates regarding bilateral distance are in line with the theoretical models.

Estimations reported in columns 3 and 4 in Table 4 include the home bias, thus providing information on the trade–FDI relationship. In column 3, we include the home bias variable for the overall EU-19, while in column 4 we consider the investor and recipient home bias variables separately. In both cases results show a negative and highly significant coefficients for these variables, suggesting that the higher the home bias of a particular country, the lower the FDI inflows it attracts. This result points out to a complementary pattern between European commercial integration and FDI.

In order to test the robustness of these results columns 5 and 6 report the estimations when using the traditional openness variable. Whereas column 5 considers the intra-European openness rate, column 6 introduces the home and host country openness rates individually. Results from using these variables indicate, as in the previous cases, a complementary relationship between intra-European trade and FDI. Moreover, results show a similar pattern to those obtained using the home bias variable proposed in this paper.

¹⁷ See Kleinert and Toubal (2010) for further information.

¹⁸ The intuition is that the more skilled labour abundant is the home country relative to the host country, the larger the bilateral FDI flows between them.

Another remarkable aspect that arises from the estimation is the impact of the economic crisis. In this sense, it is particularly interesting to test whether the FDI-Trade relationship has been affected by the financial and economic turbulences. We have addressed this issue by including an interaction term between the EU Home Bias and the time dummies for the years 2007, 2008 and 2009 (column 7) Results show an overall complementary relationship between EU Home Bias and FDI (see column 3 and 7) however, column 7 suggests that this complementary relationship has changed throughout the last years of the analysis. The coefficient for the interaction term in 2007 is negative and significant, whereas the point estimate for this variable in 2008 is not statistically significant; finally, it is positive and significant for 2009.

Results so far do not enable us to discriminate fully between horizontal and vertical strategies in the pattern of Intra-European FDI; hence, it seems to be a more complex and less straightforward phenomenon, perhaps a combination of a horizontal and a vertical model.

Table 4: Home Bias-FDI nexus by means of the gravity equation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\ln(Y_i)$	0.715 *** (0.094)	1.086 *** (0.179)	1.093 *** (0.191)	0.852 *** (0.188)	1.093 *** (0.191)	1.396 *** (0.178)	1.093 *** (0.191)
$\ln(Y_j)$	0.560 *** (0.086)	0.880 *** (0.202)	0.796 *** (0.222)	0.620 *** (0.226)	0.796 *** (0.222)	1.259 *** (0.156)	0.796 *** (0.222)
$\ln(Dist_{ij})$	-1.358 *** (0.150)	-1.347 *** (0.137)	-1.189 *** (0.102)	-0.804 *** (0.111)	-1.189 *** (0.102)	-0.631 *** (0.115)	-1.189 *** (0.102)
$\ln(Y_i+Y_j)$		-0.722 * (0.371)	-0.810 ** (0.378)	0.748 ** (0.361)	-0.810 ** (0.380)	-1.010 *** (0.327)	-0.810 ** (0.378)
RFE_{ij}		2.323 *** (0.752)	1.123 (0.825)	0.506 (0.635)	1.123 (0.825)	1.300 * (0.760)	1.123 (0.825)
CPI_j			0.296 *** (0.066)	0.248 *** (0.069)	0.296 *** (0.066)	0.269 *** (0.058)	0.296 *** (0.066)
$IRELAND_j$			0.765 ** (0.381)	0.551 * (0.298)	0.765 ** (0.381)	0.855 *** (0.244)	0.765 ** (0.381)
CEE_j			-1.288 *** (0.193)	-0.479 ** (0.218)	-1.288 *** (0.193)	-0.694 *** (0.163)	-1.288 *** (0.193)
$EU HB$			-3.359 *** (1.013)				-1.336 *** (0.164)
$Home Bias_i$				-0.373 *** (0.079)			
$Home Bias_j$				-0.298 *** (0.103)			
$EU OPEN$					2.474 *** (0.746)		
$OPEN_i$						0.712 *** (0.226)	
$OPEN_j$						1.042 *** (0.266)	
$EU HB * 2007$							-0.263 ** (0.114)
$EU HB * 2008$							-0.121 (0.082)
$EU HB * 2009$							0.562 *** (0.069)
Observations	2982	2982	2952	2952	2952	2952	2952
Test							
$\ln(Y_i)=\ln(Y_j)=1$	57.64 ***	1.45	2.74	2.96	2.74	4.97 *	2.74
p -value	0.000	0.483	0.254	0.227	0.254	0.083	0.254

Source: Own elaboration.

Notes: The dependent variable is the real bilateral FDI inflows to country j from country i (country j reporting country). Poisson pseudo-maximum likelihood estimation. Clustered robust standard errors in parenthesis. *, **, *** denote significantly different from 0 at 10%, 5% and 1% levels, respectively. Home country, host country and time fixed effects are included in all the regressions.

The next columns (3 to 7) show the results from estimations which include additional variables to test for the extended vertical model. The Corruption Perception Index (CPI) of the host country is included in order to control for a safe investment environment. Dummy variables for Ireland and the Central and Eastern European countries (CEE) as recipients of FDI are included. The rationale behind the introduction of these dummy variables deal with the fact that Ireland has reduced its corporation tax from 28.5% in 1999 to 12.5% in 2003 and afterwards, making the investment activity in that country

more profitable. In the case of the CEE countries, their particular idiosyncrasies and their relatively recent inclusion in the European Union may be relevant to attract FDI. Finally, commercial integration variables are considered to test the trade-FDI nexus.

Once the model is augmented, the lack of conclusiveness remains, as shown in columns 3 to 7. On the one hand, the sign and size of the home GDP and the goods market demand (sum of GDPs) do not match the predictions of the vertical theory. It is true that the coefficient for RFE displays the correct sign, positive, but the evidence in favour of the factor–proportion differentials argument is not robust enough, as the results are not statistically different from zero in all specifications -except for column 2-. On the other hand, although estimates for the *home and host GDPs* variable reject the hypothesis of unity in the horizontal model (column 1), the results emerging from the rest of the estimations cannot reject this hypothesis. As mentioned above, our results do not enable us to discriminate between horizontal and vertical models. Our results are in line with Braconier et al (2005) who find strong support for the knowledge capital hybrid model using data on foreign affiliate's sales for 56 home and 85 host countries for 1986, 1990, 1994 and 1998¹⁹.

CPI estimates show positive and significant values in all the specifications. Additionally point estimates across the specifications are very stable, ranging from 0.218 to 0.296. These results suggest the importance of having a corruption free environment when it comes to attract FDI flows. The dummy variable for Ireland is positive and significant, which might be due to the effect of a reduced corporate tax, *ceteris paribus*. Point estimates range from 0.551 to 1.119 and are significantly different from zero at the 5% and 1% levels.

Instead, dummies for CEE countries are negative. This suggests that there are still some factors, such as the insufficient development of the institutional framework and the rule of law, the uncertainty regarding property rights and the lack of a developed financial sector, which jeopardize FDI inflows. Finally, given the special characteristics of the Benelux and Ireland highlighted previously (see Figure 1), we have estimated the FDI models without these two countries, Table A3 in the appendix shows the outcome. Results obtained are similar and in line to those computed for the whole sample.

¹⁹ Kleinert and Toubal (2010) however, suggest the prevalence of the horizontal model when analysing foreign affiliates' sales using the same data than Braconier et al (2005).

6. Conclusions.

The empirical analysis carried out and described in this paper states that commercial integration and FDI within the European Union display a relationship of complementarity. The novelty of our analysis is that this relationship is captured using the evolution of the home bias as the proxy for commercial integration. Results obtained regarding this variable, nonetheless, are indeed confirmed and reinforced when using more traditional indicators such as the openness rate. An interesting feature suggested by our empirical exercise is that this complementary relationship does not seem to carry over in the crisis years 2008 and 2009. Does it mean that this relationship has experienced a structural change or it is just a consequence of the dynamics propitiated by the crisis? This issue deserves further research, to be pursued in the next future.

The results also point out that the FDI pattern within the European Union cannot be classified according to clear cut vertical or horizontal models. Instead, it seems that FDI flows follows a combination of both and therefore a hybrid model. While factor proportions appear not to be as relevant as the possibility of gaining market share –thus pointing to a horizontal model–, the complementarity relation between commercial integration and FDI suggest some kind of vertical motivations.

Our findings support the idea that policies targeted to promote further consolidations of the European Single Market –removing informal trade barriers, enhancing market 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

Table A2. 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 10%, 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.

Table A3: Home Bias-FDI nexus (without Benelux and Ireland)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\ln(Y_i)$	0.812 *** (0.083)	1.357 *** (0.167)	1.433 *** (0.158)	1.250 *** (0.183)	1.433 *** (0.158)	1.546 *** (0.175)	1.433 *** (0.158)
$\ln(Y_j)$	0.772 *** (0.080)	1.273 *** (0.145)	1.222 *** (0.141)	1.177 *** (0.143)	1.222 *** (0.141)	1.206 *** (0.146)	1.222 *** (0.141)
$\ln(Dist_{ij})$	-1.098 *** (0.168)	-1.087 *** (0.143)	-0.964 *** (0.138)	-0.885 *** (0.123)	-0.964 *** (0.138)	-0.914 *** (0.151)	-0.964 *** (0.138)
$\ln(Y_i+Y_j)$		-1.153 *** (0.329)	-1.350 *** (0.287)	-1.448 *** (0.292)	-1.350 *** (0.287)	-1.400 *** (0.283)	-1.350 *** (0.287)
RFE_{ij}		2.737 *** (0.841)	0.786 (0.957)	0.285 (0.732)	0.786 (0.957)	0.048 (0.968)	0.786 (0.957)
CPI_j			0.344 *** (0.048)	0.275 *** (0.054)	0.344 *** (0.048)	0.327 *** (0.055)	0.344 *** (0.048)
CEE_j			-0.761 *** (0.176)	-0.590 ** (0.212)	-0.761 *** (0.176)	-0.787 *** (0.184)	-0.761 *** (0.176)
$EU\ HB$			-2.427 ** (1.209)				-0.999 *** (0.194)
$Home\ Bias_i$				-0.289 *** (0.081)			
$Home\ Bias_j$				-0.078 (0.065)			
$EU\ OPEN$					1.788 ** (0.891)		
$OPEN_i$						0.469 ** (0.228)	
$OPEN_j$						0.164 (0.270)	
$EU\ HB * 2007$							-0.159 (0.131)
$EU\ HB * 2008$							-0.102 (0.115)
$EU\ HB * 2009$							0.415 *** (0.084)
Observations	2321	2321	2292	2292	2292	2292	2292
Test							
$\ln(Y_i)=\ln(Y_j)=1$	13.28 ***	4.83 *	8.13 **	1.99	8.13 **	14.04 ***	8.13 **
$p\text{-value}$	0.001	0.090	0.017	0.370	0.017	0.001	0.017

Source: Own elaboration.

Notes: The dependent variable is the real bilateral FDI inflows to country j from country i (country j reporting country). Poisson pseudo-maximum likelihood estimation. Clustered robust standard errors in parenthesis. *, **, *** denote significantly different from 0 at 10%, 5% and 1% levels, respectively. Home country, host country and time fixed effects are included in all the regressions.