THE BORDER EFFECT IN SPAIN*

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Abstract

This paper analyses the *border effect* in Spain over the period 1995-98 using a data set on intranational trade that is unique in Europe. The results indicate that, after controlling for market size and distance, Spanish regions trade around 21 times more with the rest of Spain than they do with OECD countries. Moreover, the size of the *Spanish bias* is lower in the case of the Spanish regions' exports than in the case of imports. Finally, the border effect is not uniform across Spanish regions.

Keywords: Spain, Border effect, exports, imports.

JEL classification: F14

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1. Introduction

The magnitude of the so-called *border effect* informs us about the limitations of economic integration in spite of increasing globalisation of world economy. McCallum (1995) was the pioneer in empirical research on this issue, finding that Canadian interprovincial trade was twenty-two times larger than trade between Canadian provinces and US states of similar size and proximity. While it seemed likely that intranational trade should exceed international trade, the degree of home bias in the data was quite surprising, given the relatively high degree of economic integration between both countries. After McCallum's seminal paper a growing literature has investigated the border effect across space and time, showing that national borders sharply reduce trade flows[1]. Despite technological progress in transports and communications and negotiated reductions in trade barriers, market segmentation continues to exist and political boundaries shape the geographical pattern of trade.

The aim of this paper is to estimate the impact of international borders on the Spanish trade. In particular, in addition to analyse the overall border effect in Spain we provide estimates for the size of border effects both by region and by the direction of trade. In the first case, we a priori expect large differences from region to region reflecting differences in industrial structures and geography. In the second case, regions might exhibit biases towards importing from other regions that differ from the bias towards exporting to other regions.

There are few empirical studies on the border effect in the European countries and they do not use direct data on interregional trade. Since intranational trade statistics are rarely available, the need of trade data on subnational units has led to the use of imaginative methods to approximate the missing data series that could bias the

[1] See, among others, Helliwell (1996, 1997, 1998), Wei (1996), Anderson and Smith (1999a, 1999b), Hillberry (1999), Nitsch (2000), Head and Mayer (2000), Helliwell and Verdier (2000), Anderson and van Wincoop (2003), Evans (2003), Okubo (2003), and Chen (2004).

estimation results[2]. This paper attempts to fill a part of that gap by using a unique data set that includes trade flows between every one of the 17 Spanish regions and the rest of Spain, as well as between each Spanish region and each one of the OECD countries during the period 1995-98.

Our approach also deviates from most previous work in the measurement of intranational distances. It is crucial to measure intranational distances "correctly" since the size of the estimated border effect is related to the value of the average internal distances. To this end, following Minondo's (2003) study on the border effect in trade of the Basque Country, we have obtained intranational distances taking into account a large amount of information. In particular, we use data on distances and populations for all cities in Spain with more than 20,000 inhabitants.

The results of this paper reveal three clear conclusions. First, national borders strongly diminish trade in Spain. Second, the size of the home bias often depends on the direction of trade. Finally, the border effect is not uniform across all Spanish regions.

The paper is organised as follows. Section 2 describes the methodological framework. Section 3 presents the data. Section 4 discusses the estimation results. Finally, section 5 concludes the paper.

2.- Methodology

The gravity model has been widely and successfully used to explain international trade flows. [3] In particular, the literature on the effects of national borders on trade has adopted the gravity model for investigating the relative volumes of internal

[2] Many studies solve this lack of direct data on a country's interregional trade by assuming that what a country exports to itself is merely the difference between its total output and its total exports to the rest of the world. See, for example, the papers by Wei (1996), Nitsch (2000), Head and Mayer (2000), and Chen (2004).

[3] Although initially the gravity model lacked theoretical foundation, since the end of the 1970´s the situation has changed and nowadays the gravity model is backed up by sound theory. See, among others, Anderson (1979), Bergstrand (1985 and 1989), Helpman and Krugman (1985), Deardoff (1995), Evenett and Keller (1998), and Anderson and van Wincoop (2003).

versus external trade. Accordingly, the methodology used here is based on the gravity model of trade. In its simplest form, the gravity equation states that bilateral trade between two countries (regions) is directly proportional to their economic sizes and inversely proportional to the geographic distance between them, in analogy to the Newtonian gravity equation.

Aiming to measure frictions to trade between countries - that imply differential costs - the basic specification of the gravity equation is often augmented in empirical studies by including other variables that are assumed to be related to the bilateral volume of trade. These variables could be dummy variables that capture the facts of sharing a common border, using a common language, or sharing membership in an integration agreement. In this framework, the *home country bias* is estimated by adding a dummy that takes the value of one for trade flows within countries and zero otherwise.

Some authors add a "remoteness" variable that try to capture the set of alternatives an importer country has. This is a weighted average of the distance across countries (including the internal distance of the country considered) in which the weight is usually their economic size. As Anderson and van Wincoop (2003) demonstrate, this is not correct. When trade barriers are considered the adequate term to include is a measure of the *relative trade resistance*, that is, the bilateral trade barrier compared with the average barrier of the two countries involved with all their partners. In this case, it is essential the inclusion of price variables. In our sample, the procedure used by these authors has a main trouble. It needs intranational trade data for all counties but, unfortunately, interregional trade is not available in most countries. As pointed out by Anderson and van Wincoop (2003), a simple way to consider "prices" in the gravity equation is the use of region-specific dummies (see, for instance, Feenstra, 2002, Hillberry and Hummels, 2003 or Chen, 2004). Using fixed effects in order to account for the multilateral resistance term gives a consistent estimate of the *average* impact of the border barrier of the countries under study. However, the inclusion of region-specific dummies leads to a problem of perfect collinearity with other dummy variables of the gravity equation. The cited difficulties preclude considering the prices in our gravity equation. This implies that our estimates of the border effect have some bias (probably upwards), so we must consider our estimation with caution.

Since results may be sensitive to the particular specification of the gravity equation employed, we estimate two alternative specifications in accordance with two standard ways of measuring the size of countries in gravity equations. The first specification appears in equation (1). It explains bilateral trade flows between each Spanish region and the corresponding trading partner (the rest of Spain or one of the 27 OECD countries in the sample) as a function of the basic variables of the gravity equation, the size of the economies (proxied, in this case, by their GDPs) and the distance between them. Additionally, we include several variables to control for different factors that may affect transaction costs and, obviously, a dummy variable that allows us to estimate the border effect in Spain. Accordingly, the gravity equation takes the following form:

$$\begin{aligned} \ln X_{ijt} &= b_0 + b_1 \ln GDP_{it} + b_2 \ln GDP_{jt} + b_3 \ln Dist_{ij} + b_4 Island \\ &\quad + b_5 Contiguity + b_6 EUEFTA + b_7 Spain + u_{ijt} \end{aligned} \qquad (1)$$

where:

X_{ijt} is the bilateral export flow from *i* to *j* at year t (sales in domestic trade)[4],

GDP_{it} and GDP_{jt} are the GDPs,

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[4] Some authors treat the sum of two-way bilateral trade as the dependent variable (see, for example, McCallum, 1995 or Frankel, Stein and Wei, 1998). However, given that this paper also investigate the possibility that the *border effect* may differ according to the direction of the trade flows, we treat exports from *i* to *j* separately from exports from *j* to *i*.

$Dist_{ij}$ denotes the distance between i and j,

Island is a dummy variable that takes the value of one if at least one of the trading partners is an island,

Contiguity is a dummy variable equal to one when the Spanish region trades with France or Portugal,

$EUEFTA_{ij}$ is a dummy variable equal to one if the trade partner is a member of the EU or the EFTA,

Spain is a dummy variable that takes the value of one if a Spanish region trades with the rest of Spain and zero otherwise, [5]

u_{ijt} is the standard classical error term.

The parameter of interest is β_7. If the trading relations between each Spanish region and the rest of Spain are stronger than those between these regions and the rest of the countries in the sample, then the estimated coefficient of *Spain* would be positive and statistically significant.

The second specification we consider in this paper is drawn from Tenreyro and Barro (2002). It measures the economic size by means of three variables: population, GDP per capita and the surface area of each region and its trading partner. As noted before, the estimation with this alternative specification is useful because it provides a robustness check of the evidence of the *border effect*. For both population (which measures scale effects) and per capita income (which measures the level of development) we expect positive estimated coefficients.[6] In contrast, a country with a

[5] We have considered as contiguous to each Spanish region the countries that share a common land border with Spain (France and Portugal). Moreover, the estimations have been performed excluding and including the rest of Spain among the trading partners that share a common border and among the members of the EUEFTA. On the other hand, we do not include a dummy variable for sharing a common language because, apart from Spain, only Mexico shares the Spanish language and, therefore, this variable would capture the peculiarities of trade with that country only.

[6] As pointed out by Baldwin (1994) and Frankel and Wei (1995), developed countries tend to be more specialised, and thus, they tend to have a larger volume of international trade for a given GDP level.

large surface area, the other measures of size constant, is relatively more self-sufficient and less dependent on trade. The estimating equation takes the following general form:

$$\begin{aligned} \ln X_{ijt} = {} & b_0 + b_1 \ln Pop_{it} + b_2 \ln Pop_{jt} + b_3 \ln GDPPC_{it} + b_4 \ln GDPPC_{jt} \\ & + b_5 \ln Surf_i + b_6 \ln Surf_j + b_7 \ln Dist_{ij} + b_8 Island \\ & + b_9 Contiguity + b_{10} EUEFTA + b_{11} \ln Spain + u_{ijt} \end{aligned} \quad (2)$$

where *Pop* represents the population, *GDPPC* the per capita GDP and *Surf* the surface area of country (region). All other variables are defined as in equation (1). The main parameter of interest in these equations is β_{11}.

3.- Data

We use data on bilateral trade between each of the 17 Spanish regions and a sample of 27 OECD countries (Belgium and Luxembourg considered jointly) over the period 1995-1998. The number of observations in each year of the sample is 952: 17 (Spanish regions) x 28 (trading partners including the rest of Spain) x 2 (exports and imports of each Spanish region).

The data on bilateral trade between Spanish regions and OECD countries in the sample are taken from the *Dirección General de Aduanas*.[7] International trade flows have been deflated using the GDPs deflators taken from the *National Accounts* database (OECD). The interregional trade flows have been estimated using figures of merchandise traffic by land, railway, sea and air (see Oliver *et al.* (2003) for details). These series have been deflated by the GDPs deflators of the Spanish regions taken from the *Regional Accounts* database (Instituto Nacional de Estadística) and converted to the euro using the average exchange rate pts/ecu of each year (*Bank of Spain)*.

[7] We only exclude Turkey from the 28 OECD countries due to data problems.

The independent variables are taken from different sources. The GDPs in real terms and national currency are taken from the *National Accounts* database (OECD). These series are converted to Euros using 1999 exchange rates. The GDP of the rest of Spain is calculated as the Spanish GDP minus the regional GDP. The data on population also comes from *National Accounts.* Data on surface area is taken from the *Encyclopaedia Britannica.* Finally, the distance variable is calculated as follows. On the one hand, to obtain the distance between each region and the rest of Spain we consider for all regions those cities with more than 20,000 inhabitants. For each city in one region we calculate a weighted average of the great circle distance from this city to the other cities of the rest of Spain, in which the weights are the respective populations of the latter. Once this value is calculated for all cities in a region we again calculate a weighted average based on populations. On the other hand, the distances between each region and each foreign country in the sample are calculated considering the distances between the province capital cities of each Spanish region and the five most important cities of each partner country. The weighting procedure is the same as defined above.

4.- Empirical results

We estimate the border effect in Spain with a number of techniques. We begin by estimating the basic version of equation (1) by Ordinary Least Squares (OLS) with year-specific intercepts added. The results are presented in column (1) of Table 1. The equation fits the data well, explaining almost three quarters of the variation in bilateral trade flows. Moreover, the gravity coefficients are economically and statistically significant with sensible interpretations: trade increases with the size of the economies and it decreases with distance. Focusing on the parameter of interest, the estimated coefficient for the dummy variable *Spain* is highly significant and equal to 3.08 (very similar to McCallum estimate) suggesting that Spanish regions trade about 21.8 times [=exp(3.08)] more with the rest of Spain than with any other OECD country, after adjusting for sizes and distances.

In column 2 *island, contiguity and EUEFTA* dummies are added to the gravity equation. All the estimated coefficients of the augmented gravity equation have the expected sign and are statistically significant at the 1 per cent level. In particular, the results show coefficients on GDPs close to unity, as theory predicts. The elasticity of trade with respect to distance is –0.88, in such a way that a 1 per cent increase in distance decreases trade by 0.88 per cent. In a similar fashion, trade drops by 46% if the trading partner is an island. On the contrary, the Spanish regions trade 144% more with a contiguous country to Spain than they do with otherwise similar countries. Finally, the Spanish regions trade 63% more with EUEFTA countries.

Before discussing the results of the coefficient of the Spain dummy, it is worth noting that the correct interpretation of this coefficient in the augmented gravity equations requires an explanation of how the dummy variables *contiguity* and *EUEFTA* are defined. The interpretation depends on the value assigned to these dummy variables in trading relations between the Spanish regions and the rest of Spain. When a value of zero is assigned to *contiguity* and *EUEFTA* variables for bilateral trade between each Spanish region and the rest of Spain, the estimated *Spanish bias* (*Spain0* in the tables) indicates how much more the Spanish regions trade with the rest of Spain in comparison to any other unrelated country. However, when these dummy variables take the value of one in trade of the Spanish regions with the rest of Spain, the estimated *border effect* (*Spain1 in* the tables) tells us how much more intense is trade with the rest of Spain than with any other country which is contiguous to Spain and member of the EUEFTA zone.[8] We report the estimated coefficients of the *border effects* (*Spain0* and *Spain1*) in the same column in the tables, since the alternative definitions of the *Contiguity* and *EUEFTA* variables only affect the estimations of the *Spanish bias*. The estimated value of the coefficient of interest is 3.99 in the first case (*Spain0*) and 2.61 in the second case (*Spain1*). Thus, the augmented equation indicates that the Spanish regions trade 54.1 times more with the rest of Spain than they do with any other country of the sample that is neither contiguous nor member of the EU or EFTA, and 13.6 times more than with any other country contiguous and a member state of one of these zones.

Since the dependent variable (exports) is a component of one of the independent variables (GDP), it is important to check the robustness of the results in the potential presence of an endogeneity problem in equation (1). To this end, we have followed the standard procedure of using the log of population as an instrument for the log of GDP. The results by Instrumental Variables, reported in columns (3) and (4) of Table 1, are very similar to those found in the estimation by OLS. In particular, the estimated coefficient in the basic specification suggests that the border effect is 21.1.

Columns 5 and 6 show the results for the basic and augmented versions of the gravity equation (1) estimated as a system using the Zellner SUR procedure to allow for year-to-year correlation of errors. The equations are estimated with the coefficients constrained to be the same in all years (only year-specific intercepts are allowed for).[9] Again, the estimated coefficients are very similar to those obtained by OLS. In particular, the estimations of the *home bias* confirm the high magnitude of the border effect in the trade of Spanish regions. For example, in the basic gravity equation, the border effect is 20.5 [=exp(3.02)].

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[8] See Helliwell (1997: 9-10).

[9] The unrestricted estimations are of great interest for the analysis of the evolution of *home bias* over time. However, we do not investigate this issue since the sample period is very short (four years). The unrestricted estimations are available from the authors upon request.

The results for the basic and augmented versions of the gravity equation (2) estimated by OLS (columns 1 and 2) and SUR (columns 3 and 4) are presented in Table 2. In the four cases, all the variables, with the exception of surface area, show the expected signs and are statistically highly significant. In the basic specification, the parameter of interest by OLS and SUR are 3.10 and 3.03, respectively. Thus, the estimated home bias in Spain remains unchanged at factor around 21. In the augmented version by OLS, the estimated coefficient of the variable *Spain0* increases to 4.34 (the Spanish regions trade 70,7 times more with the rest of Spain than they do with any other country of the sample that is neither contiguous nor member of the EU or EFTA) and the coefficient of *Spain1* decreases to 2.70 (14.8 times more than with any other country that is contiguous and a member of one of these zones). The results are little affected by the use of SUR, even though the estimated *home bias* coefficients are slightly smaller than they are in the OLS regression.

Another important issue that is an aim of this paper is the analysis of the *home bias* in Spain by direction of trade. In order to study the *border effect* on exports and imports separately, the *Spain* variable is split into two dummy variables, one relating to sales to the rest of Spain and the other covering purchases from the rest of Spain. Additionally, a new variable is introduced to distinguish exports to foreign countries from imports from them (the category of reference is imports coming from foreign countries). Estimation results are in Table 3.[10] The border coefficients reported for imports are those of the dummy variable relating to purchases from the rest of Spain. However, the export coefficient shown in the table is calculated as the coefficient for Spanish sales minus the coefficient of exports to foreign countries.[11] In all equations,

[10] To economise on space, Table 3 only offers the estimations of the augmented gravity equations in which the dummy variables *contiguity* and *EUEFTA* take the value of one in trading relations between the Spanish regions and the rest of Spain.

[11] This is the same procedure used by Anderson and Smith (1998: 28-29).

the difference between the import and export *border* coefficients is significant at the 10 per cent level, the export coefficient (*BEEXPORTS*) being lower than the import coefficient (*BEIMPORTS*). For example, according to column 1, the estimated *Spanish bias* in exports is 19.9 while in imports it is 24.0, indicating a higher dependence of the Spanish regions on purchases from the rest of Spain than on national sales.

We now turn to the analysis of border effects across Spanish regions. We expect to find different levels of border effects from region to region reflecting differences in industrial structures and geography.[12] To study the border effect by region we have estimated region-specific gravity equations. Breaking up the data set into 17 separate regional data sets allows the estimation of separate border effects in exports and imports, which is not possible in the full sample. Table 4 presents the selected results. All models explain a satisfactory amount of the variation of trade flows, with the home bias dummy always highly significant. To economise on space, we only report and discuss the evidence for the basic specification of equation (1). Border effects differ notably across regions. Baleares displays the highest coefficient (4.09), suggesting that its border effect is equal to 59.7. Comparatively large border effects are also found in other regions such as Cantabria (53.0), Extremadura (42.5), Asturias (41.7), Canarias (36.6), and La Rioja (30.6). On the opposite end of the spectrum, Madrid shows the smallest border effect, which is equal to 8.5 [=exp(2.14)], while Castilla León have the second-lowest border effect, being it equal to 14.0. The large border effects in Baleares and Canarias are not surprising on the basis of geographical and industrial structure reasons. Both regions are archipelagos which main economic activity is tourism. In general, as noted before, since the literature reports evidence that the size of the border effect varies substantially across industries, differences in industrial structures may be

[12] Several papers have documented that border effects differ greatly across industries. See, among others, Hillberry (2002), Evans (2003), and Chen (2004).

an important reason for the regional variation found in our data.[13] However, region economic size also seems to matter. Regressing the regional border coefficient on a constant an the economic size of the tradable sector of each region (measured by the value added of the agriculture and industry and its square) we find that the border effect decreases with the size but at a diminishing rate.

Table 5 presents the results for each region when the border effect is broken into its exports and import sides, following the procedure discussed before. As expected on the basis of the estimation results using the full data set (reported in table 3) we find that the coefficient for exports is smaller than the coefficient for imports in twelve cases (being the difference statistically significant at 10 percent level in nine of them) while the opposite result is found in only five regions (Asturias, Canarias, Cantabria, Galicia and Madrid). Focusing on some particular cases, the overall low border effect for Madrid is the outcome of two offsetting forces: the border coefficient for exports is 2.76, while the border coefficient for imports is only 1.51. In exponential form it indicates that Madrid´s bias towards trade with the rest of Spain is 4.5 in imports, but 15.8 in exports. It suggest that Madrid (where is located the country capital city) functions as a Spanish import platform, importing from foreign countries and exporting to the rest of Spain. Baleares (the region for which the overall border effect is higher) presents the opposite pattern: its border coefficient for exports is relatively low (3,29), while the border coefficient for imports is extremely high (4,89). This result is consistent with the specialisation of Baleares islands in tourism activity. The vast majority of Baleares's imports of goods is related with this activity and they come from Spain through two important sea ports of the Iberian peninsula (Barcelona and Valencia). Finally, it is worth noting that Castilla-León shows the lowest border

[13] Unfortunately, we cannot analyse the border effect across industries because intranational trade information is not available by industry.

coefficient for exports among regions (2.55) and the third lowest coefficient for imports (2.72), being these coefficients not statistically different at conventional levels.

5.- Conclusions

The purpose of this paper consisted in examining the magnitude of the home bias in Spanish trade, using a unique data set in Europe of intranational trade flows over the period 1995-98. The gravity model shows that intranational Spanish trade exceed the international trade around 21 times, after controlling for size and distance. This result is robust to model specification and estimation techniques. Moreover, the estimations of the augmented gravity equations indicate that the *Spanish bias* is important (around 14) even with respect to contiguous countries and members of the European Union (France and Portugal).

Region-specific border effects were also explored. The border effect by region ranges between 8.5 times (Madrid) and 59.7 times (Baleares) with the rest of the regions scattered through every part of that range. These wide differences suggest that the border effect is not uniform across Spanish regions. When the border effect is broken into its export and import sides the home bias displays great variety in most regions and it is usually greater for imports than for exports.

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Table 1.- Estimations of the gravity equation (1). 1995-1998.

	(1)	(2)	(3)	(4)	(5)	(6)
Spain	3.08 (47.70)		3.05 (46.04)		3.02 (11.73)	
Spain0		3.99 (31.39)		3.94 (30.65)		3.91 (12.59)
Spain1		2.61 (33.43)		2.60 (32.84)		2.57 (8.98)
Ln (GDP_i)	1.08 (65.12)	1.04 (63.96)	1.10 (56.02)	1.06 (57.95)	1.07 (37.31)	1.03 (36.38)
Ln (GDP_j)	1.08 (62.28)	1.04 (60.92)	1.11 (55.15)	1.07 (56.04)	1.07 (37.30)	1.04 (36.39)
Ln ($distance_{ij}$)	-1.28 (-41.54)	-0.88 (-18.22)	-1.29 (-41.48)	-0.90 (-18.52)	-1.29 (-25.50)	-0.90 (-10.99)
Island		-0.61 (-10.31)		-0.60 (-10.14)		-0.60 (-5.56)
Contiguity		0.89 (11.62)		0.87 (11.16)		0.87 (4.65)
EUEFTA		0.49 (6.04)		0.47 (5.84)		0.47 (3.43)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.73	0.74	0.73	0.74	0.72/0.72/ 0.73/0.73	0.72/0.72/ 0.73/0.73
Observations	3808	3808	3808	3808	952x4	952x4
Estimation method	OLS	OLS	IV	IV	SUR	SUR

Note: The sample of countries includes Australia, Austria, Belgium-Luxembourg, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Korea, Hungary, Iceland, Ireland, Italy, Japan, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, United Kingdom and United States. t-statistics in parentheses are robust to heteroscedasticity and autocorrelation. In the augmented gravity equations the coefficients *Spain0* (*Spain1*) are those that correspond to the definition of the dummy variables *Contiguity* and *EUEFTA* in which trading relations between each Spanish region and the rest of Spain are assigned a value of zero (one). In the estimations with Instrumental Variables, the logarithm of population is used as an instrument for the logarithm of GDP.

Table 2.- Estimations of the gravity equation (2). 1995-1998.

	(1)	(2)	(3)	(4)
Spain	3.10 (41.14)		3.03 (11.55)	
Spain0		4.34 (32.05)		4.24 (13.22)
Spain1		2.70 (33.46)		2.67 (9.33)
Ln ($population_i$)	1.06 (38.35)	1.05 (38.80)	1.05 (24.22)	1.03 (24.38)
Ln ($population_j$)	1.20 (46.27)	1.19 (45.89)	1.17 (27.17)	1.17 (27.52)
Ln (per capita $income_i$)	1.03 (24.11)	0.99 (22.79)	1.03 (14.80)	1.00 (13.53)
Ln (per capita $income_j$)	0.97 (22.51)	0.93 (21.04)	0.98 (14.03)	0.95 (12.92)
Ln ($surface_i$)	0.02 (0.86)	-0.04 (-1.73)	0.03 (0.66)	-0.03 (-0.84)
Ln ($surface_j$)	-0.11 (-4.65)	-0.17 (-7.25)	-0.10 (-2.34)	-0.16 (-4.02)
Ln ($distance_{ij}$)	-1.26 (-34.54)	-0.72 (-13.27)	-1.27 (22.12)	-0.76 (-8.32)
Island		-0.63 (-10.40)		-0.63 (-5.67)
Contiguity		0.98 (12.24)		0.95 (5.09)
EUEFTA		0.67 (7.39)		0.62 (3.97)
Time dummies	Yes	Yes	Yes	Yes
Adjusted R^2	0.73	0.75	0.72/0.73/ 0.73/0.74	0.74/0.75/ 0.75/0.75
Observations	3808	3808	952x4	952x4
Estimation method	OLS	OLS	SUR	SUR

Note: See Table 1 for the list of countries in the sample. t-statistics in parentheses are robust to heteroscedasticity and autocorrelation. In the augmented gravity equations the coefficients *Spain0* (*Spain1*) are those that correspond to the definition of the dummy variables *Contiguity* and *EUEFTA* in which trading relations between each Spanish region and the rest of Spain are assigned a value of zero (one).

Table 3.- Estimations of the gravity equations. *Border coefficients* by direction of trade. 1995-1998.

	(1)	(2)	(3)	(4)
BEIMPORTS	3.18 (44,05)	2.71 (31,08)	3.19 (37.68)	2.80 (30,83)
BEEXPORTS	2.99 (32.62)	2.52 (30.94)	3.00 (30.05)	2.60 (30.21)
Ln (GDP_i)	1.08 (51.36)	1.04 (49.77)		
Ln (GDP_j)	1.07 (54.21)	1.04 (53.29)		
Ln ($population_i$)			1.07 (35.84)	1.06 (36.15)
Ln ($population_j$)			1.18 (44.29)	1.17 (43.71)
Ln (per capita $income_i$)			1.04 (24.28)	1.00 (22.88)
Ln (per capita $income_j$)			0.96 (21.98)	0.92 (20.68)
Ln ($surface_i$)			0.04 (1.46)	-0.03 (-1.17)
Ln ($surface_j$)			-0.12 (-5.13)	-0.19 (-7.67)
Ln ($distance_{ij}$)	-1.28 (-41.53)	-0.88 (-18.22)	-1.26 (-34.51)	-0.72 (-13.25)
Island		-0.61 (-10.30)		-0.63 (-10.39)
Contiguity		0.89 (11.64)		0.98 (12.31)
EUEFTA		0.49 (6.04)		0.67 (7.40)
Time dummies	Yes	Yes	Yes	Yes
Test de Wald [P-value of equality]	3.40 [0.07]	3.75 [0.05]	3.34 [0.07]	3.73 [0.05]
Adjusted R^2	0.73	0.74	0.73	0.75
Observations	3808	3808	3808	3808
Estimation method	OLS	OLS	OLS	OLS

Note: See Table 1 for the list of countries in the sample. t-statistics in parentheses are robust to heteroscedasticity and autocorrelation. The marginal significance level for the Wald statistic (used to test the null hypothesis of equality of the *border effect* on exports and imports) appears in square brackets. In the augmented gravity equations, the export and import border effect coefficients correspond to the definition of the dummy variables *Contiguity and EUEFTA* in which trade relations between each Spanish region and the rest of Spain are assigned a value of 1.

Table 4.- Border effects by region

	Coefficient of Spain dummy	Adjusted R^2	Border effect (times)
Andalucia	3.31 (15.92)	0.82	27.4
Aragón	2.93 (18.40)	0.76	18.7
Asturias	3.73 (16.86)	0.70	41.7
Baleares	4.09 (12.19)	0.71	59.7
Canarias	3.60 (9.99)	0.66	36.6
Cantabria	3.97 (22.10)	0.69	53.0
Castilla la Mancha	2.96 (16.91)	0.84	19.0
Castilla León	2.64 (12.52)	0.83	14.0
Cataluña	3.09 (11.47)	0.86	22.0
Comunidad Valenciana	3.02 (23.50)	0.84	20.5
Extremadura	3.74 (11.76)	0.79	42.1
Galicia	3.21 (16.10)	0.74	24.8
Madrid	2.14 (12.33)	0.84	8.5
Murcia	2.98 (12.96)	0.83	19.7
Navarra	2.83 (19.04)	0.78	17.0
País Vasco	2.91 (26.98)	0.83	18.4
Rioja	3.42 (14.96)	0.75	30.6

Note: Results from regional-specific regressions, basic specification of equation (1). t-statistics in parentheses are robust to heteroscedasticity and autocorrelation. Border effect (times) = exp(coefficient of Spain dummy).

Table 5.- Border coefficients by region and direction of trade

	BEEXPORTS	BEIMPORTS	Wald test	Adjusted R^2
Andalucia	2.82 (17.05)	3.79 (25.01)	46.61 [0.00]	0.82
Aragón	2.76 (18.12)	3.09 (15.81)	3.20 [0.08]	0.77
Asturias	4.05 (17.54)	3.40 (14.93)	8.67 [0.00]	0.70
Baleares	3.29 (12.94)	4.89 (23.90)	40.19 [0.00]	0.71
Canarias	4.53 (16.62)	2.66 (12.65)	51.48 [0.00]	0.78
Cantabria	4.27 (21.75)	3.66 (20.98)	8.00 [0.01]	0.71
Castilla la Mancha	2.90 (14.88)	3.01 (14.46)	0.26 [0.61]	0.85
Castilla-León	2.55 (10.58)	2.72 (11.89)	0.60 [0.44]	0.83
Cataluña	3.04 (5.76)	3.15 (35.37)	0.04 [0.84]	0.86
Comunidad Valenciana	2.88 (18.42)	3.16 (22.19)	3.83 [0.05]	0.86
Extremadura	3.23 (11.13)	4.26 (13.49)	12.67 [0.00]	0.79
Galicia	3.52 (16.81)	2.91 (15.62)	11.18 [0.00]	0.74
Madrid	2.76 (18.87)	1.51 (9.39)	64.31 [0.00]	0.88
Murcia	2.47 (16.15)	3.50 (20.57)	43.87 [0.00]	0.87
Navarra	2.62 (17.59)	3.04 (19.37)	5.88 [0.02]	0.80
País Vasco	2.77 (20.99)	3.05 (25.91)	3.52 [0.06]	0.83
Rioja	3.11 (15.60)	3.72 (17.09)	8.11 [0.00]	0.79

Note: Results from regional-specific regressions, basic specification of equation (1). t-statistics in parentheses are robust to heteroscedasticity and autocorrelation. The marginal significance level for the Wald statistic (used to test the null hypothesis of equality of the *border effect* on exports and imports) appears in square brackets.