IESE Business School
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Working Paper
WP-802
July, 2009

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RETHINKING REGIONAL COMPETITIVENESS: CATALONIA'S INTERNATIONAL AND INTERREGIONAL TRADE,1995-2006*

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Abstract

Studies of competitiveness tend to focus on a local economy's global interactions, particularly its international trade. But for countries that are at least mid-sized (such as Spain), interregional trade tends to be as large as or significantly larger than international trade. The case of Catalonia illustrates the importance of interregional flows in truly analyzing and devising strategies for a region's external competitiveness. Accounting for interregional trade changes and performing analyses of Catalonia's overall merchandise trade balance, which sectors generate external surpluses as opposed to deficits, and who Catalonia's key trading partners are, and the use of a gravity-model approach to estimate external border effects at the regional level for Catalonia and the rest of Spain, reveal significant variations by sector and by trading partner, generally higher external border effects for exports than imports, and declines in border effects over time – but with a discernible flattening in recent years.

Classification JEL: F14; F17; F21; L14

Keywords: Border Effect; Gravity Model; Interregional Trade; Transport Flows

* ACKNOWLEDGEMENTS: We would like to express our gratitude to the 11 Regional Governments in Spain who support the C-Intereg Project, which supplied a large part of the database used in this paper. We also want to thank the other public and private institutions that have supplied the basic statistics employed here. We are grateful for suggestions from Xavier Vives, Bruno Cassiman, Antonio Ciccone, and other participants in a workshop at IESE Business School in Barcelona at which an earlier version of this paper was presented, and for commentary received on Ghemawat's keynote address to the Flemish Economic Association in Leuven in November 2008.

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RETHINKING REGIONAL COMPETITIVENESS: CATALONIA'S INTERNATIONAL AND INTERREGIONAL TRADE,1995-2006*

Introduction

Studies of (subnational) regional competitiveness mostly imitate studies of international competitiveness in focusing on international trade patterns as indicators of revealed advantage. In so doing, they gloss over the novel element exposed by digging down from the national to the regional level: the importance of economic interactions *across regions within the same nation* as well as across national boundaries. Given that gap, this paper's analysis of Catalan trade in goods is aimed not just at those interested in the Catalan economy *per se*, but, more broadly, as an illustration of the importance of expanding the usual focus on international trade to also account for interregional trade.

Catalonia turns out to be a particularly striking illustration of the importance of accounting for interregional trade, for a number of reasons. Its interregional trade is estimated to be slightly larger than its international trade, and taking the former as well as the latter into account shifts readings of Catalonia's external trade balance from chronically negative to positive, helps identify its role as an import hub for all of Spain, and changes analyses of which Catalan sectors are "competitive" in the sense of generating external surpluses and who its key trading partners are. In addition to these conclusions, which emerge directly from the data, we also fit gravity models to the data, which yields several additional insights.

These descriptions of the trade data are of obvious interest. More analytically, we also estimate international border effects for Catalonia (and other Spanish regions), measured as the relative intensity of interregional-to-international trade after controlling for GDP (economic size) and distance and putting in various other controls. The estimates vary significantly across sectors and by trading partner, hinting at the enormous heterogeneity to be encountered along both dimensions in formulating policies to boost external competitiveness. Overall, Catalan border effects do not seem – after controlling for size and distance – to be the lowest even among large, multi-provincial Spanish regions, qualifying the common perception of Catalonia as particularly outward- as opposed to inward-oriented. And while Catalan border effects have declined drastically since 1995, declines appear to be flattening out – suggesting that interregional trade may play a more important role in the growth of total trade than it did between the mid-1990s and the mid-2000s, when it ceded share.

Section 2 of this paper reviews previous work on interregional trade and on the international border effect. Section 3 describes the dataset used in this paper as well as the methodological framework and the gravity-based empirical model employed. Section 4 provides a basic description of the data, with a focus on how accounting for interregional as well as

international trade changes conclusions about key aspects of trade patterns. Section 5 summarizes the results from estimating gravity-based models of the border effect and discusses some of the implications. Section 6 concludes with some broader reflections from the exercise as well as suggestions for further work.

Related Literature

Interregional trade has traditionally attracted very little attention, at least from students of trade, as noted by, among others, Paul Krugman:

> "A man from Mars – or from the real world – would be surprised to find that economic geography and the theory of international trade are sharply distinct fields, with few intellectual or personal links. Why is the process that puts a bottle of French wine on a Berlin table very different from that which puts California wine on New York tables? True, French workers rarely move to Germany in search of jobs; but then, Francophone Swiss are almost as reluctant to move to Zurich. Surely trade and geography ought to be no more than sub-genres of a common literature."
>
> (Krugman, 2003, page 49)

Instead, interregional trade, despite being a key element of what Krugman refers to as "the new economic geography", is often relegated in empirical work to the role of the baseline against which the incremental height of international borders or, equivalently, the limited extent of international trade is to be calibrated. A large body of work along these lines was kicked off by McCallum's (1995) finding that trade between Canada's different provinces was 22 times as large as trade between the provinces and different states of the United States of similar size and proximity.

More recent research using data on interregional and international merchandise trade flows (or estimates thereof) finds that a pair of regions within a country tends to trade 10 to 20 times as much as an otherwise identical pair of regions across countries.[1] Other authors find that countries tend to trade with themselves 4 to 20 times more than with another country.[2] Border effects of this size tend to imply – and the data for countries such as United States, Canada, Japan, France and Germany to confirm – that total internal trade within large countries, at least, tends to be greater than their total international trade, often by a very large margin.

Some of the prior analyses of this stripe that are most relevant to the Catalan context merit particular mention. For Spain, Gil-Pareja et al. (2005) estimated that over 1995-1998, intranational trade was about 22 times as intense, after controlling for size and distance, as international trade. Their estimated border effects varied across Spanish regions and were often greater for imports than for exports.

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[1] The external border effect or frontier effect has been studied by McCallum (1995), Helliwell (1996, 1998), Anderson and Smith (1999), Anderson and van Wincoop (2003), Okubo (2004), Gil-Pareja et al. (2005).

[2] Wei (1997), Head and Mayer (2002), Nitsch (2000, 2002), Evans (2004) and Chen (2004). These papers all calculated domestic trade as gross output minus exports, a "rough" estimate of intranational trade flows.

For the Basque region, Minondo (2003) found that trade with the rest of Spain over 1991-1995 was 20 to 27 times more intense than with the rest of the world. Gil-Pareja et al. (2006) reached similar overall conclusions for the Basque region, highlighted the variation in border effects across trading partners based on contiguity and EU membership, and showed a significant decline in the overall size of the Basque border effect over time.

Our paper can be seen as following in this line since it uses international and interregional trade data to estimate border effects. But its broader purpose is to highlight the importance of interregional trade and how it changes the way we think about competitive/comparative advantage and competitiveness, not to identify the barriers at national borders that are responsible for international trade flows being relatively limited.

Data and Methodology

One of the reasons that the very early work accounting for interregional as well as international trade focused on Canada is that Canada actually maintains official records of interregional as well as international trade flows. It is unusual in this respect: in most other countries, interregional goods flows have to be estimated indirectly. This is necessary in the Spanish case as well.

Our core data on internal – intraregional and interregional – trade flows are drawn from the C-intereg database (see www.c-intereg.es, and Llano et al., 2008a, for a description). The data were estimated indirectly for each sector using available data about domestic transport flows of goods and translated into "monetary flows" by means of unit prices derived from detailed branch surveys. The transport statistics used in the estimation of Spanish interregional trade include origin-destination flows by the following modes of transport: road (*Permanent Survey on Road Transport of Goods, Ministerio de Fomento),* railway (*Complete Wagon and Containers flows, RENFE),* sea (*Spanish Ports Statistics, Puertos del Estado)*, air (*O/D Matrices of Domestic flows of goods by airport of Origin and Destination, AENA),* pipe *(O/D matrix of oil flows using pipe, CLH)* and electricity *(Red Eléctrica de España)*. The database also combines data on transport flows with additional information related to the output per regions and sectors (*Industrial Enterprises Survey, INE*) in order to constrain the interregional transport flows to be consistent with *National and Regional Accounts* (INE).

These estimates of internal trade are supplemented with international data on bilateral trade between Spanish regions and OECD countries that are taken from the *Dirección General de Aduanas of the Spanish Tax Agency (AEAT)*. The figures are expressed in current EMUs. Overall, we work with trade flow data for 1995-2005 covering 17 Spanish regions (Nuts 2 level) and 22 OECD countries and broken out into 13 different manufacturing industries (at the 2-digit SIC rev. 3 level).

To systematically compare the intensity of interregional and international trade, we turn to the gravity model, which has been widely and successfully used to explain trade flows. In the most basic gravity specification, the bilateral trade between two countries (regions) is directly proportional to their economic sizes and inversely proportional to the geographic distance between them. Within such a specification, the international border effect or home country bias

is estimated[3] by adding a dummy that takes the value of one for trade flows within countries and zero otherwise. Like most other empirical researchers, we actually prefer to work with an augmented gravity specification that allows for the inclusion of other variables that are assumed to be related to the bilateral volume of trade, e.g., dummy variables that capture the effects of having a common land border, using a common language, or sharing membership in an integration agreement.

Given sensitivities revealed in prior research, we actually work with two different specifications of the size variable. The first specification explains bilateral trade flows between each Spanish region and the corresponding trading partner (the rest of Spain or one of the 22 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.

$$\ln X_{ijt} = \beta_0 + \beta_1 \ln GO_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln Dist_{ij} + \beta_4 Island_{ij} + \beta_5 Contiguity_{ij} + \beta_6 EUFTA_j + \beta_7 EMU_j + \beta_8 Spain + \alpha_{ij} + \lambda_t + u_{ijt} \quad (1)$$

where:

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

GO_{it} is the gross output of the exporting partner,

GDP_{jt} is the GDP of the destination partner,

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

$Island_{ij}$ is a dummy variable that takes the value of one if at least one of the trading partners is an island,

$Contiguity_{ij}$ is a dummy variable equal to one when the Spanish region trades with France or Portugal,

$EUEFTA_j$ is a dummy variable equal to one if the trade partner is a member of the EU15 or the EFTA (including Switzerland and Norway) during the period 1995-2005,

EMU_j is a dummy variable equal to one if the trade partner is a member of the European Monetary Union after 2001,

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

α_{ij} is the country (region) pair individual effects,

λ_t are year fixed effects,

u_{ijt} is the standard classical error term.

The second specification measures the economic size by means of three variables: population, income per capita and the surface area of each region and its trading partner. As noted before,

[3] Note that the terms "border effect" and "home country bias" are considered synonyms and are used indistinctively in this paper.

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

$$\begin{aligned}\ln X_{ijt} = \quad & \beta_0 + \beta_1 \ln POP_{it} + \beta_2 \ln POP_{jt} + \beta_3 \ln GOPPC_i + \beta_4 \ln GDPPC_j \\ & \beta_5 \ln SURFACE_i + \beta_6 \ln SURFACE_j + \beta_7 \ln Dist_{ijt} + \beta_8 Island_{ij} \\ & \beta_9 Contiguity_{ij} + \beta_{10} EUEFTA_j + \beta_{11} EMU_j + \beta_{12} Spain + \alpha_{ij} + \lambda_t + u_{ijt}\end{aligned} \qquad (2)$$

where:

POP_{it} and POP_{jt} represent the populations,

$GOPPC_{it}$ and $GDPPC_{jt}$ are per capita gross output and per capita GDP,

$SURFACE_i$ and $SURFACE_j$ are the surface area of the countries (regions).

In terms of the sources of the size-related variables, gross output (GO) by sector at market prices is obtained from *Industrial Enterprises Survey* (INE). Sector-specific gross output expressed in national currency for each of the 22 OECD countries in the study is taken from the *OECD STAN 2007* database and the *EU KLEMS 2008* database. International GO figures were converted to current EMUs using the period-average market exchange rate as reported in *WDI 2005 on-lin*e database.

Foreign countries' GDP were taken from the World Bank's *World Development Indicators (WDI) Online* and converted from United States dollars to EMUs using the period-average market exchange rate. The GDP of the seventeen Spanish regions (excluding the two autonomous cities of Ceuta and Melilla) is drawn from the *Regional Accounts* (INE). The GDP of the rest of Spain is calculated as the Spanish GDP minus the corresponding regional GDP. The data on population also comes from *WDI on-line*. Data on surface area is taken from *CEPII database*.

In measuring distance, we followed the conventions developed by Head and Mayer (2000) and Gil-Pareja et al. (2005). To obtain the distances between Spanish regions we consider those cities with more than 20,000 inhabitants within Spain. For each city in a region we calculate a weighted average of the great circle distance (in kilometers) from this city to the other cities in each partner region, 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 within each region. Distances between each region and each foreign country in the sample are calculated considering the distances between the provincial 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.

Patterns in the Data

This descriptive analysis of Catalonia's international and interregional trade begins by comparing them at an aggregate level averaged over the period between 1995 and 2006: see Table 1.[4]

Table 1

Spatial distribution of the Catalan trade of goods. Average 1995-2006. All goods, (agriculture and energy included). Millions of Euros and growth rates

	Own region	Export to		Imports from		Balance		Openness Ratio
		Spain	World	Spain	World	Spain	World	
	(1)	(2)	(3)	(4)	(5)	(6)=(2-4)	(7)=(3-5)	(2+3+4+5) /(1+2+3)
Catalonia	40,410	41,835	32,284	24,025	46,764	17,810	-14,479	**126%**
Rest of regions	106,514	161,513	85,060	179,324	113,516	-17,811	-28,456	**152%**
Spain Total	**146,924**	**203,347**	**117,344**	**203,347**	**160,279**	**0**	**-42,935**	**140%**
1995-2006 (Growth rate)								
Catalonia	80%	64%	144%	79%	166%	44%	215%	12%
Rest of regions	106%	105%	121%	99%	181%	44%	502%	5%
Spain Total	99%	96%	127%	96%	177%	-	374%	6%

Source: authors, based on C-intereg and Customs data.

Several aspects of the table are worth pointing out. First, in each of these years, Catalonia traded much more with Spain (intra-plus interregional trade) than with the rest of the world. Although Table 1 captures this relationship just for goods, it holds *a fortiori* when services (generally less tradable than goods) are also taken into account. The relationship applies to both exports and imports. It has not been static, however: its evolution suggests a slow but progressive increase in the openness ratio to foreign markets that will be discussed further, towards the end of the next section.

Second, interregional trade in particular is not only the largest single category of trade for Catalonia but taking it into account as well as international trade shifts readings of Catalonia's external trade balance from sharply negative to positive: from an average international trade balance over 1995-2006 of -€14.5 billion – a third of the total Spanish international deficit – to an average total external balance, interregional and international, of €3.3 billion. This shift reflects, of course, the fact that Catalonia exports much more to the rest of Spain than it imports from there. Coupled with Catalonia's international trade patterns – high volumes of imports, significantly lower exports – it suggests that the single best way of characterizing the external trading relationships in which Catalonia is embedded is that it functions as an international import hub for the rest of Spain. This is a finer-grained characterization than the

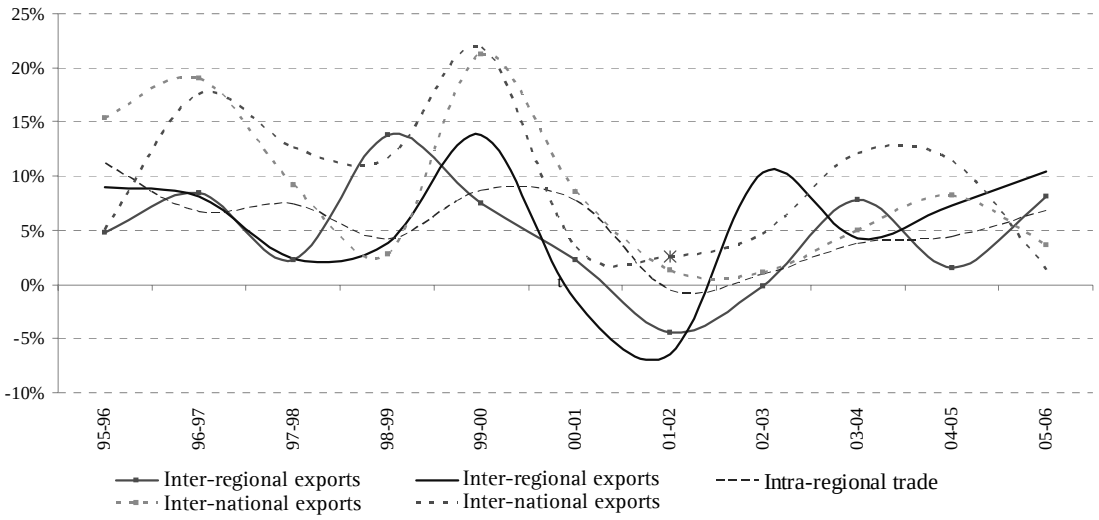
[4] Interregional data for 2006 is provisional. In order to cover the longest time period, and avoid noise in the estimation procedure, this year is included in the descriptive analysis (sub-section 5.1), but omitted in the econometric exercises (sub-section 5.2).

usual conception of Catalonia as a bridge between Spain and the rest of the world – but exposing it requires information about interregional as well as international flows.

It is also clear from Table 1, however, and even clearer from Figure 1, that the relative importance of international trade has increased since the mid-1990s, and that of interregional trade decreased. This result, which also applies to other Spanish regions, contrasts with previous findings in the case of the United States and Japan (Jackson et al. 2006; Hewings et al., 1998), where as international integration proceeded, the fragmentation of the value chain (Freenstra, 1998; Jones and Kierzkowski, 2005) led to strong spillovers across the boundaries of individual regions and, thereby, to rapid growth in interregional trade as well. Without further analysis, it is impossible to know whether this reflects the "normal" continuation of a process of international integration that received a major boost with Spain's accession to the EU in 1986, or whether alarm bells should be sounded. Without purporting to sort through these two very different kinds of explanations, one benign and the other less so, the next section will attempt to extrapolate, from changes in estimated (international-to-interregional) border effects, what the future might hold.

Figure 1

The evolution of Catalan trade of goods by main markets (1995-2006). *Growth rates of trade in current prices. Millions of Euros. All types of goods*

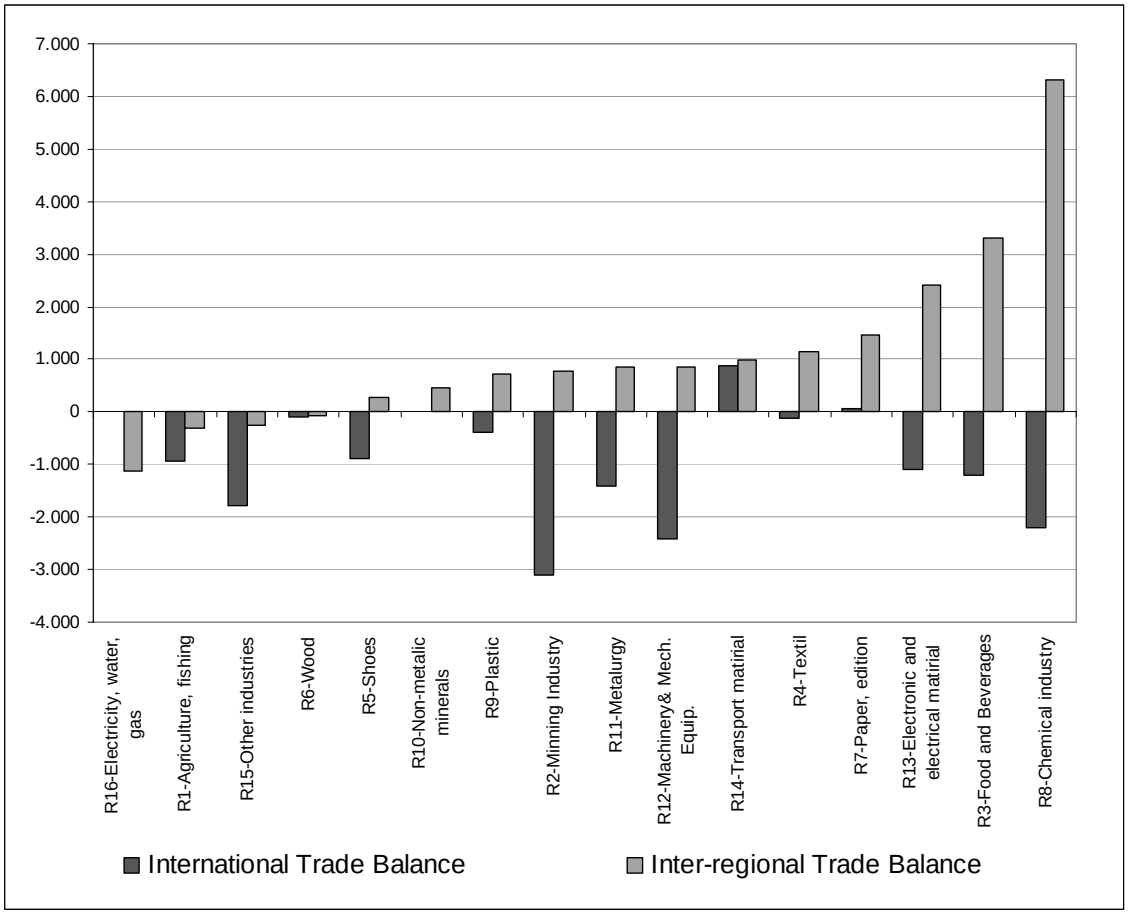


The overall trade data can usefully be disaggregated by sector and by trading partner. To highlight the difference that accounting for interregional trade can make to sector-level analysis, it is best to focus on how it shifts readings of Catalonia's external balances by sector. As Figure 2, illustrates, external competitiveness looks very limited when one focuses just on international trade, with the diagnosis being aggravated by the observation that transport machinery (looked at in detail in the next chapter), the one sector reported to yield a substantial international trade surplus over 1995-2006, actually experienced deteriorating competitiveness over the course of this period and was running substantial international trade deficits by its end. Accounting for interregional trade greatly expands the range of the Catalan goods sectors that are assessed to generate external surpluses and, even more interestingly, reveals that certain sectors that appear to generate large international trade deficits for Catalonia actually generate significant external surpluses when interregional trade is taken into account.

Chemicals and food and beverages – the latter is studied in more detail in the next chapter – supply particularly dramatic illustrations.

Figure 2

International vs total external trade balance of goods in Catalonia.
Trade balance in current prices. Millions of Euros. Average 1995-2006. All types of goods



Source: authors, based on C-intereg and Customs data.

The overall pattern of external advantage revealed by looking at the data summarized in Figure 2 was described by one senior Catalan policymaker (who looked at the figure) as "traditional", given the appearance of sectors such as food and beverages, textiles and printing and publishing in the lists of those revealed to be externally competitive. That thought is certainly consistent with the cross-country evidence on product specialization in international trade changing gradually and relatively continuously (Hidalgo et al., 2007).

Disaggregating by trading partner instead of sector, we look across other Spanish regions as well as other countries to identify Catalonia's top trading partners. As discussed above, Catalonia's trade with the rest of Spain is greater than its trade with the rest of the world and within Catalonia. Relative to other Spanish regions, Catalonia leads not only in terms of international trade volumes, but in terms of interregional trade volumes as well (although it should be noted that such absolute comparisons obviously are influenced by the fact that Catalonia is, economically, the biggest region within Spain). Thus, note from Figure 3 that Catalonia is involved (as origin or destination) in each

of the five largest bilateral flows of goods between Spanish regions in 2006 – a pattern that has held since 1995.

Figure 3

The strongest interregional flows in 2006.
All goods, R1-R16. % over total interregional trade in Millions of Euros.

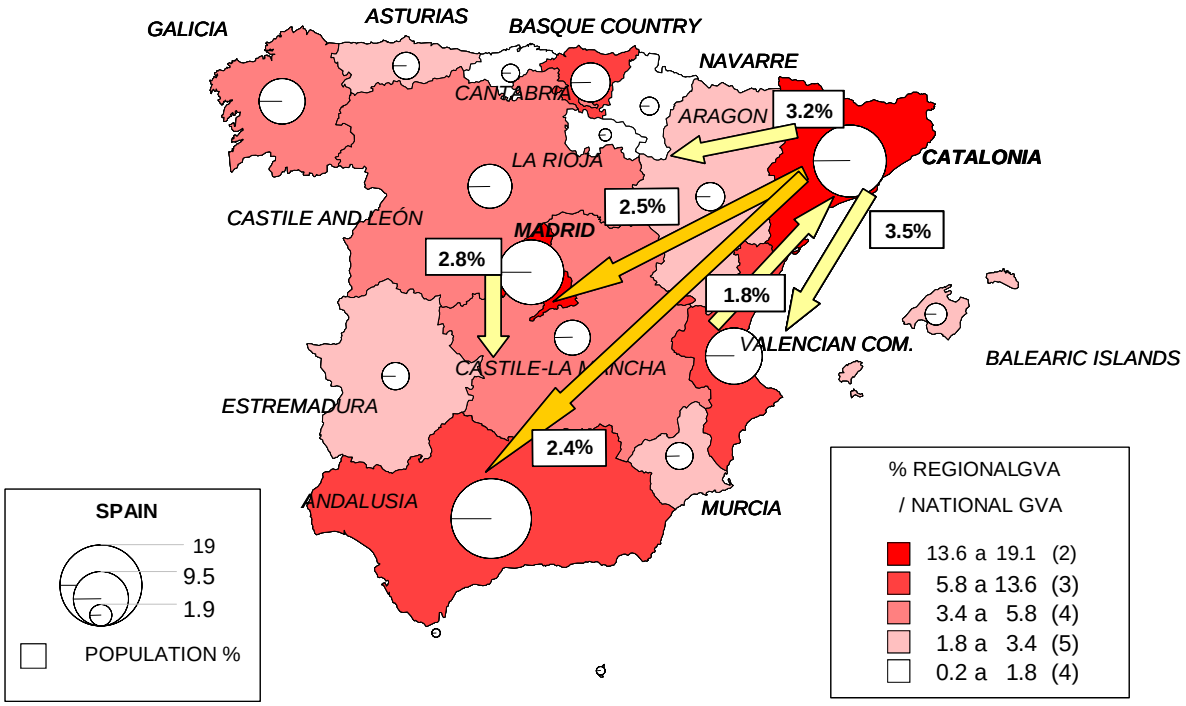


Table 2 lists Catalonia's top trading partners, whether international or interregional, in 1995, 2000 and 2006. The Spanish region of Valencia is the largest single trading partner in each of the years considered, and France has moved up to become the second largest, narrowly beating the Spanish region of Aragon. In fact, each of the top five international partners has improved its ranking over time, reflecting the fact, noted above, that international trade grew faster than interregional trade over this period. But that said, Catalonia's trade with Spanish regions still dominates its trade with other countries in the sense that for each of the international trading partners listed in Table 2, one can list a (different) regional trading partner with which the volume of trade is larger.

Table 2

Ranking of the main export flows with origin in Catalonia, 1995-2006.
All goods (energy included). Millions of Euros.

1995			2000		2006	
Exports from Catalonia		**GDP**	**Exports from Catalonia**		**Exports from Catalonia**	
Rest of Spain	**31.462**	**354,586**	**Rest of Spain**	**44,669**	**Rest of Spain**	**51,560**
Catalonia	**28,392**	**82,753**	***Catalonia***	**40,889**	***Catalonia***	**51,039**
Valencian C.	5,895	41,374	Valencian C.	8,150	Valencian C.	9,799
C. of Madrid	4,653	73,522	Aragon	6,201	**France**	**9,149**
Aragon	4,533	14,302	**France**	**6,018**	Aragon	9,019
France	**3,536**	**1,200,919**	C. of Madrid	5,623	C. of Madrid	7,149
Andalusia	3,395	58,704	**Germany**	**4,696**	**Germany**	**5,120**
Germany	**3,107**	**1,929,422**	Andalusia	3,628	**Italy**	**4,716**
Basque Country	2,702	27,647	**Italy**	**3,367**	Andalusia	3,993
Castile and León	2,264	26,714	Castile and León	3,348	**Portugal**	**3,671**
Italy	**1,876**	**861,118**	**Portugal**	**2,941**	Castile and León	3,449
Canary Islands	1,532	16,626	Basque Country	2,851	**United Kingdom**	**3,421**
Portugal	**1,375**	**87,038**	Canary Islands	2,766	Basque Country	2,975
Navarre	1,278	7,455	Balearic Islands	2,597	Canary Islands	2,483
Balearic Islands	1,173	10,062	Navarre	2,295	Balearic Islands	2,185
Galicia	1,143	24,566	**United Kingdom**	**2,278**	Castile-La Mancha	2,064
United Kingdom	**1,076**	**872,454**	Galicia	1,669	Murcia	1,957
Murcia	753	10,030	Castile-La Mancha	1,631	Galicia	1,840
Castile-La Mancha	687	15,436	Murcia	1,404	Navarre	1,662
Netherlands	566	320,502	Netherlands	1,235	Netherlands	1,615
Belgium	542	217,419	Belgium	941	Belgium	1,424
Cantabria	499	5,465	Cantabria	923	Switzerland	1,419
Asturias	438	10,583	La Rioja	750	La Rioja	1,101
La Rioja	327	3,343	Turkey	619	Cantabria	839
Switzerland	228	241,696	Austria	565	Turkey	778
Greece	200	100,717	Greece	450	Asturias	706
Austria	195	183,221	Asturias	447	Greece	690
Turkey	170	129,564	Switzerland	416	Denmark	658
Sweden	163	193,932	Sweden	364	Austria	562
Denmark	148	139,129	Poland	321	Poland	539

Source: own elaboration based on C-intereg (www.c-intereg.es) and Customs data (www.aeat.es).

Key Partners and the CAGE Framework

To supply some additional interpretation, it is worth noting that Catalonia's largest trading partners – regions as well as countries – tend to be particularly close to it along various dimensions – cultural, administrative and geographic, in particular – as well as relatively large economically. Consider, first of all, Catalonia's two leading domestic trading partners, Valencia and Aragon. Culturally, the Valencian and Catalan languages are similar and are both considered as co-official (together with *Castellano, i.e., "Spanish"*) for their respective regions. Administratively, the three regions fell under the Crown of Aragon for centuries – which probably created some additional cultural linkages as well – before being integrated under the Crown of Spain. Geographically, both Valencia and Aragon share common land borders with Catalonia. And economically, Valencia, in particular, is one of Spain's larger regions, so it is natural, in a sense, that it be one of Catalonia's largest regional trading partners. Additionally,

although the sectoral structure of these three regions is different, there are strong inter-sectoral linkages between them through several sectors like energy, equipment or the transport industry.

From this perspective, what is more surprising is how significant Aragon is as a trading partner for Catalonia, since the Aragonese economy is only one-third as large as Valencia's. The greater intensity of Catalonia's trade with Aragon seems to rest, for the most part, on geographical factors. Although Aragon and Valencia are both adjacent to Catalonia, Zaragoza is only about one-third as far from Barcelona as is the city of Valencia, which, based on the effects of physical distance that we estimate in our most basic (unaugmented) gravity specification in the next section as well as standard estimates, should offset the difference in Aragonese and Valencian GDPs.[5] In addition, Aragon lacks direct access to the sea which, coupled with difficulties crossing the Pyrenees, means that Catalonia serves as its trading intermediary with the rest of the world in a way that Valencia simply doesn't require, which should further boost Catalan-Aragonese trade relative to Catalan-Valencian trade. And, based on the general results from the gravity literature, so should the fact that Aragon is among Spain's richest regions (the fifth in 2006), with a per capita GDP nearly 20% higher than Valencia's. Another drawback for the Catalan-Valencian trade that requires further research is the inappropriate transport infrastructures connecting these two regions (an issue of permanent political debate in both regions), compared to the best connections between Aragon and Catalonia.

More familiarly, such considerations can also be applied to Catalonia's international trade. Thus, there are a number of reasons why France should be a particularly large trading partner, even compared to other EU countries (which jointly dominate Catalonia's international trade since *they* are closer to it along those dimensions than non-EU countries). Culturally, Catalan is considered close to French; in addition, even more mutually intelligible languages (e.g., Occitan) are spoken – albeit to a limited extent – on the other side of the French border. Administratively, Spain was once ruled by France's Bourbon dynasty, from which King Juan Carlos is descended, and Napoleon, in addition to invading Spain, contributed to the commonality of the two countries' legal systems. Geographically, France is the only foreign country – apart from tiny Andorra – to share a common land border with Catalonia, and the only route to Europe. Finally, economically, France is the world's sixth largest economy, and the second largest in the Eurozone. But again, economic size is only part of the story: France is less than 80% the size of Germany, the largest Eurozone economy and Catalonia's next largest international trading partner, but France trades 80% more with Catalonia.

So in other words, instead of simply categorizing other regions as the "Rest of Spain" and other countries as "International," it makes sense to think of countries and even regions as being embedded in space at varying distances from one another: France is much closer to Catalonia than the United States, and to Aragon than Andalusia. While this proximity has a geographic component, there is more to it than that: the space that regions or countries are thought of as being embedded in has to be multidimensional in encompassing cultural, administrative, geographic and economic attributes, acronymized as the CAGE framework. Since the CAGE

[5] Interregional work places a premium on more careful computation of effective distance than the simple measurement of geographic distance between capital cities. The more careful methodology described in the previous section is implemented in the next one.

framework has already been extensively discussed in an international context,[6] consider the kinds of differences it alludes to in a bit more detail in the interregional context:

- Cultural differences include interregional differences in languages and "national" identity.
- Administrative differences include those created by decentralizing decisions to the regions and the dearth of mechanisms for interregional coordination.
- Geographic differences are due not so much to physical distance as to poor infrastructure (and poorly coordinated development).
- Economic differences, e.g., in income levels, are generally predicted, based on international evidence, to decrease rather than increase trade — although trade motivated by economic arbitrage constitutes an important exception.

The next section sheds more light on variations in CAGE distances from Catalonia across Catalonia's international trading partners when it estimates variation in border effects across different foreign countries. Its broader purpose is to add rigor through formal estimation of border effects, i.e., the effects of the barriers that arise at national borders. Before moving on to the next section, though, we would like to clarify that, since the explicit considerations of some of the variables included in the CAGE framework (administrative, cultural and historical...) would require a more fine spatial scale (provinces for instance), our econometric analysis will focus on controlling the main geographical and economic factors at the regional level (Nuts 2, in Eurostat terminology), assuming that the others are also playing their role. In further research we expect to consider all of them, controlling for the intercept of these effects, and combining different levels of spatial desegregation.

Estimates of Border Effects

In estimating border effects, we follow McCallum's study in focusing on the ratio of interregional-to-international trade after controlling for size, distance, and other kinds of unilateral/bilateral characteristics, i.e., on the difference in the height of the barriers that arise at national and at (subnational) regional borders. In particular, we estimate the border effect by using the two gravity equations (1) and (2) with panel data, which lets us control for unobservable individual effects. To permit comparisons with other studies of Spain (Minondo, 2003; Gil-Pareja et al., 2005, 2006), we estimate a random effects model (REM).

We begin by estimating the basic version of equation (1). The results are presented in column (1) of Table 3. The equation fits the data well, explaining 87 per cent 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 3.79, suggesting that Catalonia trades about 44 times [= exp(3.79)] more with the rest of Spain than with any other developed economy, after adjusting for sizes and distances.

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[6] This practitioner-oriented CAGE framework — an acronym for cultural, administrative, geographic and economic — for thinking about the differences between countries was synthesized out of the large literature on gravity models by Ghemawat (2001); see chapter 3 of Ghemawat (2007) for additional discussion.

In column (2), Island, Contiguity, EUEFTA and EMU dummies are added to the gravity equation. All the estimated coefficients of the augmented gravity equation, with the exception of ISLAND variable, have the expected sign and are statistically significant at the five per cent level. In particular, the elasticity of trade to income is slightly below one for both the origin and destination partner and the elasticity of trade with respect to distance is –1. Catalonia trades 12 per cent more with a contiguous country (France) than it does with otherwise similar countries, 49 per cent more with EUEFTA countries and 22 per cent more with members of the EMU zone after 2001. The variable ISLAND exhibits a positive coefficient, although small and not statistically significant.

Table 3

The external border effect

	CATALONIA				ALL REGIONS			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SPAIN	3.79	4.01	3.87	4.58	3.70	4.28	4.00	4.62
	(6.89)	(5.72)	(6.96)	(7.78)	(13.06)	(12.89)	(15.56)	(15.53)
Ln(GO i)	0.96	0.93			1.02	1.01		
	(24.30)	(23.62)			(57.02)	(55.71)		
Ln(GDP j)	0.73	0.71			1.03	1.01		
	(22.15)	(21.56)			(56.70)	(55.39)		
Ln(POP i)			1.15	1.19			0.94	0.99
			(9.70)	(12.03)			(24.80)	(26.20)
Ln(POP j)			0.76	0.79			0.99	1.05
			(6.38)	(7.88)			(26.20)	(27.35)
Ln(pc GO i)			0.97	0.73			1.19	1.15
			(17.46)	(16.03)			(51.52)	(49.77)
Ln(pc GDP j)			0.42	0.81			1.15	1.11
			(8.56)	(7.53)			(33.43)	(31.87)
Ln(surface i)			-0.17	-0.25			-0.17	-0.26
			(6.13)	(9.34)			(5.49)	(6.87)
Ln(surface j)			-0.03	-0.07			-0.22	-0.29
			(0.86)	(2.11)			(6.54)	(7.91)
Ln(distance ij)	-1.01	-0.93	-0.95	-0.62	-1.43	-1.14	-1.22	-0.92
	(9.23)	(7.10)	(6.01)	(4.85)	(23.86)	(15.40)	(19.68)	(10.84)
Island ij		0.08		0.08		-0.23		-0.47
		(0.94)		(1.29)		(1.93)		(4.19)
Contiguity ij		0.11		0.44		0.28		0.86
		(1.73)		(5.41)		(2.10)		(2.44)
EUEFTA ij		0.15		0.63		0.38		0.41
		(2.01)		(8.08)		(2.78)		(3.26)
EMU ij		0.20		0.14		0.07		0.02
		(3.36)		(1.87)		(1.76)		(1.56)
Overall R2	0.87	0.88	0.89	0.91	0.73	0.74	0.77	0.78
Observation	550	550	550	550	9350	9350	9350	9350

The correct interpretation of the coefficient of the SPAIN dummy in the augmented gravity equations requires an explanation of how the dummy variables Contiguity, EUEFTA and EMU 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. Since our goal is to measure the greater intensity of trade between Catalonia and the rest of Spain rather than with an unrelated partner (whether or not they are neighbors and share a preferential regional agreement), a value of zero is assigned to Contiguity, EUEFTA and EMU variables for bilateral trade between Catalonia and the "rest of Spain."[7] The estimated value of the SPAIN coefficient in the augmented gravity equation is 4.01. Thus, Catalonia trades 55 times more with the rest of Spain than it does with any other country of the sample that is neither contiguous nor a member of the EU, EFTA or EMU zone. For France, the border effect of Catalonia is reduced to 3.55 (=exp(4.01-0.11-0.15-0.20), that is, Catalonia trades 35 times with the rest of Spain than with its neighbor country.

The results for the basic and augmented versions of the gravity equation (2) are presented in columns (3) and (4) of Table 3. In both cases, all the variables show the expected signs and statistically highly significant coefficients. In the basic specification, the parameter of interest is 3.87, so the estimated Spanish home bias slightly increases to a factor of around 48. In the augmented version, the estimated coefficient of the variable SPAIN increases to 4.58 (the Spanish regions trade 97 times more with the rest of Spain than they do with any other country of the sample that is neither contiguous nor a member of the EU, EFTA or EMU). For France, the coefficient of SPAIN decreases to 3.43 (30.8 times more).

For comparison purpose we estimate the basic and augmented gravity models for the 17 Spanish regions. The results are displayed in columns (5) to (8) in Table 3. All the coefficients have the expected sign and are statistically significant at conventional levels. The coefficient of the SPAIN variable in the basic specification are 3.70 (column 5) and 4.00 (column 7), which implies that the size of the border effect varies between 40 and 54. In the augmented gravity specifications, the SPAIN coefficients are 4.28 (column 6) and 4.62 (column 8), so a typical Spanish region trades between 74 and 101 times more with the rest of Spain than any other country of the sample that is neither contiguous nor a member of the EU, EFTA or EMU. In all but one specification, the overall border effect of the Spanish regions is slightly greater than the one reported for Catalonia.

This last characterization averages out the large differences that are actually observed across (other) Spanish regions. Table 4 provides a more granular characterization by reporting the border effects for the other Spanish regions. To save on space, we only report in column 1 the evidence for the basic specification of equation (1). Border effects differ notably across regions. Andalusia displays the highest coefficient (4.58), suggesting that its border effect is equal to 98. Comparatively large border effects are also found in other regions such as Castile and León, Castile and La Mancha and Canary Islands. At the opposite end of the spectrum, Madrid shows the smallest border effect, which is equal to 6 [=exp(1.8)], while Navarre has the second-lowest border effect, being equal to 13. Catalonia, with a border effect of 44, occupies a middle position together with Community of Valencia, Basque Country, Cantabria and Estremadura.

[7] We apply the same logic as Helliwell (1997) to correctly identify the border effect and properly separate it from the common border effect.

Table 4 also presents the results for each region when the border effect is broken down into its export and import sides (columns 2 and 3). Following Anderson and Smith (1999), 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). 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. The coefficient for imports is greater than the coefficient for exports in 12 cases (the difference is statistically significant at 1 per cent in 8 cases) while the opposite result is found in only 5 regions. However, there are 5 regions (Catalonia, Madrid, Canary Islands, Cantabria and Galicia) in which the coefficient for exports is greater than the coefficient for imports but the difference is statistically significant at 1 per level only for the first three. Focusing on Catalonia, the border coefficient for exports is 4.05, while the border coefficient for imports is 3.53. In exponential form it indicates that Catalonia's bias towards trade with the rest of Spain is 33 in imports, but 58 in exports.

Table 5 confirms these results when we estimate the augmented gravity model. In all equations, the export coefficient (EXPORTS) is lower than the import coefficient (IMPORTS), and the difference between the import and export border coefficients is statistically highly significant at conventional levels. Column 1 reveals that, in the case of trade with foreign countries that are neither neighbor nor member of the EUEFTA and EMU, Catalonia's bias towards trade with the rest of Spain is 40 (=exp(3,71)) in imports, but 73 (=exp(4,29)) in exports; and in the case of France, the home bias is 22 in imports and 40 in exports. This implies that the border effect for Catalan's imports is larger than for Catalan's exports. Although further research is needed on this point, this result suggests that Catalonia, together with Madrid (the country´s capital city), may function as a Spanish import platform for the rest of Spain, importing final and intermediate goods that are then stored, transformed and re-exported to the rest of Spain. Moreover, these results can be also connected with the presence of some "noise" in the data, derived from the complexity of logistics and some limitations in the statistical linkage between international and interregional trade data. In this regard, although the interregional database used in this paper has controlled for the presence of international transit flows (Llano et al., 2008a), it is reasonable to expect some "bias" in the figures of international trade for Madrid, Catalonia and other big regions, derived from the high concentration of headquarters of the exporting/importing firms in their territory.

Table 4

The border effect by region

	Coefficient SPAIN	Coefficient SPAIN EXPORTS	Coefficient SPAIN IMPORTS	Wald-test	Border effect
	(1)	(3)	(2)	(4)	(5)
Catalonia	3.79	4.05	3.53	15.69	44
	(6.63)	(7.19)	(5.83)	[0.00]	
Andalusia	4.58	4.78	4.52	0.86	98
	(8.89)	(8.46)	(8.88)	[0.35]	
Aragon	3.40	3.22	3.57	8.00	30
	(4.58)	(4.14)	(4.73)	[0.00]	
Asturias	3.21	3.31	3.10	2.09	25
	(5.16)	(4.97)	(4.84)	[0.27]	
Balearic Islands	3.37	2.81	3.88	37.05	29
	(3.28)	(2.77)	(3.99)	[0.00]	
Canary Islands	4.18	4.92	3.57	116.66	65
	(5.11)	(4.97)	(4.57)	[0.00]	
Cantabria	3.65	3.88	3.45	4.89	38
	(3.83)	(3.84)	(3.58)	[0.03]	
Castile and La Mancha	4.29	3.98	4.62	8.75	73
	(4.83)	(4.58)	(4.94)	[0.00]	
Castile and León	4.39	4.46	4.32	0.63	81
	(6.72)	(6.57)	(6.44)	[0.42]	
Community of Valencia	3.64	3.46	3.83	9.46	38
	(6.29)	(5.91)	(6.46)	[0.00]	
Estremadura	3.80	2.98	4.61	76.87	45
	(5.75)	(4.05)	(6.67)	[0.00]	
Galicia	3.94	3.81	4.01	0.44	51
	(5.41)	(5.30)	(5.29)	[0.50]	
Madrid	1.80	2.50	1.13	113.56	6
	(3.01)	(3.38)	(2.45)	[0.00]	
Murcia	3.44	2.99	3.91	56.82	31
	(6.34)	(5.28)	(7.09)	[0.00]	
Navarre	2.56	2.36	2.82	11.38	13
	(3.95)	(3.37)	(4.19)	[0.00]	
Basque Country	3.65	3.53	3.82	11.09	38
	(8.55)	(8.05)	(8.40)	[0.00]	
La Rioja	3.19	2.70	3.70	34.77	24
	(3.02)	(2.41)	(3.51)	[0.00]	

Table 5

The external border effect by direction of trade

	CATALONIA		ALL REGIONS	
	(1)	(2)	(3)	(4)
SPAIN IMPORT	3.71	3.16	4.48	4.70
	(5.73)	(7.72)	(12.39)	(14.92)
SPAIN EXPORT	4.29	4.94	4.33	4.54
	(6.56)	(7.56)	(13.00)	(15.67)
ln(GO i)	0.94		0.87	
	(36.98)		(54.72)	
ln(GDP j)	0.70		0.85	
	(29.17)		(52.48)	
ln(POP i)		1.18		0.99
		(17.25)		(25.78)
ln(POP j)		0.72		1.05
		(9.24)		(27.27)
ln(pc GO i)		0.79		1.17
		(12.84)		(48.91)
ln(pc GDP j)		0.86		1.12
		(0.60)		(31.07)
ln(surface i)		-0.30		-0.26
		(5.80)		(6.92)
ln(surface j)		-0.02		-0.29
		(1.72)		(7.72)
ln(distance ij)	-0.91	-0.62	-1.14	-0.93
	(10.87)	(12.55)	(15.42)	(10.84)
Island ij	0.07	0.08	-0.31	-0.47
	(1.05)	(1.37)	(8.40)	(4.16)
Contiguity ij	0.23	0.44	0.39	0.87
	(2.79)	(5.70)	(6.31)	(2.45)
EUEFTA ij	0.15	0.73	0.53	0.41
	(1.67)	(8.14)	(12.22)	(8.40)
EMU ij	0.21	0.14	0.10	0.07
	(3.35)	(1.94)	(2.29)	(1.75)
F-equality test				
Xspain=Mspain	34.83	15.92	1.17	6.09
	[0.00]	[0.00]	[0.28]	[0.01]
Adjusted R2	0.88	0.89	0.75	0.77
Observation	550	550	9350	9350

Border Effect by Sector

Apart from previous explanations based on the limitations of the available statistical sources and the distribution strategy of trade, as we suggested in the previous section, the size of the Spanish bias of Catalonia and the greater border effect of its exports compared to its imports may be also explained by its sectoral structure. The results of estimating the border effect for each of 13 broad manufacturing sectors is reported in Table 6.

Table 6

The external border effect by sector

	Coefficients		Border effect		Coefficients CATALONIA		
SECTOR	CATA-LONIA SPAIN	ALL REGIONS SPAIN	CATA-LONIA	ALL REGIONS	SPAIN IMPORT	SPAIN EXPORT	Wald test
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Food and drink products	4.97	4.91	144	136	4.85	5.07	1.44
	(7.93)	(9.26)			(4.50)	(5.19)	[0.23]
Textile and clothing products	4.35	4.23	77	69	4.55	4.17	1.96
	(5.06)	(7.90)			(4.99)	5.14	[0.16]
Leather and shoes	4.14	4.27	63	72	3.95	4.75	1.94
	(3.20)	(8.70)			(4.40)	(4.87)	[0.16]
Wood products	4.90	5.20	134	181	4.87	4.91	0.14
	(4.11)	(19.32)			(3.85)	(3.71)	[0.71]
Paper and Edition	5.12	4.92	167	137	4.83	5.38	2.99
	(5.33)	(10.74)			(4.92)	(4.47)	[0.05]
Chemical products	3.80	3.90	45	49	3.15	4.45	33.80
	(5.46)	(9.38)			(4.93)	(5.13)	[0.00]
Rubber and plastic products	3.88	3.87	48	48	3.64	4.13	2.13
	(6.66)	(10.50)			(5.82)	(6.22)	[0.13]
Non-metallic minerals prod.	4.56	4.95	96	141	3.98	5.52	15.35
	(6.16)	(12.19)			(5.47)	(6.00)	[0.00]
Metallurgy and metallic prod.	4.23	4.07	69	59	3.77	4.69	9.89
	(6.51)	(10.47)			(5.46)	(6.06)	[0.00]
Mechanical engineering	3.34	3.73	28	42	3.11	3.67	7.86
	(6.16)	(8.81)			(5.56)	(6.26)	[0.00]
Electrical & Electronic mat.	3.47	4.18	32	65	3.37	3.61	0.14
	(5.40)	(9.26)			(5.12)	(4.97)	[0.70]
Transport equipment	3.40	3.24	30	26	3.76	2.91	2.09
	(2.34)	(7.24)			(4.15)	(5.01)	[0.14]
Other manufacturing prod.	3.64	4.50	38	90	4.13	3.26	13.18
	(6.34)	(9.73)			(4.46)	(5.57)	[0.00]

The estimated values vary from 3.34 in machinery and mechanical engineering to 5.12 in paper and edition. To gain a sense of what they correspond to in real terms, consider the two sectors that are studied in detail in the next chapter, and that were selected, in part, because they exhibit widely different border effects: food and beverages (5.0) and transport equipment (3.4). In food and beverages, international trade averaged 60% of interregional trade over the period studied; for transport equipment, the ratio was 160%. The competitive landscape seems to be much more internationalized in the latter case than in the former, as the detailed sectoral studies will confirm.

For 7 out of the 13 sectors, the border effect is lower for Catalonia than for Spain as a whole, but that leads more to a conclusion of average rather than exceptional internationalization, confirming the earlier conclusions that did not control for sectoral structure. It is also interesting to

distinguish between imports and exports at the sectoral level. With the exceptions of textile and clothing and transport equipment, the border effect for exports exceeds that for imports for every sector, consistent with Catalonia being more of an international import than export hub for Spain.

Border effect by trading partner

It is also interesting to ascertain whether there are important differences in the Spanish bias among the trading partners. Table 7 reports the results of an OLS estimation that addresses this issue. The dependent variable is the logarithm of exports (sales) from country (region) i to country (region) j and the explanatory variables are log GO of country (region) i, log GDP of country (region) j and 27 dummy variables for each of the 22 trading partners of Catalonia apart from Spain included in the sample. For example, the dummy variable for France takes the value of 1 in bilateral trading relations with this country, and zero otherwise, and its estimated coefficient allows one to know the Spanish bias with respect to France after controlling for economic size.

Table 7

The border effect by foreign country

	CATALONIA				ALL REGIONS			
	Coef.	(t-stat)	Spanish Bias	Spanish bias corrected by distance	Coef.	(t-stat)	Spanish Bias	Spanish bias corrected by distance
ln(GO i)	0.78	(14.75)			0.78	(38.46)		
ln(GDP j)	0.72	(12.92)			0.86	(39.27)		
dummy FRA	-4.14	(17.19)	63	58	-3.98	(9.87)	54	29
dummy BEL	-4.04	(22.80)	57	38	-4.30	(10.69)	74	31
dummy NLD	-4.17	(22.85)	65	39	-4.46	(11.24)	86	34
dummy DEU	-4.63	(17.03)	102	54	-4.43	(10.77)	84	28
dummy ITA	-4.47	(18.73)	87	62	-4.46	(10.91)	86	47
dummy GBR	-5.10	(21.50)	164	95	-4.71	(11.81)	111	46
dummy IRL	-4.55	(27.84)	95	46	-5.00	(12.90)	148	58
dummy DNK	-4.73	(30.51)	113	46	-5.29	(13.56)	198	55
dummy GRC	-4.66	(32.37)	106	40	-5.53	(14.56)	252	62
dummy PRT	-2.95	(18.76)	19	13	-2.93	-(7.37)	19	15
dummy SWE	-5.20	(30.45)	181	61	-5.40	(13.46)	221	52
dummy FIN	-5.36	(32.89)	213	58	-5.71	(13.97)	302	59
dummy AUT	-4.77	(29.06)	117	65	-5.55	(13.92)	257	84
dummy NOR	-6.11	(39.47)	449	97	-6.10	(15.85)	446	74
dummy USA	-7.50	(23.79)	1,806	168	-7.00	(17.16)	1,097	87
dummy MEX	-5.87	(34.08)	355	27	-6.56	(17.40)	706	48
dummy KOR	-6.47	(32.10)	646	48	-7.52	(18.08)	1,845	106
dummy JPN	-7.58	(25.68)	1,953	135	-7.92	(19.15)	2,752	150
dummy AUS	-6.98	(40.11)	1,071	46	-7.91	(20.07)	2,724	93
dummy CZE	-4.47	(27.43)	87	44	-5.82	(14.12)	337	106
dummy SVK	-4.36	(26.23)	78	35	-6.59	(16.08)	728	200
dummy SVN	-4.46	(27.99)	86	40	-6.10	(15.32)	446	129
dummy HUN	-4.14	(27.28)	63	29	-5.70	(14.33)	299	86
dummy POL	-5.27	(33.41)	194	80	-5.87	(14.90)	354	94

This estimation with fixed effects by country has an important caveat that must be noted: the impossibility of estimating time-invariant variables. Thus, the Spanish bias for each country is obtained without controlling for distance (a basic variable of the gravity model) and, therefore, the border effects by country are overstated since Catalonia is more distant from foreign countries than from the rest of Spain. But, if one assumes that the distance – trade elasticity is – 1.0, which seems a reasonable assumption in light of the previous results in this paper and more broadly in the literature, one can correct the Spanish bias for each country by dividing its value by the ratio of the distance between Catalonia and the trading partner in question to the distance between Catalonia and Spain. Considering again the case of France as an example, the coefficient on Dummy variable France is –4.14 and is highly statistically significant. It suggests that trade between Catalonia and France is 98.4% [(exp(–4.14) – 1)x100] lower than what would otherwise be expected given the GDPs of France and the rest of Spain. In other words, trade with France is 1.49% [exp(–3.18)x100] of that with the rest of Spain and, therefore, the Spanish bias with respect to this country (the number of times that Catalonia trades more with the rest of Spain than with France) is 62.8 [1/exp(–3.18)] after controlling for differences in output. Dividing this bias by the ratio of the distance between Catalonia and France to the distance between Catalonia and Spain one can obtain the Spanish bias corrected by the distance.

The results show that the United States (168), Japan (135) and Norway (97) are the three countries in the sample for which the Spanish bias is greater. At the opposite extreme, one finds the cases of Portugal (13), Mexico (27) and Hungary (29). As far as the EU is concerned, the border effect is greater than 37 in all of the 15 EU countries except Portugal, with the four largest EU Member States (Germany, France, Italy, the United Kingdom) ranging from 38 to 72. Thus, the analysis of Spanish bias by trading partners shows that there are important differences even in the context of EU Member States and, therefore, the estimation of the overall bias masks a great heterogeneity across partner countries. Several factors could explain this evidence by partner countries such as distinct levels of tariffs, differences in transaction costs and product characteristics, or simply the fact that imports and domestic goods are closer substitutes with respect to some countries than to others.

The Border Effect over Time

Finally, we analyze the evolution of Catalan border effects over time. The results are reported in Table 8. Column 1 reports the estimated Spanish bias coefficients, estimated year by year, using the basic gravity equation (1).

Table 8

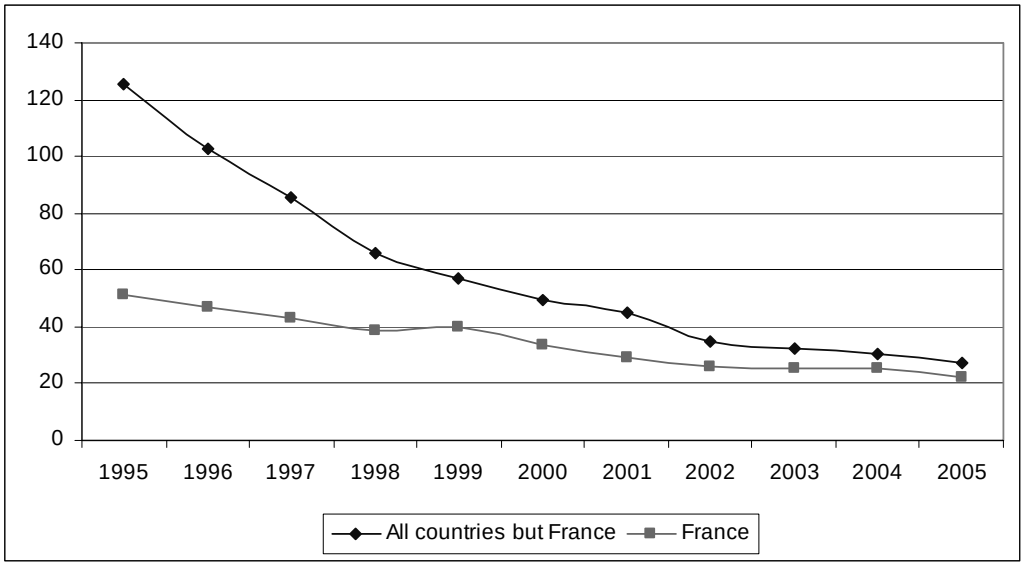
The external border effect by year

	Catalonia-Spain	All regions Spain	Catalonia Spain Import	Catalonia Spain Export
	1	2	3	4
1995	4.38	4.21	4.14	4.62
1996	4.22	4.14	4.01	4.42
1997	4.10	3.95	3.88	4.31
1998	3.92	3.84	3.69	4.16
1999	3.88	3.78	3.58	4.18
2000	3.78	3.63	3.50	4.06
2001	3.68	3.57	3.39	3.96
2002	3.54	3.47	3.22	3.86
2003	3.47	3.40	3.18	3.76
2004	3.44	3.33	3.12	3.76
2005	3.35	3.38	3.04	3.66
Growth rate 95-05	-24%	-20%	-27%	-21%

The basic Catalan border effect shows a downward trend that ranges from 80 in 1995 to 29 in 2005. The decline over time shows a similar path to the one calculated for all the regions (column 2), although it is more pronounced in the case of Catalonia (-24% versus -20%). The decline in the border effect in Catalonia has occurred in both imports and exports, exhibiting a very similar path (columns 3 and 4). Finally, Figure 4 illustrates the evolution of the size of Spanish bias with respect to any other country in the sample that is neither contiguous nor a member of the EU, EFTA or EMU, compared to any other country that is contiguous and a member of one of these economic areas. It is evident that the decline has occurred mainly in the first group of countries, moving from 125 in 1995 to 27 in 2005, while in the case of France the border effect went down "just" a bit more than one-half, from 51 in 1995 to 22 in 2005. This downward trend over time is consistent with the increasing international economic integration of Catalonia.

Figure 4

Evolution of the Catalonia's external border effect over time by country



The apparent asymptoting towards 20 of the estimated border effects suggests an inference that does not depend on whether one regards the pattern depicted in Figure 4 as reflecting desirable international integration or undesirable interregional fragmentation. If declines in border effects do in fact flatten out, interregional trade will, by definition, play a bigger role in total growth than it did between the mid-1990s and the mid-2000s, when it ceded share to international trade. Of course, this is a prediction about the medium term; the financial crisis is likely to inject significant turbulence in the short term, with declines in trade (growth) overall.

Conclusions

This paper argued that studies of regional competitiveness need to pay particular attention to interregional trade, instead of focusing on just international trade patterns as indicators of revealed advantage. Some of the attractions are conceptual. Including interregional flows satisfies the basic craving for (more) complete coverage: otherwise, interactions with geographic spaces that lie in between the boundaries of the focal region and the country that it is part of simply fall through the cracks.

Including interregional flows also helps address what Paul Krugman has described as the problem of "two-ness": the dominance of two-location models in research on trade despite that fact that "empirical economic geography must cope with a world in which activities are spread across continuous space" (Krugman, 2003, page 57). Work on competitiveness, like work on international trade, tends to dichotomize between local and international/global (or, more prosaically, home and abroad). The trichotomy of intraregional-interregional-international does more than add resolution: three locations allow for variation in distances across trading partners in a way that two do not. Actually, what we have advocated is not a three-location model of the world, but a gravity-based representation in which trade varies with the geographic distance between locations, often continuously, but with discontinuities at boundaries of various sorts (with the boundaries of Spanish regions and of Spain itself being of particular concern in our empirical work). In other words, trade is modeled in a piecewise continuous function of distance between any two locations—as well as other unilateral/bilateral variables whose distribution varies spatially. This is consistent with the broader evidence indicating that we live in a semi-integrated world in which there are still important differences at boundaries — internal as well as international.[8]

The bulk of our paper actually focused on the empirical rather than conceptual attractions of taking interregional trade flows into account. To this end, we analyzed Catalan interregional as well as international trade — of regional interest, to be sure, and of broader interest because Catalonia turns out to be a particularly striking illustration of the importance of accounting for interregional trade, for a number of reasons. First of all, confirming the importance of the phenomenon, we estimate Catalonia's interregional trade in goods to be slightly larger than its international trade. Second, taking interregional flows into account helps identify Catalonia's role as a trading (particularly import) hub for Spain, and shifts readings of its external trade balance from chronically negative to positive. Third, it also changes conclusions of which

[8] See Ghemawat (2003) for a comprehensive review of data indicating semi-integration across national boundaries and Ghemawat (2008) for a discussion of some of the evidence that there are also smaller but still significant barriers to integration across regions within a country.

Catalan sectors are "competitive" in the sense of running external trade surpluses: thus, in food and beverages, a sector discussed in more detail in the next chapter by Ghemawat, a large international trade deficit is offset by a much larger interregional trade surplus, yielding a large overall external surplus for Catalonia. And fourth, accounting for interregional as well as international flows changes and expands the list of Catalonia's key external trading partners: Valencia, not France, turns out to be the largest. But a similar list of cultural, administrative, geographic and economic (CAGE) factors seems to determine who the key partners are at both the interregional and international levels.

These descriptions of the trade data are of obvious interest. More analytically, we also fitted gravity models to the data, yielding several additional insights. First, international border effects, measured as the relative intensity of interregional-to-international trade after controlling for GDP (economic size), distance and other variables, vary significantly across sectors and by trading partner. This is suggestive of the heterogeneity to be encountered—and somehow addressed rather than dismissed — in formulating policies to boost external competitiveness. Second, the permeability of international borders also varies by the direction of the flow: Catalonia's exports exhibit higher border effects than its imports, consistent with its role as a trading hub for Spain being more weighted toward imports than exports. Third, Catalan border effects do not seem to be the lowest even among large, multi-provincial Spanish regions, qualifying the common perception of Catalonia as particularly internationalized. Fourth, while the international border effect for Catalonia has declined drastically in recent decades, declines appear to be flattening out. This suggests that interregional trade may play a more important role in the growth of total trade than it did between the mid-1990s and the mid-2000s, when it ceded share.

All these analyses notwithstanding, what we have provided is but a first cut at a conceptually as well as practically important issue. Our own agenda includes further exploration of border effects at a finer level of disaggregation than the 13 sectors used in this paper (the C-intereg database used for the interregional trade data will allow us to consider around 30 sectors), and further analysis (probably at this disaggregated level) of the determinants of border effects — a task that some of the additional controls in the augmented gravity equation made a start at, but did not pursue. Also appealing is the idea of disaggregating by unit of analysis, from the regional down to the provincial level. We already know from preliminary analyses of the data that this would expose some interesting variations, since the metropolitan (and largest) province of Barcelona exhibits a higher ratio of international-to-interregional trade than the other three provinces of Catalonia. In addition, moving from 17 regions to 52 provinces would permit us to dig deeper into the effects of determinants of trade such as common languages, and regional administrations. In addition, the use of a lower spatial scale could increase the possibility of analyzing in more detail the impact of historical, cultural and administrative factors determining the intensity and direction of the flows. Moreover, it could also offer new possibilities of analyzing the impact on intra and inter-regional trade of some recent fiscal measures taken at the state (increase in the fiscal capacity of the regions regarding the State-fuel-tax) and regional levels (launch of eco-taxes by some regions, new laws regulating the commercial timetables).

A longer-term objective is to extend the present analysis beyond goods to include services. Omitting a sector that accounts for 60% of GDP seems less than desirable. Of course, Catalonia is slightly less dependent on services than the rest of Spain, so the omission is somewhat less problematic than it would be, say, in the case of the Community of Madrid, which is Spain's services hub, but it *is* still problematic.

The reason that looking at services is a longer-term project, even though it would seem to be a high priority, is that data on interregional flows of services in Spain, like in most of the countries in the world, simply *do not exist* yet. Taking into account that the estimation of the interregional trade of services is one of the current lines of research in the C-intereg project (De la Mata y Llano, 2009; Llano y De la Mata, 2009), in the meantime, we expect to extract all the possible consequence from the available data on goods. Given the potential importance of interregional trade, surely a major effort is warranted — in many countries, not just in the United States, Canada, Belgium or Spain — at improving and extending the existing data! This seems essential to getting the broader attention and study that the phenomenon so clearly deserves.

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