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# Competitiveness and interregional as well as international trade: The case of Catalonia

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## ABSTRACT

Recent years have seen a surge of interest among industrial organization economists in using data on international trade flows as windows into competitiveness. For countries that are at least mid sized (e.g., Spain), interregional trade tends to be as large as or significantly larger than international trade. The case of Catalonia, a Spanish region, illustrates how ignoring interregional flows can lead to erroneous inferences about a region's external competitiveness. Accounting for Catalonia's interregional as well as international flows shifts what is generally assessed to be a chronic trade deficit in goods into a surplus and changes diagnoses of which Catalan sectors generate external surpluses and who its key trading partners are. We also use a gravity model approach to estimate international border effects for Catalonia.

Keywords:

Regional competitiveness

Border effect

Gravity model

Interregional trade

Industrial organization

## 1. Introduction

Recent years have seen a surge of interest among industrial organization economists in using data on various attributes of international trade flows—their existence, direction, size and sustainability—as windows into competitiveness<sup>1</sup>. The focus on national borders makes some sense given that they seem to lead to particularly large drop offs in trade flows and in that sense appear to embody significant barriers. On the other hand, there are other kinds of borders as well, and ignoring flows across them can lead to erroneous inferences about competitiveness.

The example used to make this broader point involves Catalonia, an autonomous region within Spain. For medium to large countries, interregional merchandise trade flows tend to be larger than or at least comparable to international flows and Spain and Catalonia in particular are no exceptions. Catalonia's interregional trade in goods is slightly larger than its international trade, and taking both into account shifts a chronic trade deficit into a surplus, helps identify its role as an import hub for Spain, and changes diagnoses of which Catalan sectors are “competitive” in the sense of generating external surpluses and who its key trading partners are. These sector and partner level patterns also appear to be quite logical. Fitting gravity models to the data yields additional insights. In particular, Catalonia's

international border effects defined in terms of the intensity of interregional trade relative to international trade after controlling for economic size and distance have decreased significantly since 1995 but have recently flattened 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.

Section 2 describes the interregional trade data used in this paper and how it shifts basic inferences about Catalonia's trade in goods. Sections 3 and 4 disaggregate the trade data by sector and by trading partner respectively. Section 5 discusses some of the border effects for Catalonia formally estimated from gravity based models of trade. Section 6 concludes with some broader reflections as well as suggestions for further work.

## 2. The basic data

Our core data on trade flows internal to Spain—intraregional and interregional—are drawn from the C interreg database (see [www.cinterreg.es](http://www.cinterreg.es), and Llano et al., 2008, 2010 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 database also combines data on transport flows with additional information related to the output by region and sectors in order to constrain the interregional transport flows to be consistent with Spanish national/regional income data.

These estimates of internal trade are supplemented with international data on bilateral trade between Spanish regions and OECD

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<sup>1</sup> See, for example, Das et al. (2007) and Melitz (2003).

**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 (1)	Export to		Imports from		Balance		Openness ratio (2+3+4+5)/(1+2+3)
		Spain (2)	World (3)	Spain (4)	World (5)	Spain (6) = (2–4)	World (7) = (3–5)	
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%
<i>1995–2006 (growth rate)</i>								
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: own elaboration based on C-interreg and Customs data ([www.aeat.es](http://www.aeat.es)).

countries. The figures are expressed in current EMUs. Overall, we work with trade flow data for 1995–2006 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).

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<sup>2</sup>.

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 also shifted however, as evinced by the slow but steady 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 as well as in international trade into account 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 and significantly lower exports) it suggests that the best single 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 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 Fig. 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 US and Japan (Jackson et al., 2006; Hewings et al., 1998), where as international integration proceeded, the fragmentation of the value chain (Feenstra, 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. In the case of Catalonia, the data discussed in the next section, in particular, tilt one more towards the inference of a “normal” continuation of a process of international integration that got a major boost with Spain's accession to the EU in 1986 rather than a reason to sound alarm bells.

The overall trade data can usefully be disaggregated by sector and by trading partner, a task that is performed in the next two sections.

### 3. Analysis by sector

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 Fig. 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 (mostly autos), 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 (e.g., food and beverages). The auto and food and beverage sectors were subject to further study as part of the broader research program in which this effort was embedded (Ghemawat, 2009).

The overall pattern of external advantage revealed by Fig. 2 was described by one senior Catalan policymaker (who looked at the figure) as “traditional” given the appearance of sectors such as food, textiles and printing and publishing in the lists of those revealed to be competitive. To the extent that traditional sectors are more disposed to interregional than international trade, focusing just on the latter is likely to lead to underweighting of the cross country evidence on product specialization in international trade changing gradually and relatively continuously (Hidalgo et al., 2007).

Furthermore, the pattern of surplus versus deficit appears quite logical if one looks at interregional as well as international trade. Researchers who have looked at the relationship between (labor) productivity growth rates in Catalan manufacturing and changes in international trade position have noted a “productivity puzzle”: an apparent lack of any relationship. Replacing international trade with interregional plus international trade seems to take care of this puzzle<sup>3</sup>. Fig. 3a and b relates the two types of trade measures to productivity growth. Note that the correlation between productivity growth and improved trade position triples when one takes interregional trade into account. The bottom line is that with productivity growth rates of less than 1.5% (close to the average for all of Catalan manufacturing),

<sup>2</sup> 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 (Section 2), but omitted in the econometric exercises (Section 5).

<sup>3</sup> The degrees of freedom do get reduced, relative to Jaumandreu's chart of world trade advantages and productivity growth, because interregional trade data were available for this project only at an aggregated level. In addition, we have excluded miscellaneous manufacturing from this analysis.

Growth rates of trade in current prices. Millions of Euros. All types of goods.

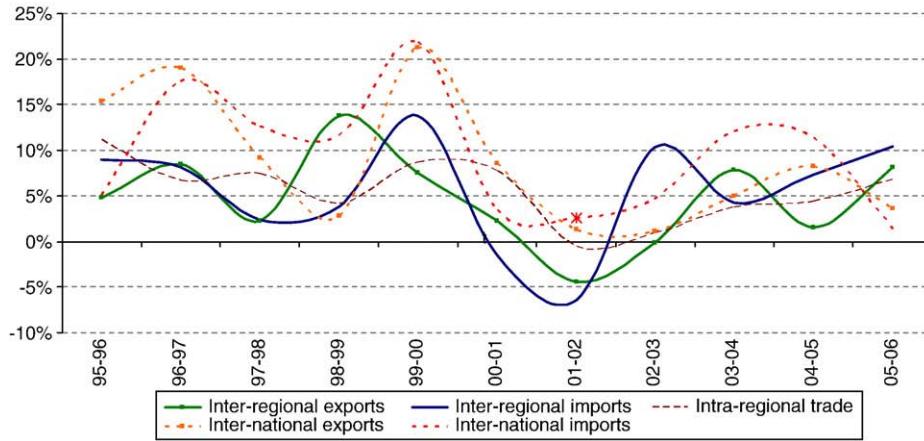


Fig. 1. The evolution of Catalan trade of goods by main markets (1995–2006). Growth rates of trade in current prices. Millions of Euros. All types of goods. Source: own elaboration based on C-intereg and Customs data ([www.aeat.es](http://www.aeat.es)).

sectors' revealed advantages tended not to increase, whereas with growth rates greater than 1.5%, they tended not to decrease.

#### 4. Analysis by trading partner

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 or within Catalonia. Relative to other Spanish regions, Catalonia leads

not only in terms of international trade volumes, but also 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 the biggest region within Spain economically). Thus, note from Fig. 4 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 actually held up since 1995.

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

Trade balance in current prices. Millions of Euros. Average 1995–2006. All types of goods.

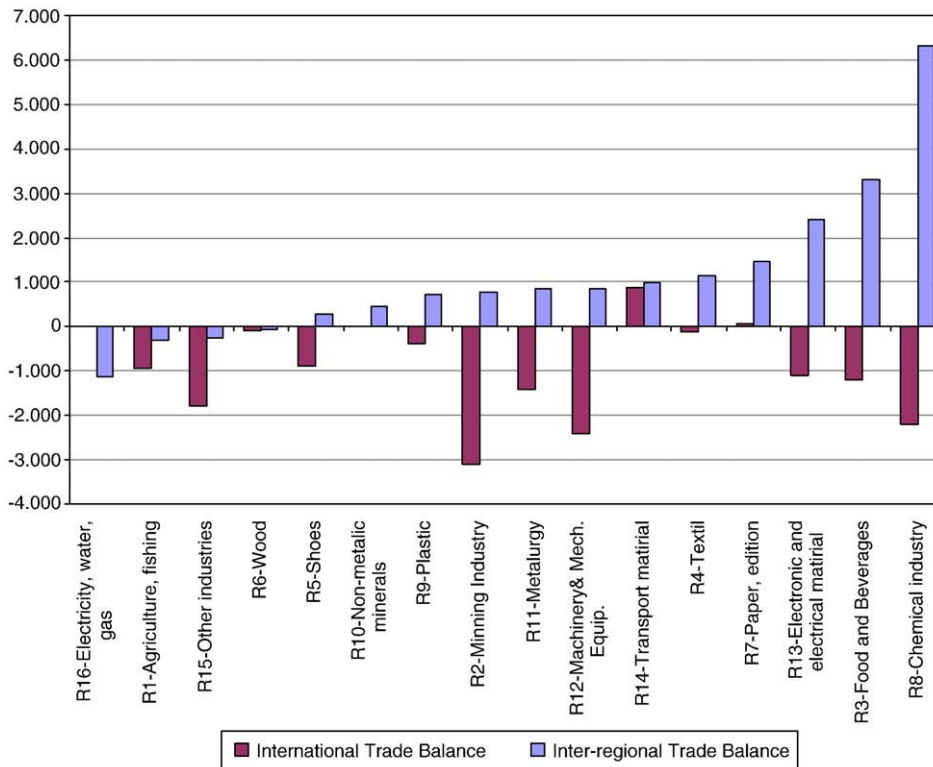
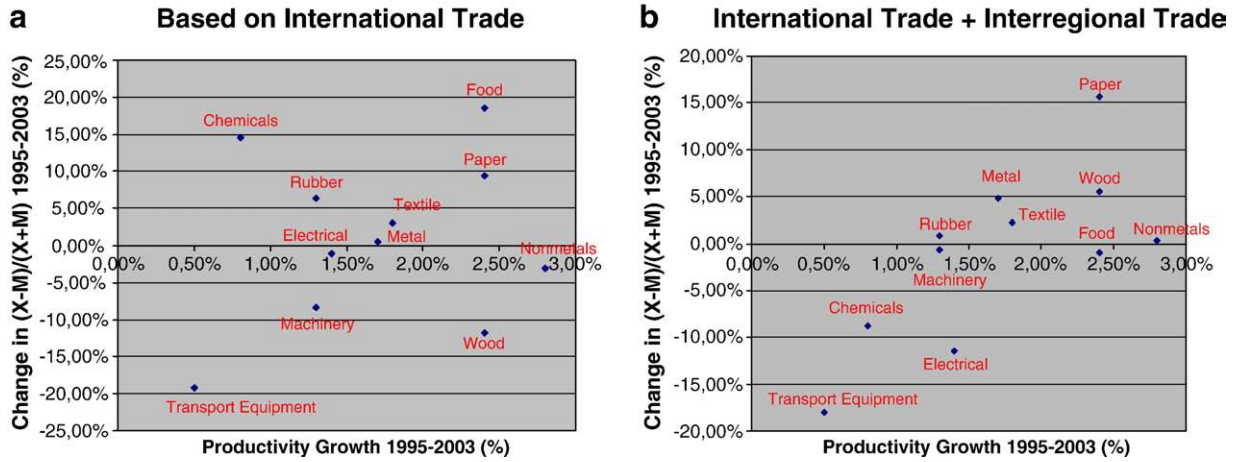


Fig. 2. International versus total external trade balance of goods in Catalonia. Trade balance in current prices. Millions of Euros. Average 1995–2006. All types of goods. Source: own elaboration based on C-intereg and Customs data ([www.aeat.es](http://www.aeat.es)).

Revealed Advantages versus Productivity Growth



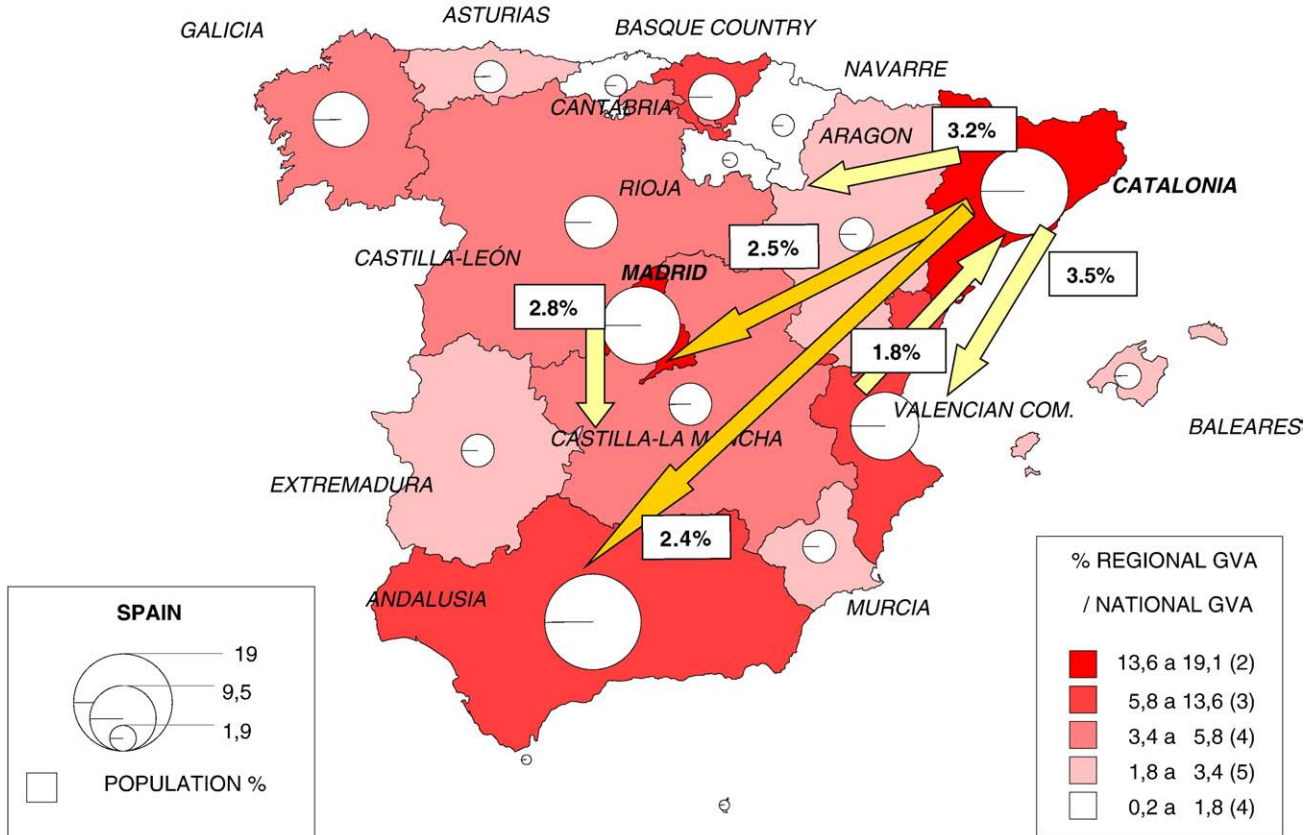
**Fig. 3.** Revealed advantages versus productivity growth. Source: productivity growth rates by Catalan sector drawn from Jaumandreu (2009) and trade data from Ghemawat et al. (2009).

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. 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 regional trading partner with which the volume of trade is larger.

To supply some additional interpretation, it is worth noting that Catalonia's largest trading partners domestic and international 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

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



**Fig. 4.** The strongest interregional flows in 2006. All goods, R1-R16. % over total interregional trade in millions of Euros. Source: own elaboration based on C-interreg.

**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	Aragón	6.201	France	9.149
Aragón	4.533	14.302	France	6.018	Aragón	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-interreg ([www.c-interreg.es](http://www.c-interreg.es)) and Customs data ([www.aeat.es](http://www.aeat.es)). White cells correspond to the Spanish regions (Nuts II); green to the UE countries and yellow to non-UE countries. Countries in bold are do scaling positions in the ranking of Catalonia's best clients.

trading partners, Valencia and Aragon. Culturally, Valencian and Catalan are similar and are both considered as co official languages (apart from the *castellán*) for their respective region. 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. 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. In addition, although the sectoral structure of these three regions is different, there are strong linkages between them in key areas such as energy, equipment and 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, to a significant extent, 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 gravity specification see the next section as well as standard estimates, should offset the difference in Aragonese and Valencian GDPs<sup>4</sup>. 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 doesn't require. In terms of cultural/administrative factors, one might add the sense that Catalan Aragonese relations have been

exempt from some tensions between Valencia and Catalonia in the economic and political grounds during the last years. In terms of economic factors, the fact that Aragon is among Spain's richer regions (the fifth out of 17 in 2006), with per capita GDP nearly 20% higher than Valencia's, should also be helpful.

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 to a limited extent on the other side of the French border. Administratively, Spain was once ruled by France's Bourbon dynasty, which King Juan Carlos is descended from, and the 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. Again, economic size is only part of the story: France is less than 80% the size of Germany, the Eurozone's largest economy and Catalonia's next largest international trading partner, but France trades 80% more with Catalonia.

So in other words, instead of simply bucketing other regions into the "Rest of Spain" and other countries into "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 Aragon than Andalusia. Furthermore, this closeness has a geographic component, but there is more to it than that: the space that regions or countries are thought of as being embedded has to be multidimensional in encompassing

<sup>4</sup> 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.

cultural, administrative, geographic and economic attributes, acronymized as the CAGE framework<sup>5</sup>.

## 5. Gravity-based estimates of border effects

To compare the intensity of interregional and international trade more systematically, we turn to the gravity model, which has been widely used to explain trade flows. In the most basic gravity specification, the trade between two countries (or 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 is estimated by adding a dummy that takes the value of one for trade flows within countries and zero otherwise. The augmented gravity model includes variables that control for different factors that may affect transaction costs, such as whether the trading partners share a common border, whether one of the partners is an island or whether they belong to the same regional trade or monetary agreement. This structure is fitted to region by region trade with the 22 other countries all OECD members for which Spanish Customs data are available. Our preferred specification is:

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

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 trading partner is a member of the EU15 or the EFTA 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;  $\alpha_{ij}$  is the country (region) pair individual effects;  $\lambda_t$  is the year fixed effect; and,  $u_{ijt}$  is the standard classical error term. We estimate the border effect by using the gravity Eq. (1) 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, Requena and Llano, in press), we estimate a random effects model (REM). Ghemawat et al. (2009) describe the sources and the construction of these variables as well as the use of alternative gravity based specifications as a robustness check.

Table 3, column (1) presents the main results. The model fits the data well, explaining 88% of the variation in bilateral trade flows. 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 5% level. In particular, the elasticity of trade to income is slightly below one for both the origin and destination partners and the elasticity of trade with respect to distance is close to  $-1$ . Catalonia trades 12% more with a contiguous country (France) than it does with otherwise similar countries, 49% more with EUEFTA countries and 22% more with members of the EMU zone after 2001. The variable ISLAND exhibits a positive coefficient, although it is small and statistically insignificant. The estimated value of the SPAIN coefficient in the gravity equation is 4.01. Thus, Catalonia trades 55 times more with the rest of Spain than with any other country of the sample that

**Table 3**  
The border effect in Catalonia.

	Catalonia		All regions	
	(1)	(2)	(3)	(4)
Spain trade	4.01 (5.72)		4.28 (12.89)	
Spain imports		3.71 (5.73)		4.48 (12.39)
Spain exports		4.29 (6.56)		4.33 (13.00)
ln(GO <sub>i</sub> )	0.93 (23.62)	0.94 (36.98)	1.01 (55.71)	0.87 (54.72)
ln(GDP <sub>j</sub> )	0.71 (21.56)	0.70 (29.17)	1.01 (55.39)	0.85 (52.48)
ln(Dist <sub>ij</sub> )	0.93 (7.10)	0.62 (12.55)	1.14 (15.40)	0.93 (10.84)
Island <sub>ij</sub>	0.08 (0.94)	0.08 (1.37)	0.23 (1.93)	0.47 (4.16)
Contiguity <sub>ij</sub>	0.11 (1.73)	0.44 (5.70)	0.28 (2.10)	0.87 (2.45)
EUEFTA <sub>ij</sub>	0.15 (2.01)	0.73 (8.14)	0.38 (2.78)	0.41 (8.40)
EMU <sub>ij</sub>	0.20 (3.36)	0.14 (1.94)	0.07 (1.76)	0.07 (1.75)
Wald-test [exports = imports]		34.83 [0.00]		1.17 [0.28]
Overall R <sup>2</sup>	0.88	0.89	0.74	0.74
Observations	550	550	9350	9350

Source: own elaboration based on C-intereg.

is neither contiguous nor a member of the EU, EFTA or EMU zone<sup>6</sup>. 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 neighbour country.

We also estimated the same gravity models for all 17 Spanish regions. The results are displayed in column (3) in Table 3. All the coefficients have the expected sign and are statistically significant at conventional levels. The coefficient of the SPAIN variable is 4.28 (column 3), which implies that a typical Spanish region trades 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, the EFTA or the EMU. Therefore, the border effect for Spanish regions in general is somewhat greater than the one reported above for Catalonia.

Finally Table 3 also presents the results of breaking down the border effect into its export and import components (columns 2 and 4)<sup>7</sup>. For Catalonia the export coefficient (SPAIN EXPORTS) is lower than the import coefficient (SPAIN IMPORTS), and the difference between the import and export border coefficients is statistically highly significant at conventional levels. However, for all the regions taken together, there is no significant difference. This again highlights Catalonia's role as a Spanish import platform.

We also analyzed the evolution of Catalan border effects over time. The estimated SPAIN coefficient for Catalonia shows a downward trend, from 80 in 1995 to 29 in 2005. The decline over time shows a similar path to the one calculated for all the regions, although it is more pronounced in the case of Catalonia ( $-24\%$  versus  $-20\%$ ). Fig. 5 illustrates the evolution of the size of Spanish bias with respect to three groups of countries: (1) France; (2) EU, EFTA or EMU countries and (3) any other country in the sample that is not a member of the EU, EFTA or EMU areas. It is evident that the decline has occurred mainly in the last group of countries, decreasing by more than three quarters, while in the case of France the border effect went down “just” a bit more than one half. This downward trend obviously illustrates the increasing international economic integration of Catalonia.

<sup>6</sup> Note that a value of zero is assigned to Contiguity, EU, EFTA and EMU for bilateral trade between Catalonia and the “rest of Spain.”

<sup>7</sup> 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.

<sup>5</sup> 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.

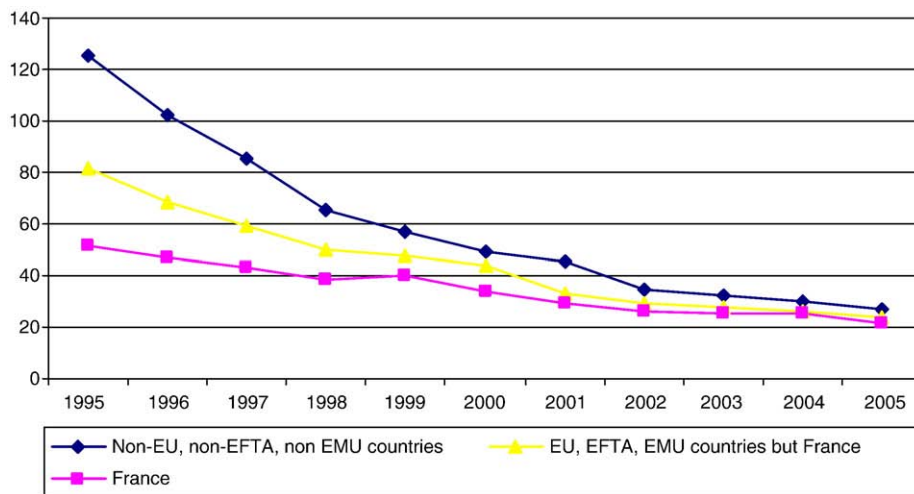


Fig. 5. Evolution of Catalonia's international border effects.  
Source: own elaboration based on C-intereg.

Very recently, however, the border effects appear to be asymptotizing. 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.

## 6. Conclusions

Looking at interregional and international trade has helped identify Catalonia's role as an import hub for all of Spain, changed readings of which Catalan sectors generate external surpluses, clarified the link between productivity growth and improving external balances and expanded the list of key external trading relationships to be managed. None of this would have been feasible if one had looked, as is common in such contexts, at international trade alone.

The broadest implication of the exercise is that it is important to be explicit and ideally, mutually exclusive and completely exhaustive in imposing structure on spatial interactions. Thus, the many studies of (subnational) regional competitiveness that imitate studies of international competitiveness in focusing on international trade patterns as indicators of revealed advantage violate this principle by ignoring (large) interregional flows intermediate to within region flows and international flows, even though such interregional flows are the novel element exposed by drilling down from the national to the regional levels. The case of Catalonia within Spain supplies an illustration of the oversights that may be associated with such an omission. It generally makes sense to think of (mid to large) countries as not only existing in space but as themselves occupying space within which regions or other subunits are embedded.

In specific regard to industrial organization, perhaps the most direct implication is that the very interesting body of work about flows or firms that cross national borders should be supplemented with consideration of other kinds of border crossings as well. Thus, interviews with Catalan firms as part of the broader project of which this paper formed one part suggest that many did in fact regard rolling out across Spain (often relatively recently) as an important stepping stone to international expansion. A broader way of formulating this point would be to suggest that industrial organization researchers try to pay some attention to the sequencing of a firm's geographic expansion trajectory, typically involving the incurral of progressively more distance along at least one of the CAGE dimensions (as suggested by research on international

business<sup>8</sup>), rather than simply relying on whether the firm ever crosses one or two border checkpoints.

It should also be reemphasized that the focus in the body of this paper on the regional level should *not* be read as a general recommendation to focus on subnational regions as the unit of analysis. There are obviously a number of possible levels of analysis ranging upward from subnational regions to nations, clusters of nations, continental regions and the world, and downward to provinces, districts, cities et cetera. Ideally, one would like to estimate the effects of each of these kinds of borders in a consistent way that allows them to be superimposed on each other. That is, in fact, part of the next phase of the present/current project, in which we plan to disaggregate our analysis from 17 Spanish regions to 50 provinces.

This multilevel perspective on the world has a very specific implication for measurement: it suggests modeling spatial flows as (piecewise continuous) functions of the distance between two locations as well as other unilateral/bilateral variables whose distribution varies spatially<sup>9</sup>. This is very different from the approach of looking for "natural breakpoints" as in units of analysis within which space can be ignored but beyond which it is heavy going that has hardened into dogma in certain circles. Cf. The Oxford Handbook on Economic Geography:

"There is a prior tradition that reduced the definition of location to a simple distance metric ... The new empirical work in economic geography builds on the idea of knowledge spillovers using distance and geographic space differently. The concept of location that empirical studies attempt to measure is the geographic unit over which interaction and communication is facilitated ... There is no general consensus for the correct unit of analysis in empirical studies and variation in findings may be due to differences in the unit of analysis." (Feldman, 2000)

Note that this approach of looking for natural breakpoints is also the one adopted in many attempts in industrial organization to draw market boundaries!

Finally, the other aspect related to measurement that should be highlighted has to do with the dearth of data for tracking flows across

<sup>8</sup> For an earlier example, see Johanson and Vahlne (1977).

<sup>9</sup> This is consistent with the broader evidence indicating that we live in a semiintegrated world in which there are still important differences at boundaries—internal as well as international. See Ghemawat (2003) for a comprehensive review of data indicating semiglobalization at the international level 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.



region (or other non national) borders as opposed to national ones. When quasi official data of the sort reported here for Spain are available, they typically suffer from the problem of being confined to goods. Omitting, the service sector, which accounts for the bulk of GDP in most advanced countries, seems less than desirable. Getting some handle on interregional as well as international services flows for Spanish regions is therefore another planned focus over the longer run.

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