"THE ESTIMATION OF THE INTERREGIONAL TRADE IN THE CONTEXT OF AN INTERREGIONAL INPUT-OUTPUT MODEL FOR THE SPANISH ECONOMY"

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In this paper we introduce the first version of INTERTIO, a Multiregional-Multisectoral model for the Spanish Economy. The model combines the spatial and sectoral dimensions assuming the theoretical and empirical possibilities and limitations of the interregional input-output model. The research tries to use most of the regional information available at that time, using non-survey techniques for the estimation of incomplete data. The model is based on the following two pillars:

- A complete set of 17th regional input-output tables built (or updated) for 1995 (one for each of the 17th Spanish regions-NUT2). All of them coherent with the National input-output Table.
- A set of interregional trade matrices, estimated indirectly for each kind of product and developed from the interregional transport flows, and valued using export prices.

Apart from a brief description of the main underpinnings of INTERTIO, we will focus on the strategy used for the estimation of this set of interregional trade matrices, using transport flows and value/weight relations indirectly deduced from detailed international trade statistics. As a consequence, we obtain a full estimation of a total Balance of Goods for the 17 Spanish regions with considerable sectoral detail.

1. INTRODUCTION

Although there are several evidences on an increase in the intensity of international economic relations within Europe, it is commonly accepted that regional economies are more closely integrated with each other than their national counterparts. Apart from peculiar small and truly open economies (such us Belgium, Luxemburg or The Netherlands; see Oosterhaven et al., 1995; Dietzenbacher et al. 1997; Llano C. 1998), most of inter-sectoral and final trade relations takes place among national agents. As a consequence, although regional dependence on international trade is increasing in most of the Spanish regions, a large part of regional growth should be explained by national causes.

Some recent work has illustrated the existence of deep inter-country relations between clusters of sectors (Dietzenbacher 1997), where the international dependence could be even stronger than their corresponding inter-sectoral relations within the national economy (Kollmann, 1995; Costello, 1993). As a consequence, sectoral specialisation of regions could induce deeper backward or forward relations with foreign economies than with their *natural partners*, imposing stronger synchronicity of the regional economy with the foreign cycle than with the national one.

With the progressive fulfilment of the EMU stages and the introduction of the EURO as a single currency, the international transactions between European countries will take place in almost the same way as they do between different regions within one country. As a consequence, it is expected that some of the Spanish regions will open their economies even more, re-orienting their sales and purchases to foreign markets, breaking the frontiers of spatial proximity and contiguity. The effects of such openness and trade diversion will depend mostly on sectoral specialisation.

With this new and more integrated market structure, the capability of detecting and valuing the spatial and sectoral effects of regional, national and supra-national shocks seems to be an important part of any strategic information system. Additionally, the evidence of “spatial clubs” and “sectoral clusters” interacting in most of current debates on integration, growth and convergence have also influenced the interest in the spatial and sectoral dimensions of these questions in Europe. As a consequence, we find new efforts by economic model designers to develop new and more realistic tools for economic analysis, one that would be able to simulate inter-sectoral relations, within

inter-regional (Benvenuti et al., 1996; Hewings et al, 1993) and inter-national (Oosterhaven et al, 1995) systems.

Apart from the European integration process, Spain is facing a parallel evolution towards a more decentralised kind of government, where regions absorb increasing quotas of power. As a consequence, the role of central planners is moving towards an intermediate position between supranational policies and local expenses, with an increasing need to anticipate and justify sectoral and spatial effects of any policy using powerful analytical tools.

In this paper we introduce the first version of a multiregional-multisectoral model that combines the spatial and sectoral dimensions assuming the theoretical and empirical possibilities and limitations of the interregional input-output model (Isard, 1951), using most of the regional information available at that time.

The paper begins with a brief description of the input-output model and its main spatial extensions. Then, we introduce the main underpinnings of our model, starting with a brief description of the principal steps followed in the process of its construction. Most of our attention will focus on the estimation of the interregional trade matrices, that have been deduced indirectly using interregional transport flows, and valued through export prices. As a consequence, we obtain a full estimation of a total and bilateral balance of goods for the 17 Spanish regions with a considerable sectoral detail.

2. SOME SPATIAL EXTENSIONS OF THE INPUT OUTPUT MODEL.

The interregional input-output model was originally developed by Isard, who in 1951 suggested a new version of the Leontief model where the USA inter-sectoral relations were split in three big areas : EAST, SOUTH and WEST (Isard, 1951). After this first theoretical work, where the main underpinnings of the model were established, some multi-regional input-output projects have navigated towards this “ideal” where the spatial and sectoral origin and destination of the inter-industry flows where perfectly and directly known. Probably, the best known derivation from this ideal is the so called multiregional or Chenery-Moses model, where instead of splitting the sectoral and spatial origin and destination of each flow, it propose a combination of single-region tables and commodity trade matrices (Miller&Blair, 1989).

2.1. The estimation of interregional trade: methods and examples

One of the critical elements that determine the kind of model to be estimated is the availability of information related to the interregional flows. Usually, neither national statistical systems nor regional ones could satisfy the sectoral and spatial detail for inter-sectoral and final flows that is required for the pure interregional input-output model. As a consequence of this important gap, a large number of researchers have look for less-expensive approaches, watering down some theoretical assumptions (Chenery-Moses approach, Leontief Pool-approach...), or developing non-survey techniques for the estimation of regional and interregional technical and trade coefficients (see Batten 1983; Oosterhaven, 1984, for a deep description). Next we offer a brief classification of the some approaches used in the specification of those interregional flows:

Table Error! Unknown switch argument.**: Possible approaches for the estimation of interregional flows within the context of Multirregional input-output models**

	TECHNIQUE USED FOR THE ESTIMATION	**SOME MODELS**
A POSTERIORI → A PRIORI	**INDIRECT ESTIMATION**	
	Use of Gravitational model	TIM, (Funck et al. 1975)
	Use of Entropy Maximising Paradigm	Batten (1983)
	Pool-Approach of Leontief	Leontief (1977) INTERREG (Martellato et al, 1996)
	DIRECT ESTIMATION BASE ON REAL DATA	
	Use of International trade flows	EU-IRIO (Oosterhaven et al., 1995)
	Use of Transport flows	MRIO-HERP (Polenske 1980); Hewings, 1993; Kazumi H., 2000. INTERTIO, (Llano, 2000)
	Use of surveys designed ad-hoc for producers and consumers.	JAPAN IRIO TABLES (1960-70)
Note: Classification proposed by the author based on previous work (Batten 1983)		

In our case, the combination of direct regional input-output tables with non survey ones and the use of indirect estimation for the interregional flows takes our model into a mixed position between *pure-survey vs pure-non-survey* approaches, "as an hybrid between the so-called *"multi-regional-columns-only input-output table"* and its *"inter-regional-columns-only"* equivalent (Oosterhaven, 1984).

3. A BRIEF DESCRIPTION OF THE MODEL

Our purpose of reproducing a *complete* multi-regional input-output model force us to use a complete set of 17 input-output tables, one for each of the Spanish regions. Although some of the them have a large tradition in the generation of survey and non-survey regional input-output tables, others have no antecedents at all. As a consequence, the process of construction of a complete interregional framework has had to combine all the regional information available with the use of non-survey techniques for the estimation of the non existing statistics. In essence, the model is based on the following two pillars:

- A complete set of 17 regional IO tables built (or updated) for 1995 (one for each of the 17 Spanish regions-NUT2). All of them coherent with the 1995 national input-output table (INE) and the Regional Spanish Accounts.
- A set of Interregional trade matrices, estimated indirectly for each kind of product and developed from the interregional transport flows, and valued through export prices.

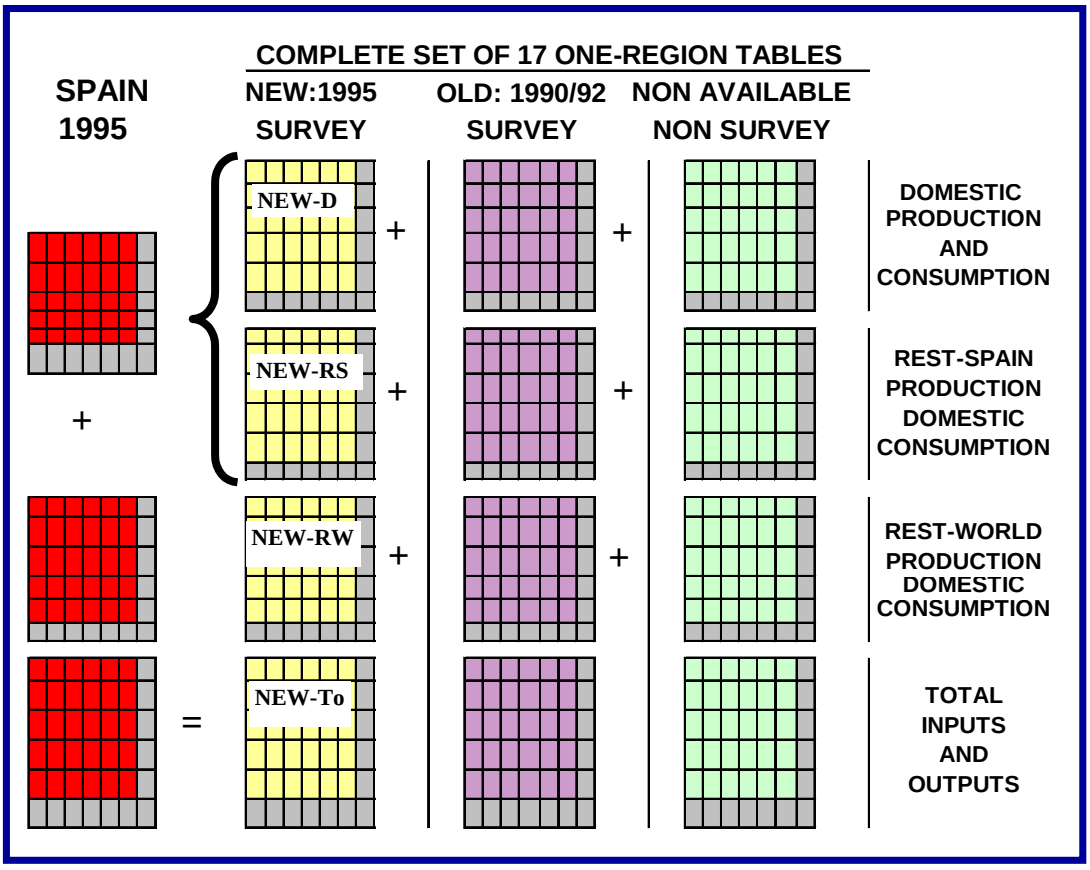
Since the process of construction of the model has been already described in previous work (Perez J., 2000) we will summarise it by means of a short set of schemes and graphs that will make easier going trough the more detailed description of the methodology used for the estimation of the interregional trade.

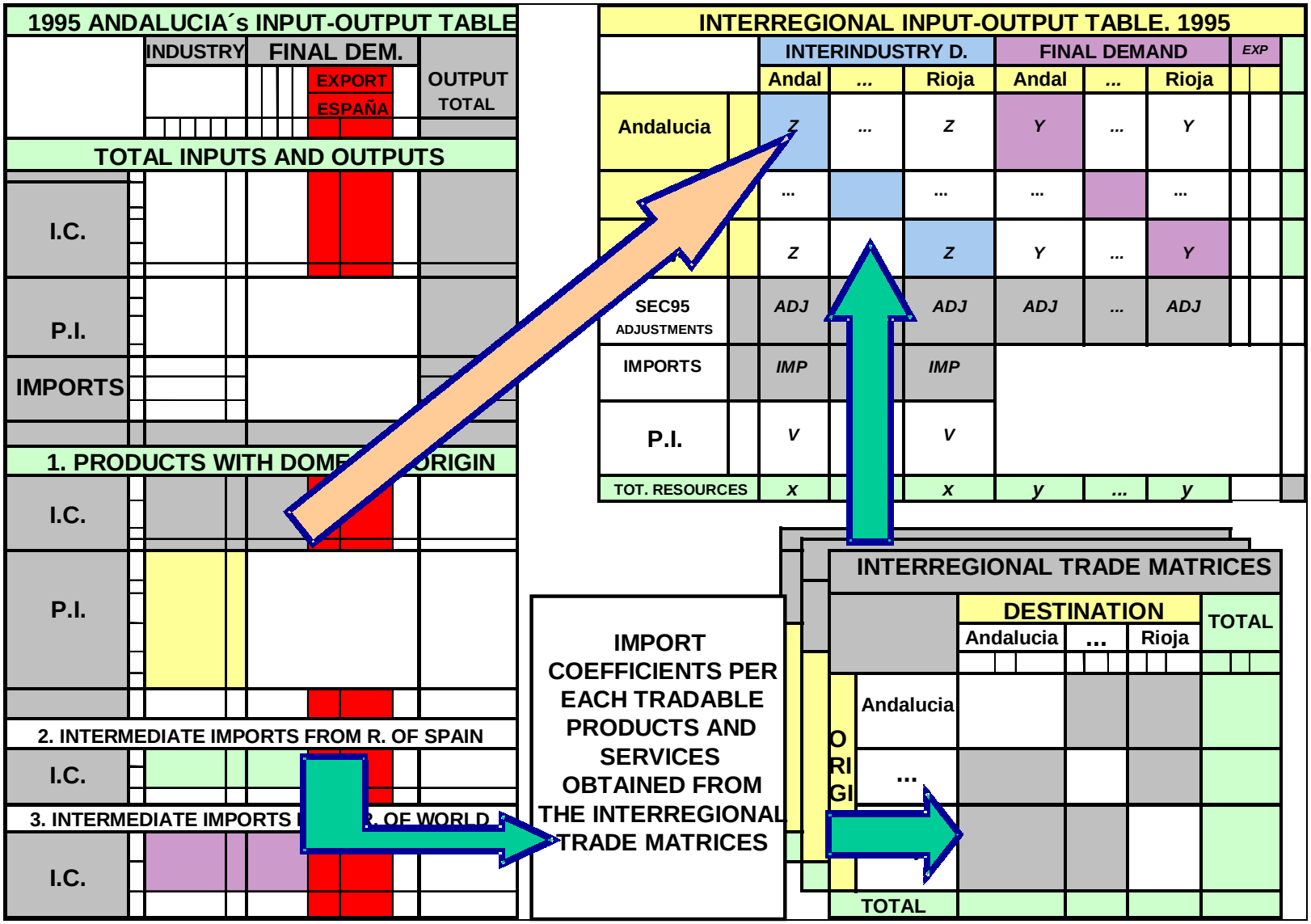
Table Error! Unknown switch argument.**: Principal steps on the process of construction of INTERTIO**

STEP	ACTIVITY
1.	Estimation of the complete data set that is going to be used as constraints for sectoral and regional figures
2.	Homogenisation of the "official" regional input-output Tables available for 1995
3.	Actualisation and homogenisation of the "official" regional input-output tables available for other years: 1987, 1990, 1992, 1996.
4.	Estimation of the non-available tables (total figures) by RAS technique using the structure of similar-regions with input-output tables and the control figures estimated in the first step.
5.	Estimation of the corresponding Domestic, Rest of Spain and Rest of the World matrices, using different approaches depending on the existence of official, up-dated or pure-non-survey Table for each region.
6.	Estimation of the 26th interregional flows matrices for different products and

	services. Developed in parallel to the rest of the model, and detailed reviewed in the following sections.
7.	Re-estimation of the interregional flows matrices adjusting rows and columns sums to the control totals that remain in the "National Net Consumption" row and column estimated in the first step.
8.	Assignation of the specific geographic origin/destination to the Region-Rest of Spain flows (both, inter-industry and final ones) contained in the harmonised set of Regional input-output Tables:

Figure Error! Unknown switch argument.**:Process of construction of the model: the estimation of a complete set of 17 one-region input-output tables armonized with the 1995 national one.**




1995 ANDALUCIA´s INPUT-OUTPUT TABLE
INDUSTRY
FINAL DEM.
EXPORT
ESPAÑA
OUTPUT TOTAL
TOTAL INPUTS AND OUTPUTS
I.C.
P.I.
IMPORTS
1. PRODUCTS WITH DOME ORIGIN
I.C.
P.I.
2. INTERMEDIATE IMPORTS FROM R. OF SPAIN
I.C.
3. INTERMEDIATE IMPORTS R. OF WORLD
I.C.
INTERREGIONAL INPUT-OUTPUT TABLE. 1995
INTERINDUSTRY D.
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Y
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Y
SEC95 ADJUSTMENTS
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ADJ
ADJ
...
ADJ
IMPORTS
IMP
IMP
P.I.
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y
IMPORT COEFFICIENTS PER EACH TRADABLE PRODUCTS AND SERVICES OBTAINED FROM THE INTERREGIONAL TRADE MATRICES
INTERREGIONAL TRADE MATRICES
DESTINATION
Andalucia
...
Rioja
TOTAL
ORIGI
Andalucia
...
TOTAL

4. THE ESTIMATION OF INTERREGIONAL TRADE.

4.1. Possible approaches based on the information available.

In Table **Error! Unknown switch argument.** we sum up the principal accounts that offer some information related to interregional flows and the corresponding statistical sources in which they are usually based on. Apart from the partial information (Region-Rest of Spain) published on our incomplete set of survey regional input-output tables, there are some other accounts systems and statistical sources that could contribute to the estimation of the required data.

Table Error! Unknown switch argument.**: Statistics containing data related to the Spanish Interegional trade**

<table>
<tr><th></th><th>ACCOUNTING SISTEM</th><th>STATISTICAL SOURCES</th></tr>
<tr><td rowspan="2">TOP-DOWN APPROACH</td><td>Macro-economic balance
(Alcaide-BBV)</td><td rowspan="2">Interregional trade is deduced as “a rest” by comparing different variables from both sides of the Economy, Inputs and Outputs</td></tr>
<tr><td>Input-output Tables
Regional Accounts.
(Most of the Spanish regional input-output tables)</td></tr>
<tr><td>DOWN-TOP APPROACHE</td><td>Regional Balance of Payments
(Parellada, 1982;
Oliver, 1997).</td><td>The use of interregional transport flows data, with detailed information about the geographic origin and destination of the flows:
• The use of regional and national transport statistics in terms of volume.
• Estimation of domestic prices using extra information to value transport flows.</td></tr>
<tr><td></td><td>NOT AVAILABLE BECAUSE OF STATISTICAL SECRET
(Santiso, 2000)</td><td>The use of fiscal information contained in some administrative documents of the Spanish Taxation over Economic Activity:
• Declarations of economic transactions done with other economic agents specifying its regional code.</td></tr>
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</table>

With the exception of using ad-hoc surveys or a-priori estimations based on different techniques (see Table 1), the only way to estimate the specific origin and

destination of interregional flows from real information lies on the use of transport and, probably, fiscal data. We say "probably" because, as a consequence of the "*statistical secret"*, there is no previous experience in the use of such information for the quantification of the Spanish domestic trade. Obviously, it is an interesting line to be explore in the future. Next we resume the main steps followed in the process of estimation of the interregional trade of products and services.

4.2. The estimation of the interregional trade of goods.

According to Table **Error! Unknown switch argument.** most of the Spanish experiences on the use of transport data for the estimation of interregional trade correspond to few studies related to the calculation of some regional balance of payments (Parellada 1980, 1982; Oliver 1996). We find also abroad some precedents in the use of transport data to approximate the interregional trade flows within the context of some multiregional input-output models (Polenske, 1980; Hewings, 1993; Kazumi, 2000). Following some of these approaches we will combine the use of transport flows with some complementary data referred to regional-sectoral production in order to constrain the interregional transport flows.

The use of transport flows as a proxy of the real interregional trade provide significant contributions to our goals:

- Most of the Spanish transport statistics are disaggregated by products.
- Most of them allow also take into account the geographic origin and destination of its flows that, in general, could be identified with the producing and consuming spots of the economic transactions. Some of them offer even higher spatial disaggregation than what is strictly required for our analysis (NUTS-2). This fact will allow further developments and different exercises of data verification (see point 4.2.3-III)

4.2.1. Statistical information available on interregional transport flows.

Table Error! Unknown switch argument.**: Transport statistics used in the estimation of Spanish interregional trade**

MODE	DESCRIPTION AND MAIN FEATURES
ROAD	***Permanent Survey of Goods Transported by Road.*** **Source:** Spanish Ministry of Public Works **Data:** Annual/quarterly-Municipal/Provincial/Regional. **Product Disaggregation:** 160 products (class.NST/R-3 digits) **Available since:** 1993... **Observations:** • Permanent survey on a large sample of heavy trucks operating by themselves or in service: they are request about their travels, specifying origin, destination, type of product, volume, km... • It could include international or insular goods in transit that are moved from ports or airports to final locations. • It is important to notice that the figures obtained surveying lorries may not be consistent with figures on production or purchases obtained surveying firms and households.
RAILWAY	*RENFE statistics on Complete Wagon and Containers flows.* **Source:** information from the *Statistics Department of RENFE* **Data:** Annual **Product Disaggregation:** aprox. 40 categories (own classification) **Observations:** • Registration of every domestic flow: High quality, low product detail. • Problems: no information on the product disaggregation of the movements into containers (30% of rail flows). Each flow in container was split in product categories according to the product specialisation of rail flows in *complete wagon* with origin in each region.
SHIP	*Indirect estimation of interregional flow matrices using a RAS-based approach (Polenske et al., 1987) and two different sources of information:* a) *Tons loaded/Unloaded by Principal Spanish Ports, kind of flow, and type of product.* **Source: Statistical Yearbook.** Puertos del Estado. • **Data:** Annual-by 26 Spanish principal ports. • **Product Disaggregation:**. 40 products (own classification) b) *Set of Spanish Domestic flow matrices with Ports of Origin and Destination.1989.* **Source: *Domestic maritime flows by Origin and Destination.1989*.** Puertos del Estado: • **Data:** Annual- by 38 Spanish principal ports. • **Product Disaggregation:** 52 products (CSTE) **Observations:** • Due to the absence of an up-dated set of Inter-port matrices of maritime domestic flows, we have estimated a collection of 40 matrices O/D, one for each kind of product, using RAS on the most modern O/D information available (1989) and the product-port detailed totals for loaded/unloaded tons (1995)

AIRCRAFT	*O/D Matrices of Domestic flows of goods by airport of Origin and Destination 1995. AENA.* **Source:** AENA**&**Spanish Ministry of Public Works. **Data:** Annual-Principal Airports. **Product Disaggregation:** None **Observations:** • Product disagreggation of the unique matrix available of total domestic flows is deduced using the product specialisation of international flights (available) per airport of origin in 1995.
PIPE	*O/D matrix of oil flows using pipe 1995* **Font:** CLH (main oil distributor in the Spanish market). 1993. **Data:** Not available for 1995 **Product Disaggregation:** None **Observations:** • Non available data on O/D flows after sector liberalisation. • Indirect estimation using O/D matrix obtained by Department of Public Works&TEMA-Consulting Group from CLH. Data from 1993 are re-scaled to 1995 figures. • Due to the special characteristics of oil distribution where *pipe* is often used as an approach to consumer locations, the *pipe* information should be used just for the re-allocation of road (capillary distribution) flows of energetic products *apparently* loaded in regions without refinery, that have been fed by other regions (with refinery) using pipe.

4.2.2. Limits of transport information

Spanish transport statistics are usually designed not with economic purposes but with the goal of covering different needs of engineers and transport planners. As a consequence, they do not satisfy all the information desired for our analysis:

a) As transport flows are expressed in physical units (Tn, Km.*Tn...) rather than in monetary ones, they should be valued using some kind of "value/volume" relations.

b) Information for each mode of transport (truck, rail,...) is collected by different institutions, with different strategies, specific product classifications, and incompatible methodologies. This fact introduce additional difficulties to the conciliation and harmonisation of different sources, both between them and as regards to the economic information (input-output Tables, National and Regional Accounts, International trade data...).

c) Additionally, the lack of co-ordination in collecting data for each mode of transport introduces serious problems in the capability to follow multi-modal flows. Due to the current proliferation of multi-modal combinations in logistics, the inattentive use of transport statistics could introduce the wrong assignment of the origin/destination and accumulate problems of double-counting.

d) Other limitations come from the complex strategies currently displayed on product distribution. For instance, the existence of "central purchase centres" and "transport platforms" could over-estimate imports and exports of some big markets, inducing infra-estimation of peripheral ones: after the reception and consolidation of different transport flows (with different origins), a large part of the stock will be re-exported to the final spot of consumption.

e) Another important limitation on transport information comes from the special characteristics of the available statistics for road, that almost represents the 90% of total transport flows in Spain: although the survey is reliable in general terms, interpretation needs to be made with care when it is used at lower levels of aggregation in space and products. In fact, we have checked the existence of important conflicts between some flows of product x with origin in one region and the economic information on the available resources (production+imports) of such products in the region. This fact forced us to introduce a new data screening system that is briefly described in point 4.2.3.-VIII

4.2.3. Methodology used for the estimation of interregional trade flows of goods

I. Harmonisation of physical transport flows obtained from different sources.

II. Estimation of non-available data: Bringing up to date the available maritime domestic flows; disaggregating the total domestic air and rail flows moved using containers according to the most probable product categories.

III. First screening procedure for transport flows in tons:

- *Identification of international trade in transition along the Spanish peninsula using road statistics: the* EPTMC survey allows the identification of detailed road flows (split by 160 types of products) between the 17 regions and the municipalities where the main maritime ports are located. Then we confront such flows with the detailed information on international goods (40 categories measured in tons) loaded/unloaded into/from ships in those ports, with production data of the region and also with different information on known inertial practices on the logistic management of some international exports and imports (Ministerio de Fomento, 1995, 1996). Following this exhaustive approach, we detect some unbelievable interregional flows that are then eliminated.
- Re-allocation of multi-modal flows: with a similar approach we identify and re-allocate possible interregional flows that use ships and trucks complementarily.

V. Estimation of value/weight relations from International trade statistics.

Due to the total absence of a perfect statistical source that contains domestic prices for every kind of product, we have to deduce them from alternative information. Following previous works on the estimation of regional balance of payments (Oliver, 1997), we use value/weight relations deduced from very detailed statistics on International Trade (exports) split by value and weight, region of origin, and about 1300 types of products (NC-4 digits). In contrast to other previous works we have estimated 18 different vectors of export prices (one for each possible region of origin) instead of only two (one for imports one for exports) with the purpose of capturing price differences derived from the sectoral specialisation of each region. As the inter-regional comparison of deduced prices shows high volatility, we decide to introduce previous debug in the *rough* regional export data:

- First we estimate a unique *debugged-price-vector* containing the *statistical median* for the 18 different original prices and each of the 1300 items available. In that way we eliminate extreme values.
- Then we deduce a set of 18 *definitive-price-vectors* (one for each mode of transport an its classification) as weighted means of the *"debugged-price-vector" (the weigh comes from the amount of tons exported for each product and region):*

$$PRICE_I^{\text{Re}\,gion} = \left(\frac{Exports\_Tns_i^R}{\sum_{i=1}^{i=n} Exports\_Tns_i^R} * \text{Pr}\,ice_i^{Debbuged} \right) + ... + \left(\frac{Exports\_Tns_n^R}{\sum_{i=1}^{i=n} Exports\_Tns_i^R} * \text{Pr}\,ice_n^{Debbuged} \right)$$

The PRICE for the flow of the products contained in the "I" category of a particular transport mode (i.e.: within the Road NST/R class.) with origin in region "R". *I= ranges from i=1 to n (NC class)* *R= range from 1 to 18 regions*	=	• Weighted mean of the *"single-debugged prices" for each "i" category included en "I", weighted by the ratio between Tons exported of "i" product over the whole amount of Tons of category "I" exported by the same region "R" of origin*

VI. Translation of O/D debugged matrices measured in Tons into Monetary Units using the whole set of vector prices deduced in the previous step.

VII. Aggregation of the different sets of O/D-product-matrices valued in current ESP. into the common INTERTIO´s classification, where 16 out of the 26 activities produce primary or manufactures goods of any kind.

VIII. Final screen of the 16 O/D matrices of Goods expressed in ESP.:

Although we have observed significant correspondence between our total exports and imports and those published in regional input-output tables for some regions, we have also detected some remarkable divergences:

- In general, interregional trade deduced exclusively from transport flows (without any constraint from regional/sectoral production) appear overvalued.
- Coincidence between different sources increase, both from export and import sides, when we introduce additional restrictions for each regional/sectoral export based on the capability of the region to produce (and export) each kind of product.

At this stage we have applied two different options:

1. According to the needs of INTERTIO our matrices are submitted to marginal totals deduced *"as a difference"* from known information deduced in the *first stage* of the process of construction (see stage 1 and 7 in Table 2).
2. With the purpose of analysing interregional trade databank outside the restrictions imposed by INTERTIO we adopt an additional option:
   - The 15 O/D trade matrices corresponding to industrial activities are harmonised by "sums along rows" (exports only) with the detailed information on the *"Sales to the Rest of Spain"* that is generated from the **Industrial Survey (INE)** for all of our regions and industrial activities. As a consequence, any activity of any region will not be able to export to other regions more than what this survey establishes as *"Production sold to the Rest of Spain"* for this region/activity. The lack of information on the imports side encourages us to leave the "sums along columns" without restriction.
   - Since there is not a equivalent information for primary products, the constraint for the flows of the first activity (Agriculture, Fishing and Forestry) is based on the information available on regional production and exports for a range number of products, so that any region could move (intra+inter) more tons of than its production not exported to foreign countries.

4.3. Interregional trade of services.

The estimation of the interregional trade on the "building" and "services" sectors is considerably more complicated. The complete absence of direct statistics on this kind of flows and the difficulty to use proxy variables as in the case of goods forced as to adopt *an a-priori indirect approach* using a some kind of a **gravity model:**

$$D^{i}_{rs} = X_{rs} * \frac{(VA^{i} pb_{r} / POP_{r})}{(VA^{i} pb_{s} / POP_{s})} \qquad 1$$

$$F^{i}_{rs} = D^{i}_{rs} / \sum_{r}\sum_{s} D^{i}_{rs} \qquad 2$$

The bilateral flow (standardised) of service *i* ($F^{i}rs$) is related to the intensity of interregional trade flows of goods between each pair of regions (X_{rs}), and the relation between the size of both spots in terms of Population and VA on this service ***i***. As it has been tasted, since (X_{rs}) behave following the gravity model (Llano, 2000) there is not need for an explicitly consideration of "distance" (somehow, implicitly included in X_{rs}). In other words, (X_{rs}) could be interpreted as a measure of the economic proximity of any pair of regions.

5. DATA ANALYSIS

In the following section we analyse some of the most remarkable phenomena observed in a first exploration of the interregional trade matrices. We start by identifying the main ratios deduced from the total interregional trade matrix analysed outside the model so that the corresponding margins are harmonised with the available figures on interregional sales by each sector and region of origin (see point 2-VIII on section 4) and not with the margins deduced form the input-output system.

Table Error! Unknown switch argument.**: Intra, intereg and international Spanish trade flows of goods.**

MAIN RATIOS FROM THE INTERREGIONAL TRADE MATRICES. GOODS (ITEMS 1-16 FROM INTERTIO CLASSIFICATION.). BILLIONS OF ESP.								
1995	**INTRA REGION***	**EXPORTS**		**IMPORTS**		**BALANCE**		**OPENESS 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)
ANDALUCIA	1.895	2.320	985	2.527	1.025	-208	-41	**132%**
ARAGON	612	1.270	699	1.796	563	-526	**136**	**168%**
ASTURIAS	675	689	166	743	170	-53	-4	**116%**
BALEARES	248	*96*	*110*	499	134	-403	-24	**185%**
CANARIAS	493	318	109	541	383	-224	-274	**147%**
CANTABRIA	227	448	133	622	169	-174	-36	**170%**
C-LEON	1.380	1.938	685	2.298	708	-360	-24	**141%**
C-MANCHA	768	1.622	149	1.513	245	**109**	-96	**139%**
CATALUÑA	4.965	5.363	2.925	*3.035*	*4.263*	**2.328**	-1.338	**118%**
C.VALENCIA	2.207	2.674	1.626	3.045	1.164	-371	**463**	**131%**
EXTREMADURA	236	384	61	528	33	-144	**27**	**148%**
GALICIA	1.289	1.546	563	1.034	646	**511**	-82	**111%**
MADRID	1.691	2.644	1.141	3.112	2.966	-468	-1.824	**180%**
MURCIA	357	713	284	950	217	-237	**66**	**160%**
NAVARRA	302	995	469	851	286	**144**	**183**	**147%**
PAIS VASCO	972	2.161	1.039	1.919	960	**242**	**79**	**146%**
LA RIOJA	95	460	74	435	58	**25**	**16**	**163%**
CEU/MEL	0	10	5	201	60	-191	-56	**1894%**
TOTAL	18.413	25.650	11.222	25.650	14.052	0	-2.829	

Source: Own calculation based on our Interregional Trade Matrices. 1995
**Interregional Exports and Imports are deduced from own calculations.*
*** Flows with the Rest of the World are obtained from Custom data.1995*
**** Since data does not include "services", Openess ratio is different than the usual (X+M)/PIB.*

Table 7: The strongest interregional flows of goods within the Spanish economy.

RANKING OF THE MAIN INTRA-INTER REGIONAL FLOWS ALL GOODS (INDUSTRIES 1-16). % and billions of Esp.					
1995	INTRA *As % of Total Trade*		INTERREGIONAL *As % of Total Interregional Trade*		
	ORIGIN=DESTINATION	*%*	*ORIGIN*	*DESTINATION*	*%*
1	CATALUÑA	11,3%	CATALUÑA	C.VALENCIA	4,1%
2	C.VALENCIA	5,0%	CATALUÑA	ARAGON	3,1%
3	ANDALUCIA	4,3%	CATALUÑA	MADRID	3,0%
4	MADRID	3,8%	C.VALENCIA	CATALUÑA	2,6%
5	C-LEON	3,1%	CATALUÑA	ANDALUCIA	2,1%
6	GALICIA	2,9%	MADRID	C-MANCHA	1,8%
7	PAIS VASCO	2,2%	ARAGON	CATALUÑA	1,8%
8	C-MANCHA	1,7%	CATALUÑA	PAIS VASCO	1,7%
9	ASTURIAS	1,5%	PAIS VASCO	C-LEON	1,7%
10	ARAGON	1,4%	MADRID	ANDALUCIA	1,7%
INTRA+INTER TOTAL		44.063	INTERREGIONAL TOTAL		25.650
Source: Own calculations based on our interregional trade matrices					

- With the exception of Aragón, the highest openness ratio appear in the economies with smaller surface: Madrid, La Rioja, Baleares, Navarra, Cantabria.
- According to our figures we confirm the expected fact that most part of the regional trade relations, both from the import and the exports sides, takes place among other regional markets within Spain rather than with foreign countries. The rankings of regions in terms of international and interregional trade remains stable. Just Galicia and Castilla-León seems to be more focus on foreign markets.
- Just six regions register positive balances in terms of interregional trade while seven does in the international one. The highest surplus appears in Cataluña trade relations with the rest of Spain, followed by the positive balance of Galicia and País Vasco.
- It is interesting to notice some changes in the sign of some balances when we move from the interregional trade to the international one: while some regions -Cataluña, Galicia and Castilla-La Mancha- show positive balances in the national market and deficits in the international one, others as –Aragón, Valencia, Extremadura and Murcia- register just the opposite relation among their two balances.

By means of the relative share that each bilateral flow represents overall the interregional Spanish flows we could identify some of the strongest economic transactions that have taken place in 1995 (see Table 7):

- The highest intra-regional flows occurs within the regions that combine a large territorial size (Andalucía, Castilla-León), with high population ratios (Cataluña, Andalucía, Madrid, C. Valenciana) and high shares of the economic activity (Cataluña, Madrid, Andalucía).
- Then if we rank the strongest interregional flows of goods we realise that the first 10 positions of the ranking include at least one of the most industrialised economies, namely Cataluña, Madrid, C.Valenciana, Aragón or País Vasco.

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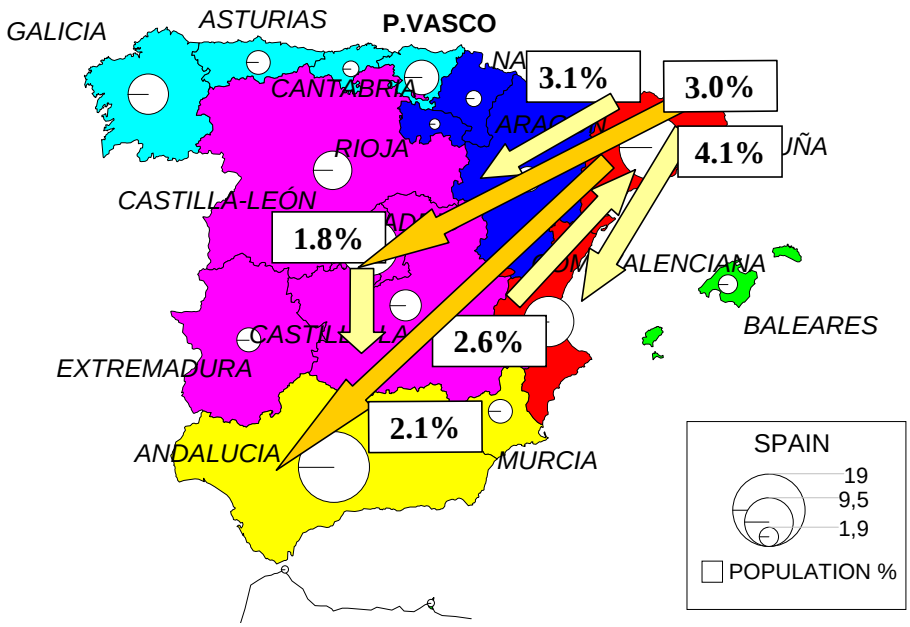
TOTAL INTERREG TRADE OF GOODS

(1)-THE STRONGEST INTERREGIONAL FLOWS. 1995



Once that the main intra and interregional trade flows have been detected it would be interesting to have a look on these other flows that, despite of their relative importance in terms of their intensity, involve the highest levels of concentration in the inflows or outflows of a specific region.

RANKING OF THE SPATIAL CONCENTRATION OF INTERR FLOWS
AS % OVER THE TOTAL INFLOWS/OUTFLOWS OF EACH REGION
ALL GOODS (INDUSTRIES 1-16)
% Over billions of ESP. 1995

ORIGIN /DESTINATION	DESTINO	%	ORIGEN	%
ANDALUCIA	MADRID	8,0	CATALUÑA	12,0
	CATALUÑA	7,0	MADRID	10,0
	EXTREMADURA	5,0	C-MANCHA	7,0
ARAGON	CATALUÑA	**25,0**	CATALUÑA	**33,0**
	C.VALENCIA	11,0	C.VALENCIA	8,0
	PAIS VASCO	6,0	NAVARRA	8,0
ASTURIAS	C-LEON	11,0	GALICIA	12,0
	PAIS VASCO	8,0	C-LEON	10,0
	CATALUÑA	5,0	ANDALUCIA	6,0
BALEARES	CATALUÑA	15,0	CATALUÑA	**32,0**
	CANARIAS	4,0	C.VALENCIA	19,0
	C.VALENCIA	3,0	ANDALUCIA	6,0
CANARIAS	C.VALENCIA	15,0	ANDALUCIA	17,0
	ANDALUCIA	14,0	CATALUÑA	11,0
	CATALUÑA	5,0	C.VALENCIA	8,0
CANTABRIA	C-LEON	16,0	C-LEON	19,0
	PAIS VASCO	12,0	PAIS VASCO	13,0
	MADRID	8,0	CATALUÑA	12,0
C-LEON	MADRID	9,0	PAIS VASCO	12,0
	PAIS VASCO	7,0	CATALUÑA	11,0
	CATALUÑA	6,0	MADRID	10,0
C-MANCHA	MADRID	16,0	MADRID	20,0
	C.VALENCIA	14,0	C.VALENCIA	14,0
	ANDALUCIA	13,0	ANDALUCIA	9,0
CATALUÑA	C.VALENCIA	10,0	C.VALENCIA	8,0
	ARAGON	8,0	ARAGON	6,0
	MADRID	7,0	MADRID	4,0
C.VALENCIA	CATALUÑA	14,0	CATALUÑA	20,0
	MADRID	6,0	C-MANCHA	6,0
	C-MANCHA	6,0	MADRID	6,0
EXTREMADURA	ANDALUCIA	14,0	ANDALUCIA	**30,0**
	C-LEON	10,0	C-MANCHA	8,0
	C-MANCHA	8,0	C.VALENCIA	5,0
GALICIA	MADRID	12,0	CATALUÑA	10,0
	C-LEON	8,0	C-LEON	8,0
	ASTURIAS	6,0	MADRID	6,0
MADRID	C-MANCHA	11,0	CATALUÑA	16,0
	ANDALUCIA	10,0	C-MANCHA	8,0
	C-LEON	8,0	ANDALUCIA	7,0
MURCIA	C.VALENCIA	**25,0**	C.VALENCIA	**22,0**
	ANDALUCIA	15,0	ANDALUCIA	15,0
	C-MANCHA	6,0	CATALUÑA	*10,0*
NAVARRA	PAIS VASCO	19,0	PAIS VASCO	**27,0**
	ARAGON	15,0	CATALUÑA	18,0
	CATALUÑA	13,0	ARAGON	7,0
PAIS VASCO	C-LEON	14,0	CATALUÑA	15,0
	NAVARRA	10,0	C-LEON	8,0
	CATALUÑA	10,0	NAVARRA	8,0
LA RIOJA	PAIS VASCO	15,0	CATALUÑA	**21,0**
	CATALUÑA	13,0	PAIS VASCO	14,0
	NAVARRA	12,0	NAVARRA	13,0
CEUTA/MELILLA	ANDALUCIA	**75,0**	ANDALUCIA	**81,0**
	BALEARES	**21,0**	CATALUÑA	12,0
	CANARIAS	2,0	C.VALENCIA	5,0

Although it has been observed that most of the regions keep trade relations with the others, the table below shows the existence of high levels of concentration in the spatial origin and destination of the interregional imports and exports [1]:

- First of all, it is important to realise that most part of the highest export and import shares are registered between contiguous regions.
- Since this concentration on the spatial distribution of trade could be interpreted as an evidence of the existence of important interregional intersectoral linkages we will be identifying some important channels for the interregional spillover of domestic impulses in terms of growth, prices, and *per capita* income...

The spatial distribution of the main interregional flows (see **Error! Unknown switch argument.**) and the observed tendency to find the highest exports shares around the contiguous regions (see Table 8), remain us once again the importance of the first law of geography in which "everything is related with everything else, but near things are more related than distant things" (Tobler´s 1979, quoted in Anselin 1986). Besides the graphical and intuitive approach, the use of a gravity-based model[2] help us to understand the relation between the intensity of the interregional Spanish trade taking into account the socio-economic power (approached by means of Population and Value Added) of the two areas interconnected (regions r and s) as well as the distance (dist) between them:

$$\ln(x^{p}_{rs} + x^{p}_{sr}) = a_0 + b_1 \ln(VA^{p}_{r} + VA^{p}_{s}) + b_2 \ln(POP_r + POP_s) + b_3(dist_{rs}) + u \qquad 4$$

Dependent Variable: L(Xij+Xji)
Method: Least Squares
Sample: 1 105
Included observations: 105

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.573249	2.371691	-1.506625	0.1350
L(Value Added)	1.290173	0.282891	4.560670	0.0000
L(Population)	0.558684	0.275641	2.026856	0.0453
L(Distance)	-1.304770	0.115770	-11.27036	0.0000
R-squared	0.784140	**Mean dependent var**		11.89013
Adjusted R-squared	0.777728	**S.D. dependent var**		1.414740
S.E. of regression	0.666990	**Akaike info criterion**		2.065266
Sum squared resid	44.93239	**Schwarz criterion**		2.166369
Log likelihood	-104.4265	**F-statistic**		122.2984

[1] Since the % are calculated over the total inflows/outflows, that is including intrarregional fows, the identification of exports and import shares around 20% in some of the regions should be considered considerable high.
[2] The formulation of the gravity model is based on (Goicolea, et al. 1998)

Durbin-Watson stat	2.081379	Prob(F-statistic)	0.000000

Although the results obtained in the estimation of equation 4 by OLS seems to validate the gravity model for a general explanation of most part of the interregional flows of goods, it is important to remark the possible existence of different behaviours depending on the type of commodity being traded. For this reason it would be interesting to reproduce a similar analysis for each of the 16 sectoral matrices of goods. Due to the obvious limitations of time and space, we analyse the main features of the interregional trade observed for the products generated by two activities clearly interrelated: Agriculture and Food&Beverages industries.

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RATIOS FROM THE INTERREGIONAL TRADE MATRICES R1. AGRICULTURE, FORESTRY, FISHING. BILLIONS OF ESP.							
1995	**INTRA**	**EXPORTS**		**IMPORTS**		**BALANCE**	
	REGION	**SPAIN**	**WORLD**	**SPAIN**	**WORLD**	**SPAIN**	**WORLD**
ANDALUCIA	745	378	226	431	120	-54	**107**
ARAGON	230	270	10	248	24	**23**	-14
ASTURIAS	384	76	0	71	7	**5**	-7
BALEARES	95	9	1	108	4	-100	-3
CANARIAS	134	89	50	88	37	**1**	**13**
CANTABRIA	48	43	2	88	19	-45	-17
C-LEON	735	393	10	310	32	**84**	-22
C-MANCHA	297	559	6	254	12	**306**	-5
CATALUÑA	810	408	59	378	285	**30**	-225
C.VALENCIA	207	*287*	*298*	350	96	-63	**202**
EXTREMADURA	140	215	12	62	2	**153**	**10**
GALICIA	463	85	17	151	54	**-66**	-37
MADRID	22	78	7	237	73	-159	-66
MURCIA	159	137	129	197	29	-60	**100**
NAVARRA	71	131	4	95	16	**36**	-12
PAIS VASCO	37	60	3	163	77	-104	-73
LA RIOJA	32	111	3	82	11	**29**	-8
CEU/MEL	0	1	0	18	2	-17	-2
TOTAL	4.609	3.331	839	3.331	899	0	-60

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RANKING OF THE MAIN INTRA-INTER REGIONAL FLOWS R1-AGRICULTURE, FORESTRY AND FISHING. % and billions of Esp.					
1995	INTRA *As % of Total Trade*		INTERREGIONAL *As % of Total Interregional Trade*		
	ORIGIN=DESTINATION	*%*	*ORIGIN*	*DESTINATION*	*%*
1	CATALUÑA	10,2%	C-MANCHA	ANDALUCIA	5,4%
2	ANDALUCIA	9,4%	ARAGON	CATALUÑA	4,1%
3	C-LEON	9,3%	C-MANCHA	C.VALENCIA	4,0%
4	GALICIA	5,8%	CATALUÑA	ARAGON	3,1%
5	ASTURIAS	4,8%	C.VALENCIA	C-MANCHA	2,2%
6	C-MANCHA	3,7%	CATALUÑA	BALEARES	2,1%
7	C.VALENCIA	2,6%	C-MANCHA	MADRID	2,1%
8	MURCIA	2,0%	C-LEON	CANTABRIA	1,9%
9	EXTREMADURA	1,8%	CATALUÑA	C.VALENCIA	1,9%
10	CANARIAS	1,7%	ANDALUCIA	MURCIA	1,6%
INTRA+INTER TOTAL		7.940	INTERREGIONAL TOTAL		3.331
Source: Own calculations based on our interregional trade matrices					

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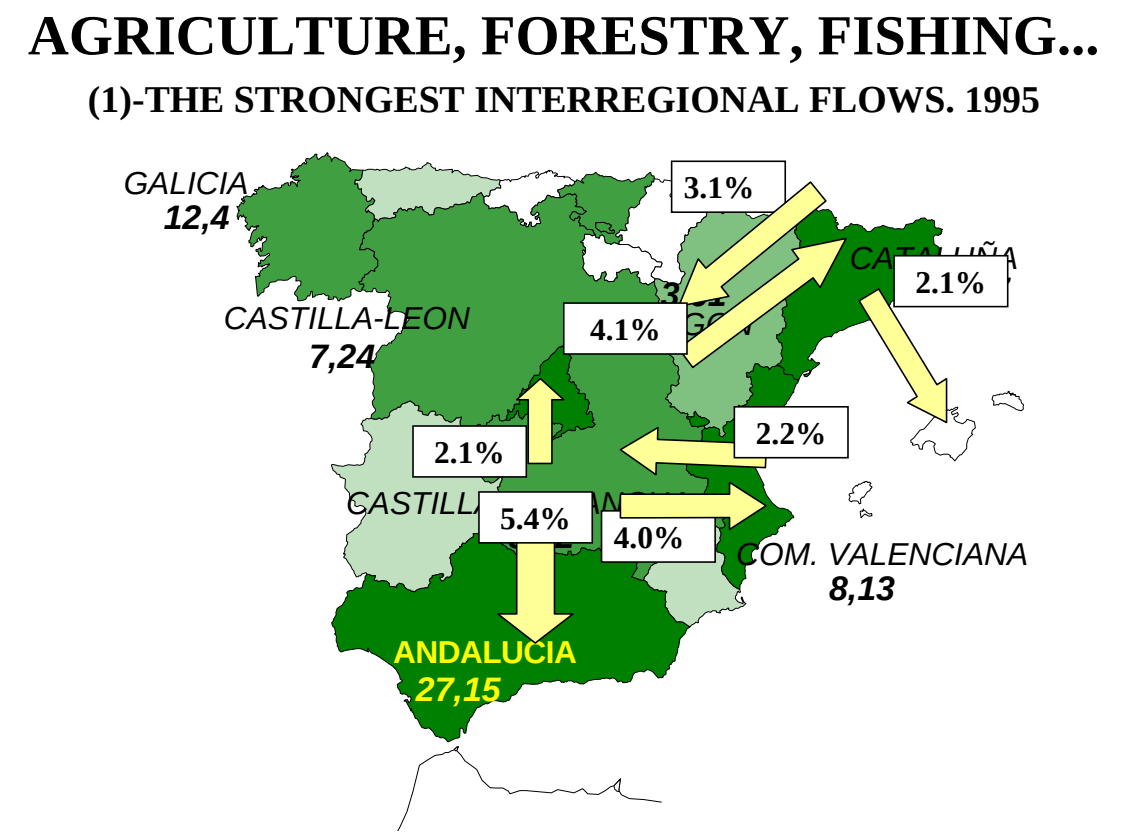

[3] The intensity of the colour express the spatial concentration of population while the numbers are the percentage shares of regions in the Agriculture VA of the Spanish economy. Regional Accounts (INE).

According to the results contained in Table 6 and Table 7, most of the Spanish regions keep having more intense trade of agricultural products with other national agents than with foreign ones. Just the Comuidad Valenciana region seems to be more specialised in the exports to non-national economies.

- The number of regions with positive balance in their interregional trade has increase compare to the previous analysis based on all goods, although just Extremadura seems to keep positive balance also in the international market. Andalucia, C. Valenciana and Murcia share the same trend in their balances: a considerable positive balance in their trade with foreign countries and a slight deficit in the national market.
- In average, the share of intrarregional trade of agriculture products appears to be higher than in the case of *total goods*. The strongest intra flows are located in the regions that capture the highest shares of the Spanish production in the sector.
- Now, the most intense interregional flows take place among regions with hard specialisation in the production of agricultural products (as origins) and regions with strong levels of final or intermediate consumption as a consequence of their level of population or/and an important presence of transforming industries (as destination).
- Notice that, in this particular case all of the strongest interregional flows take place between neighbour economies. Probably, this fact could be partially explained by the location-process of the transforming industries as well as the presence of centralised markets of agricultural products in the main cities of each region (the “MERCA”-net).

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RATIOS FROM THE INTERREGIONAL TRADE MATRICES R3-FOOD&BEVERAGES. BILLIONS OF ESP.							
1995	INTRA	EXPORTS		IMPORTS		BALANCE	
	REGION	SPAIN	WORLD	SPAIN	WORLD	SPAIN	WORLD
ANDALUCIA	613	813	192	675	116	**138**	**76**
ARAGON	74	198	28	307	13	-109	**16**
ASTURIAS	55	165	10	174	7	-9	**3**
BALEARES	57	33	4	127	9	-93	-4
CANARIAS	154	59	14	131	106	-72	-92
CANTABRIA	24	130	15	87	10	**42**	**5**
C-LEON	219	512	50	390	40	**122**	**10**
C-MANCHA	123	338	34	318	26	**19**	**8**
CATALUÑA	846	997	235	493	383	**504**	-148
C.VALENCIA	258	446	80	484	104	-38	-24
EXTREMADURA	47	85	27	176	8	-91	**19**
GALICIA	229	304	98	197	124	**108**	-26
MADRID	267	302	50	782	174	-480	-124
MURCIA	58	182	82	198	28	-16	**55**
NAVARRA	67	136	20	74	26	**61**	-6
PAIS VASCO	105	184	36	261	57	-76	-21
LA RIOJA	13	157	26	94	8	**63**	**18**
CEU/MEL	0	1	2	73	8	-72	-5
TOTAL	3.211	5.042	1.005	5.042	1.246	0	-241

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RANKING OF THE MAIN INTRA-INTER REGIONAL FLOWS R3-FOOD&BEVERAGES. % and billions of Esp.						
1995	INTRA *As % of Total Trade*			INTERREGIONAL *As % of Total Interregional Trade*		
	ORIGIN=DESTINATION		*%*	*ORIGIN*	*DESTINATION*	*%*
1	CATALUÑA		10,3%	CATALUÑA	MADRID	3,8%
2	ANDALUCIA		7,4%	CATALUÑA	C.VALENCIA	3,6%
3	MADRID		3,2%	ANDALUCIA	MADRID	3,4%
4	C.VALENCIA		3,1%	CATALUÑA	ARAGON	3,4%
5	GALICIA		2,8%	CATALUÑA	ANDALUCIA	2,9%
6	C-LEON		2,7%	ANDALUCIA	EXTREMADURA	2,0%
7	CANARIAS		1,9%	C.VALENCIA	ANDALUCIA	2,0%
8	C-MANCHA		1,5%	ANDALUCIA	CANARIAS	1,9%
9	PAIS VASCO		1,3%	C.VALENCIA	C-MANCHA	1,7%
10	ARAGON		0,9%	C-LEON	MADRID	1,7%
INTRA+INTER TOTAL			8.253	INTERREGIONAL TOTAL		5.042
Source: Own calculations based on our interregional trade matrices						

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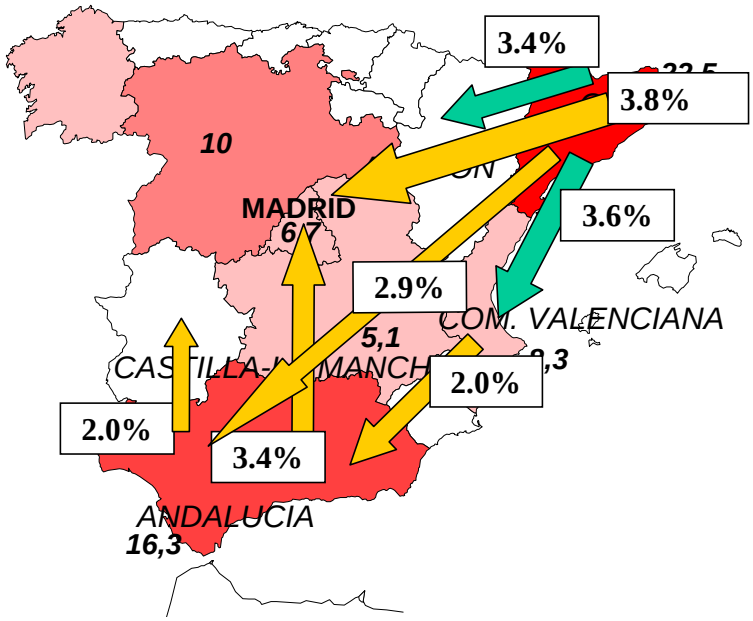
FOOD AND BEVERAGES

(1)-THE STRONGEST INTERREGIONAL FLOWS. 1995



- Now the amount of regions with positive figures in both sides of the balance increases up to five. It is also remarkable the clear contrast observed between the high positive balance of Cataluña in the national market and the negative balance account in the international one.
- Taking into account the economic nature of this products, it is normal that the strongest intrarregional flows appears in the regions with the largest shares of final consumption induced by their high levels of population: Cataluña, Madrid, Andalucia and Comunidad Valenciana.
- Cataluña, with about the 22% of the Spanish food industry total output, appears as the main origin of interregional exports toward their neighbour regions and even further. It is interesting to observe that in this case the strongest interregional flows tends to interrelate some of the economically most power regions rather than the closest ones.

[4] The numbers and the intensity of the colour in the map express the spatial concentration of the Food&Beverages industry output calculated according to the National Industry Survey (INE, 1995).

6. CONCLUSIONS

In this paper we have described the main steps followed on the process of construction of the first version a Multiregional-Multisectoral model for the Spanish Economy. Apart from the interest of our methodological approach, the process of construction implies the estimation of important pieces of information that are worthy in and of themselves.

We have specially focused on the strategy followed for the estimation of a complete set of interregional trade matrices, using transport flows and value/weight relations indirectly deduced from detailed international trade statistics. Finally, we have analysed some key-figures that have been helpful for the identification of some of the highest interregional trade flows. As a consequence we offer a general vision about the quality and credibility of the interregional data that interconnect each of the 17 one-region input-output tables within the interregional framework, as well as we introduce a new, interesting and exclusive overview about the interregional trade relations within the Spanish economy.

AKNOWLEDGEMENTS

The first part of this paper briefly describes the work developed by the whole team involved in the **Project of INTERTIO** (Catalina Cantero, Milagros Dones, Julián Pérez, Ana Serrano). The estimation and analysis of the interregional trade is derived from my own thesis. An special mention corresponds to Antonio Pulido, who has support all my work since the very beginning. To Emilio Fontela and Geoffrey Hewings for their comments on an earlier draft. The project and my own thesis have been financed respectively by the **Spanish Ministry of Economy using FEDER funds**, and by a **FPI fellowship from the Regional Government of Madrid**. I would also like to thank all the people and Institutions that have supplied the required statistics.

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