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## Conference Paper

# Consequences of the Spanish integration in the EU on the trade of Catalonia

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**38<sup>th</sup> Congress of the European Regional Science Association**

**28 August-1 September 1998**

**Consequences of the Spanish Integration in the EU  
on the Trade of Catalonia**

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**ABSTRACT:**

The aim of this paper is to analyse, according to the new trade theories, the changes in the trade of Catalonia -a Spanish region- from the trade liberalisation due to the Spanish integration in the European Community. Concretely we examine if the changes in trade are predominantly of the intra-industry type or on the contrary they are, above all, of inter-industry type. Measures of intra-industry trade (IIT), marginal intra-industry trade (MIIT) and unmatched changes in trade are examined and calculated using the SITC classification on Catalonia for the years 1985 and 1994, studying the share of these changes as well as their amount. This research allows us to determine the consequences of trade liberalisation in the sense that the change in the pattern of trade triggers off other outstanding effects, specially referred to the structural adjustment. The adjustment costs are expected to be lower if the increase of the trade is of the intra-industry type since in this case the adjustment will imply productive factors moving within the same industry.

**Keywords:** *Regional Integration, Adjustment Costs, Intra-Industry Trade.*

*1. Introduction.-*

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The traditional theories of international trade, which try to explain the existence of trade through differences among countries, have not the support of the empirical evidence since they cannot explain the fact that most of the commercial exchanges take place between similar countries that have similar factor endowments. Besides, a significant share of these exchanges are intra-industry trade (IIT), that is, they consist of the simultaneous exports and imports of the same statistical product group. The introduction of a theoretical frame based on imperfect competition, economies of scale and product differentiation -Lancaster (1980), Krugman (1981), Helpman (1981)- provides a theoretical explanation of IIT. In addition, the analysis of the pattern of the change in the trade between two periods of time allows us to detect whether it has been an increase more significant in the IIT or, on the contrary, the change has been above all of inter-industry type as a consequence of the exploit of comparative advantages.

Changes in the IIT or marginal changes shed light on the type of the adjustment. In this context, we assume that the adjustment pressures are reflected in the link between trade and production factors. If the change in trade is of intra-industry type, the adjustment involves less movements of production factors due to most of the expansion of trade are made within the same industry.

In this paper we analyze the share of the IIT of Catalonia -a Spanish region- with several geographical zones. Afterwards, we focus on bilateral trade flows among Catalonia and the European Union (EU) members as well as the changes in the trade after the Spanish accession to EEC.<sup>1</sup>

## *2. Classic and new theories of international trade.-*

The classic theories of international trade, based on the contributions of Ricardo (1817), develop the principle that a country will export (import) the good that can produce with smaller (larger) relative cost in terms of the other good. This theory is the starting point of the analysis of the international trade, but it does not explain the reason of the differences on comparative costs between countries, that is, it does not say anything about the origin of the comparative advantage. The Heckscher-Ohlin model makes up for this lack. According to this theory, developed by Heckscher (1919) and Ohlin (1933), the comparative advantage is due to differences in factor endowments in the countries. In this way, starting from the existence of two factors and two countries, one country will tend to be relatively effective producing the good that

it is intensive in the factor with which it is relatively well endowed. From that, it can be inferred the theorem of Heckscher-Ohlin: one country will export the good in which makes intensive use in its production the factor more abundant and will import the other one. In this way, a country will export and import different goods and, as a result, the international trade will be larger among different countries.

However, the empirical researches do not prove this theory. For instance, Leontief (1953) obtained that, contrary to what it had thought, USA's exports in 1947 were less capital-intensive than USA's imports. This result, named Leontief paradox, went against the theory of factors proportions since USA had the capital biggest relative abundance. Moreover, it has been checked that most of the international trade take place among developed countries that have similar factor endowments. Over time, the industrial countries have become similar both in their levels of technology and in the availability of capital and skilled labour, increasing their IIT, so most of the trade is not connected with the Heckscher-Ohlin theory. In this way, the comparative advantage frame, based on the existence of perfect competition, does not explain a significant part of the trade.

Increasing returns involve that markets are of imperfect competition and the economies of scale mean an incentive to international trade and specifically to IIT. The introduction of the concept of IIT is due to Balassa (1966) who, analyzing the effects of the formation of EEC, notices that the tariff reductions involves that the most part of trade takes place within the same groups of goods.

Several analysis such as Lancaster (1980) and Krugman (1990) developed a theoretic frame of IIT and showed the association between IIT, product differentiation and imperfect competition. In this context, Krugman and Obstfeld (1995) mark four outstanding points:

- Inter-industrial trade reflects comparative advantage and involves a share of the trade but not the whole trade.
- IIT does not reflect comparative advantage being the economies of scale an independent source of this type of trade.

- The pattern of IIT, unlike inter-industrial trade, cannot be predicted.
- The share of the inter and intra-industrial trade will depend on the similarity of the countries. The more similar are the countries -for instance, the ratio capital/labour-, the more is the share of the IIT.

As a result, there is not an universally valid theory of international trade. On one hand, the industries with little IIT are typically labour intensive products. On the other hand, industries that produce sophisticated manufacture goods tend to have high levels of IIT. This fact allows countries to benefit from larger markets since they can both reduce the number of goods that produce and increase the variety of goods so they can produce each variety at larger scale and with higher productivity and lower costs.

### 3. Measures of intra-industry trade and marginal intra-industry trade.-

Although several researchers put forward diferents measures of IIT the best known and most used is the index introduced by Grubel and Lloyd (1971). These authors define the intra-industry trade in an industry as the exports from this industry that are matched with its imports:

$$GL_{ij} = \frac{(X_{ij} + M_{ij}) - |X_{ij} - M_{ij}|}{X_{ij} + M_{ij}}, \quad (1)$$

where  $X_{ij}$  and  $M_{ij}$  are the exports and imports of the country  $j$  of the good  $i$ .  $GL_{ij}$  can range from 0 (when  $X_{ij}$  or  $M_{ij}$  is equal to zero there is not intra-industry trade) to 1 (when  $X_{ij} = M_{ij}$  and all trade will be intra-industry trade). Therefore, the most balanced are the trade in the product group, the most share of intra-industry trade in this group.

As a summary measure of the whole IIT of the country  $j$  for any aggregation level, Grubel and Lloyd introduced a weighted measure of the values of  $GL_{ij}$ , where the weights are the share of each industry in the whole trade. The index of total IIT is:

$$GL_j = \sum_i GL_{ij} \frac{(X_{ij} + M_{ij})}{\sum_i (X_{ij} + M_{ij})} = \frac{\sum_i (X_{ij} + M_{ij}) - \sum_i |X_{ij} - M_{ij}|}{\sum_i (X_{ij} + M_{ij})}. \quad (2)$$

This index is a downward measure when the whole trade is unbalanced and because of this it has been proposed several adjustments in order to solve this question.<sup>2</sup> However, there is not consensus on this matter and the use of GL index is common and is the used in this paper.

In order to measure the change in the IIT between two periods some authors compare the Grubel Lloyd index for diferent time periods. For instance, Globerman (1992), analyzing the trade of Mexico, get an increasae trend in the index concluding that the growth in trade had been largely IIT. This conclusion had been criticized by Shelburne (1993) who points out that it cannot say anything concerning the change in the IIT noticing that the indexes had increased because it is possible an increase in the  $GL_j$  index when the change in trade is only of inter-industry type. This fact happens when the increase in inter-industry trade involves a reduction of the trade imbalance in the sector being measured. What is relevant to analyzing the structural adjustments is not the final level of IIT but the trade growth being of an IIT variety, so Globerman's conclusions on the adjustment process were misleading.

In any case, the comparison of  $GL_j$  indexes in diferent periods of time provides information about the structure of the trade, but does not allow to come any conclusion on the change in trade. Nevertheless, it is usefull when the aim is to do a comparative analysis on trade in diferents years.

Hamilton y Kniest (1991), analyzing the impact of trade liberalisation between Autralia and New Zealand, introduced a dinamic measure in order to calculate the proportion of the increase in exports or imports which is matched. They defined the marginal IIT as:

$$HK_{ij} = \begin{cases} \frac{X_{ij}^t - X_{ij}^{t-n}}{M_{ij}^t - M_{ij}^{t-n}} = \frac{\Delta X_{ij}}{\Delta M_{ij}} & \text{for } M_{ij}^t - M_{ij}^{t-n} > X_{ij}^t - X_{ij}^{t-n} > 0 \\ \frac{M_{ij}^t - M_{ij}^{t-n}}{X_{ij}^t - X_{ij}^{t-n}} = \frac{\Delta M_{ij}}{\Delta X_{ij}} & \text{for } X_{ij}^t - X_{ij}^{t-n} > M_{ij}^t - M_{ij}^{t-n} > 0 \\ \text{undefined} & \text{for } X_{ij}^t < X_{ij}^{t-n} \quad \text{or} \quad M_{ij}^t < M_{ij}^{t-n}. \end{cases} \quad (3)$$

However, this index can only be calculated for non-negative changes of exports and imports, so it had the lack of its undefinition when exports or imports have decreased.

Some researchers have developed several measures in order to overcome the lack of the previous index. In this sense, Greenaway et al. (1994) proposed the following measure:

$$GHME_{ij} = \Delta CII_{ij} = \Delta \left[ (X_{ij} + M_{ij}) - |X_{ij} - M_{ij}| \right],$$

where,  $\Delta CII_{ij} = CII_{ij}^t - CII_{ij}^{t-n}$ , and  $CII_{ij} = X_{ij} + M_{ij} - |X_{ij} - M_{ij}|$ . (4)

The changes in IIT measured in this way are centred on the absolute amount of IIT and not on the share. Nevertheless, this measure has a similar limitation for comparisons that of  $GL_j$  index since if over the period an industry has been balanced its trade the Greenaway *et al.* measure can show a value that it does not correspond to the change in IIT.<sup>3</sup>

Brühlhart (1994) propoposes to measure the intensity of MIIT by means of the next index:

$$A_{ij} = 1 - \frac{|\Delta X_{ij} - \Delta M_{ij}|}{|\Delta X_{ij}| + |\Delta M_{ij}|},$$
 (5)

that ranges between 0 and 1. A value equal to 0 implies that the marginal trade in an industry is completely of inter-industrial type, and this happens when there is not any change in exports or imports, or else the changes in exports and imports are of different sign. If the index reaches to 1, the whole marginal trade is of intra-industrial type and this happens when the changes in exports and imports are equal and of the same sign. In this way, the closer the  $A$  coefficient is to 1, the greater is the share of IIT in the change in trade. It is defined the cut-off point for intra-industry adjustment as  $A > 0,5$ . This index can be used as a summary measure of IIT in the same way than the  $GL_j$  index.

Brühlhart (1994) also developed the following index:

$$B_{ij} = \frac{\Delta X_{ij} - \Delta M_{ij}}{|\Delta X_{ij}| + |\Delta M_{ij}|} \quad \text{where, } |B_{ij}| = 1 - A_{ij}, \quad (6)$$

that it can range between -1 and 1. This is a two-dimensional measure, containing información about the proportion of marginal intra-industry trade and also about the industrial performance of the country. On one hand, the closer is to 0, the higher is marginal IIT and alternatively the closer is either to -1 or 1 the higher is the marginal inter-industry trade. On the other hand, if it is greater than 0, the increase of the exports has been bigger than that of imports whereas if it is negative the increase of the exports has been lesser than that of imports, reflecting the sectorial performance. The lack of this measure is that, in contrast to  $A_{ij}$ , it cannot be used as a summary measure for more than one sector since it can show both positive and negative values and the weighted average could not reflect the true change in trade. Therefore, its application is reduced to the analysis industry by industry.

#### *4. Intra-industry of Catalonia, 1985-1994.-*

The IIT measurement was carried out from trade data of Catalonia at 3 digit SITC dissaggregation, later adding their values in SITC sections -1digit- and the whole trade by means weighted averages.

The results of the IIT of Catalonia in 1985 and 1994 are shown in tables 1 and 2. It is worth mentioning that the IIT as a whole of trade is a high share of the trade of Catalonia, that it reaches 41,8% and 62,8% trade in 1985 and 1994. With regard to the different geographical zones, it is notice the larger IIT with the european countries. In this way, the calculations on the trade with the European Union -46% and 65%- and with the rest of Europe -31% and 48%- are the highest. On the contrary, as it can see from tables, Catalonian IIT with some of the geographical zones are very small. Such is the case of Australia, Oceania and others, Africa and Central and South America. Even in 1994, the IIT with these zones is down of 15% of the whole trade.

**Table 1. Intra-Industry Trade of Catalonia. 1985.**



SITC Section	Description	EU	rest of Europe	Central and South America	USA	Africa	Asia	Australia, Oceania and others	All World
0	Food, live animals	28.7	25.4	2.3	0.9	6.3	35.9	3.3	36.7
1	Drink, tobacco	88.5	25.2	25.7	0.6	0.0	2.7	0.0	30.3
2	Raw materials	25.3	16.3	2.4	2.7	7.2	6.5	0.5	20.2
3	Minerals fuels	26.8	2.5	0.0	35.9	0.7	1.0	0.0	14.7
4	Animal / vegetable oils	10.9	2.1	0.1	0.4	0.0	2.7	0.0	6.1
5	Chemicals	42.0	44.7	14.9	40.6	6.5	39.8	5.0	58.1
6	Manufactures classified by materials	53.6	40.4	14.5	26.3	3.3	24.6	3.7	51.1
7	Machinery, transport equipment	53.4	40.9	4.0	40.9	0.9	20.1	7.4	58.2
8	Miscellaneous manufactures	54.0	34.1	5.0	28.4	1.8	20.4	2.4	43.9
9	Commodities n. e. s.	64.9	1.8	0.0	33.7	0.0	34.1	0.0	22.8
5-8	Manufactures	50.5	41.1	9.7	35.4	3.4	25.2	4.6	54.4
0-9	All commodities	46.5	31.4	4.1	20.8	2.3	17.3	1.9	41.8

**Table 2. Intra-Industry Trade of Catalonia. 1994**

SITC Section	Description	EU	rest of Europe	Central and South America	USA	Africa	Asia	Australia, Oceania and others	All World
0	Food, live animals	42.4	35.2	4.2	2.4	9.8	21.2	3.7	41.9
1	Drink, tobacco	52.1	15.9	41.9	18.2	6.6	6.5	4.4	52.0
2	Raw materials	44.8	17.6	8.2	8.0	15.5	21.7	0.8	34.7
3	Minerals fuels	26.5	6.6	0.1	14.3	0.4	0.1	0.2	15.9
4	Animal / vegetable oils	24.4	22.7	8.7	0.9	88.3	1.0	0.2	24.0
5	Chemicals	58.9	56.9	33.6	39.7	12.8	59.6	2.3	65.4
6	Manufactures classified by materials	71.0	46.3	27.8	38.2	28.9	33.2	8.1	73.7
7	Machinery, transport equipment	74.5	58.1	11.3	33.5	10.0	32.8	5.6	72.8
8	Miscellaneous manufactures	69.3	63.6	12.6	45.4	45.7	34.2	26.1	64.3
9	Commodities n. e. s.	13.3	10.4	4.6	12.8	0.2	2.2	3.3	7.6
5-8	Manufactures	69.7	55.7	18.4	38.7	22.7	37.0	8.9	70.2
0-9	All commodities	65.0	48.1	13.8	28.9	12.0	33.0	5.0	62.8

Concerning to the SITC sections, it is worth noting that it obtains the highest values in the manufactures industries -sections 5 to 8- for all zones and specially for the european countries.

In this way, the IIT in manufactures with EU is 65% of the commercial exchanges and with the rest of Europe is almost half of the whole trade.

Table 3 summarizes the difference over time between  $GL_j$  indexes and the marginal measure<sup>4</sup> developed by Brühlhart with regard to the Catalonia's trade with European Union. As it can be seen from this table, there is a significant difference between the comparison of  $GL_j$  indexes and the marginal index. On one hand, it can be noticed that it has been a generalized increase in the  $GL_j$  index in all sections with the only exception of *drink, tobacco* and *commodities n.e.s.* On the other hand, the marginal indexes only reach values higher than 50 in *Machinery and transport equipment* and *Manufactures classified by materials*, being especially in the former, which 74% of the change in trade has been IIT. In the same way, it is worth mentioning that manufactures -sections 5 to 8- reach the highest values of the marginal index so these industries not only have the largest IIT but they also have grown the higher.

**Table 3. Catalonian IIT with the European Union, by SITC Sections. 1985-1994.**

SITC section	GL 1985	GL 1994	change GL 1994-1985	A
0 Food, live animals	28.69	42.35	13.66	33.69
1 Drink, tobacco	88.51	52.06	-36.45	35.29
2 Raw materials	25.32	44.82	19.50	30.66
3 Minerals fuels	26.78	26.50	-0.28	0
4 Animal / vegetable oils	10.97	24.36	13.39	22.33
5 Chemicals	42.05	58.89	16.84	42.61
6 Manufactures, classified by materials	53.64	71.01	17.37	53.00
7 Machinery, transport equipment	53.40	74.53	21.13	74.29
8 Miscellaneous manufactures	54.01	69.29	15.28	43.92
9 Commodities n. e. s.	64.98	13.32	-51.66	10.51
5-8 Manufactures	50.51	69.67	19.16	60.42
0-9 All commodities	46.49	65.03	18.54	55.02

The calculations of  $GL_j$  indexes regarding to the country members of the European Union are presented in table 4. As it can see, the overall average of the index for all commodities has increased over time for almost all the countries. The only exception is Ireland, the index of which has declined from 30% to 13%. On the opposite side, the countries that have the main increase of the  $GL_j$  are United Kingdom and Italy. The IIT with this countries and so with

France has the highest share in both 1985 and 1994. This fact proves that even before the trade liberation as a consequence of the Spanish accession to EEC, Catalonia had an important degree of integration with this countries.

With regard to the marginal IIT and as far as the overall averages are concerned, the coefficients point to inter-industry adjustment since for all the members of the EU the  $A_j$  measure is lesser than 50%. This is more pronounced for Greece, Ireland, Denmark and Netherlands, whose indexes of marginal IIT are lower than 20%. With United Kingdom, France, Portugal and Italy it reaches higher results of the marginal index and so the  $Gl_j$ .

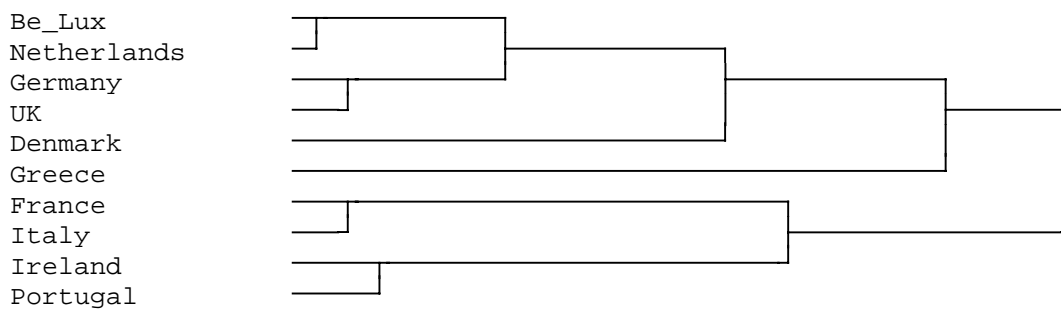
**Table 4. Changes in the Intra-Industrial Trade of Catalonia. 1985-1994.**

	GL 1985	GL 1994	change GL:1994-1985	A
1. Belgium and Luxemburg	25.28	34.58	9.30	24.16
2. Denmark	23.58	28.19	4.61	17.84
3. France	42.25	50.34	8.09	41.44
4. Greece	2.51	14.00	11.49	9.20
5. Ireland	30.13	16.91	-13.22	10.59
6. Italy	37.04	51.44	14.40	34.00
7. Netherlands	24.42	29.76	5.34	18.23
8. Portugal	20.02	31.95	11.93	36.52
9. United Kindom	32.14	54.97	22.83	45.20

Subsequently, we have done a cluster analysis refering to 1994 that allows us to shape different groups of countries in accordance with the IIT in SITC sections.<sup>5</sup> Table 5 shows the dendogram of the cluster analysis of the IIT of Catalonia regarding to the members of EU in 1994. It can be appreciated the existence of two groups of countries. France, Italy, Ireland and Portugal belong to the former group. The main charateristic of IIT with these countries is its high share in industries such as *Drink and tobacco* and *commodities n.e.s.* with values upper than 50% of the whole trade. Into this group the differences come from the magnitude in manufactures, particulary in sections 6 to 8. With regard to these industries the IIT of Catalonia with France and Italy is above 50%, whereas for Ireland and Portugal the IIT is a bit lower.

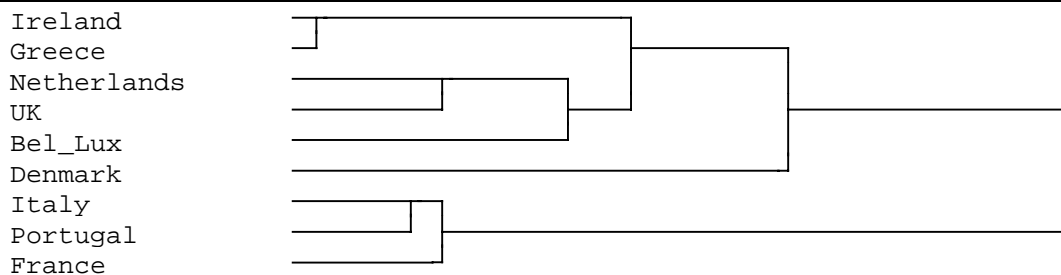
Belgium and Luxemburg, Netherlands, Germany, United Kingdom, Denmark and Greece belong to the latter group, which is more heterogeneous. Regarding to the latter country, the IIT is high in *Animal / vegetal oils* and *mineral fuels* being the rest of the industries perceptibly lower. With regard to Belgium and Luxemburg and Netherlands this type of trade keeps in similar proportions in the great majority of the industries, even though it is higher in *miscellaneous manufactures* and *manufactures classified by materials*. The Catalonian IIT with Germany and United Kingdom is an important share of the trade in *Machinery and transport equipment* in which the indexes reach a value close to 70% and *manufactures classified by materials*. The IIT with Denmark is characterized by the importance of *minerals fuels* that reaches three quarters of the whole trade in this sector. Regarding to the primary industries, as it has been thought, comparative advantage appears to explain its low IIT share.

**Table 5. Cluster analysis of intra-industrial Trade of Catalonia, 1994. Dendrogram.**



The dendrogram of the cluster analysis for the marginal IIT, shown in table 6, also reveal the existence of two groups. The former is made up of Italy, Portugal and France. With this countries, the marginal IIT is high in both *manufactures* and in *drink and tobacco* and *food and live animals*.

**Table 6. Cluster analysis of marginal intra-industrial trade of Catalonia, 1985-94. Dendrogram.**



The marginal IIT with the rest of the countries is appreciably lower in non-manufactures - sections 1 to 4-, being almost zero in some of them, especially for the IIT with Ireland and Greece. The change in the Catalonian IIT in manufactures with these countries has not been as high as in the former group, although United Kingdom and Netherlands stand out in relief. In this way the marginal IIT with United Kingdom is particularly high in *manufactures classified by materials* and *Machinery and transport equipment*.

Finally, we have computed the  $B_{ij}$  measure and the ratio of the number of industries with positive values relative to the number with negative ones. On one hand, the results show that only 25% of the sectors have an increase in the exports greater than in the imports. Since imports are expanding more than exports, the industries did not suffer a decline in the production or the employment. On the other hand, 60% of the sectors have a  $B_{ij}$  lower than 50% so that there was a greater inter-industry change. In any case, this is due to the great penetration of the imports since there has been an important increase of the exports.

##### 5. Conclusions.-

The analysis of the trade and its change is a relevant matter because of trade is the catalyst of other outstanding effects provoked by a trade liberalisation. In this sense, we analyse the trade of Catalonia with the members of the EU in 1985 and 1994. The choice of these years is justified because the former is the previous year to Spanish integration to EEC. The latter was chosen because a decade after the former it is reasonable analysing the consequences of the liberalisation.

The results show the importance of IIT in Catalonian commercial foreign relations with the EU, that reaches to 63% of the whole trade in 1994. It is worth mentioning that, on one hand, this trade is high, above all, regarding to the members of the European Union and, on the other hand, there are differences in the share depending on the industries. In this way, manufactures -sections 5 to 8- reach the upper values of IIT. These facts prove that the production structure of Catalonia is more similar to the EU than the rest of the zones.

Regarding to the members of the European Union it is noted a high intensity of the trade, in general terms and particularly of the IIT. The IIT is specially high in the trade with Italy and

France both in 1985 and 1994. This fact together with the raise commercial exchanges with this countries involves that Catalonia has a productive structure more similar with these countries. The changes in the IIT also has been higher with these countries, even though it points out the increase with United Kingdom, due to the great increase in the IIT in *Machinery and transport equipment* and *manufactures classified by materials*.

The index of marginal IIT as a whole of the trade reaches in all cases values lesser than 50% so that it has been a predominantly inter-industry change in Catalonian trade flows. In addition, the results regarding manugactures have values significant higher, but in some cases do not reach the cutt off point of 50%. The marginal IIT is relevant with those countries with that the IIT already was high in 1985.

The changes in Catalonian exports and imports cannot be completely attributed to the impact of the integration of the EEC in view of two facts. Firstly, the period 1985-1990 was characterised by an important economic expansion so it is difficult to evaluate which share of the increase of trade is a consequence of the integration of the European market. Secondly, previous to the Spanish accesion to EEC, the Catalonian economy already had an important volume of trade with the european countries. Suming up, the extent of the Catalonian IIT in part reflects certain characteristics among Catalonia and the European countries such us per capita incomes or geographical proximity rather than integration.

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<sup>1</sup> We include the memberships of the European Union in 1994, that is, France, Germany, Italy, Greece, Portugal, United Kingdom, Ireland, Denmark, Netherlands and Belgium and Luxemburg.

<sup>2</sup> See Aquino (1978), Greenaway and Milner (1981) and Bergstrand (1983) for a detailed exposition.

<sup>3</sup> For an exposition of the lack of the Greenaway et al. measure see Brülhart (1994).

<sup>4</sup> In order to obtain the changes in trade in real terms, the 1985 trade values are converted in 1994 prices.

<sup>5</sup> The clustering has been carried out by the Ward's method.

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