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The Nature and Causes of Intra-Industry Trade: Back to the Comparative Advantage Explanation? The Case of Spain

Carmela Martín
José V. Blanes

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The Nature and Causes of Intra-Industry Trade: Back to the Comparative Advantage Explanation? The Case of Spain

By

José V. Blanes and Carmela Martín

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Contact:

Professor Carmela Martín
Universidad Complutense de Madrid
E-mail: carmelamartin@ccee.ucm.es
Professor Vicente Blanes
Universidad Autónoma de Barcelona
E-mail: JoseVicente.Blanes@uab.es

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I. Introduction

The bulk of the literature relative to Intra-Industry Trade (IIT), both theoretical and empirical, has presumed that traded products will be mainly horizontally differentiated. Among the few exceptions are Falvey (1981) and Falvey and Kierzkowski (1987) developed one of the few models of IIT with vertically differentiated products[1]. They state that differences in factor endowments between partner countries could also explain IIT. Recent empirical work on the nature of IIT has provided evidence challenging the hypothesis of IIT based on horizontally differentiated products (HIIT), since it shows that trade in vertically differentiated products (VIIT) is significant. Furthermore, the results obtained in most econometric studies on the determining factors of IIT have not turned out to be very conclusive, and often do not match the predictions of the monopolistic competition theory[2]. The diversity of econometric results might be explained by the mismeasurement of IIT, because the usual IIT index includes both horizontal and vertical IIT. Results might improve if pure vertical or pure horizontal measures are used.

An additional reason for paying attention to vertical IIT concerns welfare analysis of economic integration. Models of IIT based on horizontally differentiated products predict low adjustment costs from trade adjustment in response to regional integration processes. However, if vertical differentiation prevails, adjustment costs may be significant because of two main reasons. First, the factor content of exports and imports differs, as is the case of interindustry trade (Greenaway and Hine, 1991). Second, the lower-quality varieties (labour intensive) produced in the poorest countries (relatively labour abundant) could be displaced by the higher-quality varieties (capital intensive) produced in the richest countries (relatively capital abundant), as Shaked and Sutton (1984) and Motta (1992) suggest. This could lead to the closure of firms in the poorest countries, and hence to unemployment. If these negative effects are not compensated by an improvement in the consumer's welfare emanating from lower prices and access to higher quality varieties, an impoverishment of the poorest countries will take place. This outcome could point to the need for policies, such as the promotion of R+D and human capital in the poorest countries or direct transfer policies between the members of the integrating area.

[1] Another model of vertical intra-industry trade is the one developed by Shaked and Sutton (1984).
[2] An example is the elusive empirical verification of the role of scale economies as a positive determinant of IIT.

In this paper we will, therefore, construct IIT indexes that take into account the two different types of product differentiation , and then test for differences in their determinants. To this end, we estimate a more general empirical model than those used in previous studies by introducing simultaneously both national and industry-specific variables. Greenaway et al. (1994, 1995) include either country or industry characteristics, but not both. We want to test, first, whether disentangling the measure of IIT into VIIT and HIIT helps to improve our understanding of their determinants and, secondly, whether comparative advantage may explain VIIT. We also extend the previous studies by introducing in our empirical model measures of differences in human and technological capital endowments between partner countries, partly following the recent theoretical work of Davis (1995). Finally, we test the role of foreign direct investment (FDI) in both types of trade. Bilateral trade data at the six digit level of the Combined Nomenclature (4900 items) between Spain and 60 countries over the period 1988-1995 are used to do this analysis.

The structure of the paper is as follows. The next section presents the theoretical foundations of the empirical models tested further on. Section III briefly describes the evolution and nature of IIT in Spain during the period analysed. The section IV presents the empirical models and the econometric results. Finally, section V offers some concluding remarks.

II. Theoretical Framework

In the traditional approach to IIT, models of monopolistic competition with increasing returns to scale, combined with homogeneous consumer preferences in the partner countries, explain the existence and significance of IIT[3]. The combination of monopolistic competition and factor proportion theory generates the co-existence of intra and inter-industry trade (Helpman and Krugman, 1985). Moreover, the more similar the factor endowments of each country, the greater the extent of intra-industry trade and, therefore, the lesser the extent of inter-industry trade. Thus, this theory predicts a negative relation between comparative advantage and IIT.

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[3] See Kol and Tharakan (1989) for references.

The existence of vertical IIT challenges this view. The essence of the theoretical models developed by Falvey (1981), Falvey and Kierzkowsky (1987) and Shaked and Sutton (1984) can be summarized as follows. Vertical product differentiation means that varieties in two-way trade in similar goods differ in quality[4]. On the supply side, the distinguishing feature of each variety is the capital-labour ratio used in its production, with high-quality products requiring more capital-intensive production techniques and having higher prices. On the demand side, goods are distinguished by perceived quality. Although all consumers have the same preferences, each individual demands only one type of differentiated product which is determined by individual income. Given that the aggregate income is not equally distributed, there is an aggregate demand for a variety of differentiated products. The country which is relatively labour abundant will tend to export the lower-quality/labour-intensive varieties of the differentiated product (demanded abroad by low-income consumers) and to import the higher-quality/capital-intensive varieties (demanded by high-income consumers in that country). Thus, intra-industry trade is in fact determined by comparative advantage as in the Hecksher-Ohlin model, with IIT being greater the greater the differences in factor endowments between countries.

Some interesting extensions to the theory of IIT have been recently made. Davis (1995) has developed a model to explain IIT on the basis of comparative advantage deriving from differences in technology between countries. This model also possesses the challenging feature, unlike the earlier models, that increasing returns are not necessary to explain IIT. Moreover, recent modelling efforts in the area of endogenous growth and on the relationship between trade and technological progress[5], have reinforced the idea of the essential importance of human and technological capital not only for productivity growth but also as a key driving force in the international pattern of specialisation and trade.

Other authors have focused on the role of foreign direct investment (FDI) in IIT. These models account for the existence and expansion of multinational companies and their growing influence in trade, via intra-firm transactions. Markusen (1984), Helpman (1984, 1985) and Motta (1994), provide an explanation for a positive relationship between

[4] In fact, in these models variety is referred to as quality.
[5] See Grossman (1996), Helpman (1998) and Harrigan (1999) for references, and Martín and Velázquez (1999) for empirical evidence for the OECD countries.

foreign direct investment and IIT, both vertical and horizontal. Evidence for this is very scant, and this paper will provide some.

Although an encompassing model is not available, the existing theoretical models provide valuable ideas for empirical modelling. The first is the need, given de diverging predictions, to distinguish and properly measure vertical IIT and horizontal IIT. Second, the need to use as explanatory variables factor endowments as well as measures for product differentiation and economies of scale. Finally, the need to include FDI in order to prevent omitted variable bias.

III. Extent and Nature of Intra-Industry Trade in Spain

In this section, we briefly describe the extent, nature and dynamics of Intra-industry trade in Spain from 1988 to 1995[6]. To measure its significance, we use Grubel and Lloyd (1975)'s index of IIT, adjusted for categorical aggregation (Greenaway and Milner, 1983):

$$A_{ikt} = \frac{\sum_{j=1}^{n}\left(X_{ijkt} + M_{ijkt}\right) - \sum_{j=1}^{n}\left|X_{ijkt} - M_{ijkt}\right|}{\sum_{j=1}^{n}\left(X_{ijkt} + M_{ijkt}\right)} \times 100 \qquad (1)$$

where A_{ikt} is the intra-industry trade index of industry "*i*" with the partner country "*k*" in the year "*t*", and X_{ijkt} and M_{ijkt} are exports and imports of the variety "*j*" pertaining to the industry "*i*" with the partner country "*k*" in year "*t*". The index is equal to 100 if all trade is IIT, and it is equal to 0 if there is no IIT at all. The index is built on a bilateral basis, in order to avoid geographical aggregation. We use the trade of Spain with 60 countries, accounting for 95% of Spanish trade in manufacturing. In this paper, the index has been calculated at the 6 digit level of the Combined Nomenclature (about 4900 items).

To measure its nature (vertical or horizontal), we use relative unit values per tonne of exports and imports[7], calculated at the same level of disaggregation. Unit value indexes

are considered as a proxy for prices, assuming that prices properly reflect quality. IIT (A_{ikt}) can thus be divided into horizontal IIT (HA_{ikt}) and vertical IIT (VA_{ikt}):

$$A_{ikt} = HA_{ikt} + VA_{ikt} \qquad (2)$$

Horizontal IIT is defined as the simultaneous exports and imports of a 6 digit CN item where the unit value of exports relative to the unit value of imports is within a range of ± 15%[8] (α):

$$1 - \alpha \leq \frac{VU^{x}_{ijkt}}{VU^{m}_{ijkt}} \leq 1 + \alpha \qquad (3)$$

IIT is considered as vertical when the relative unit value of exports and imports is outside this range:

$$\frac{UV^{x}_{ijkt}}{UV^{m}_{ijkt}} < 1 - \alpha \qquad (4) \qquad \text{or} \qquad \frac{UV^{x}_{ijkt}}{UV^{m}_{ijkt}} > 1 + \alpha \qquad (5)$$

Since vertical IIT represents specialisation in varieties of different quality that require different factor intensity and/or technical knowledge, we will define High and Low vertical IIT as follows. When the relative unit value index of a product is below/over the limit of 0.85 / 1.15 (1 - α / 1+ α), it is considered as a low- / high-quality Spanish export (VIIT (LQ) and VIIT (HQ), respectively). This will allows us to ascertain whether Spain is specialised in low or high quality varieties and the dynamics and geographical distribution of such a specialisation.

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[6] Although it would be interesting to calculate IIT for the years before 1986 in order to better analyse the effects of Spanish integration into the European Union, the change in trade nomenclatures in 1988 prevents us from doing so at the desaggregated data level required for an IIT analysis.

[7] This methodology was proposed first by Abd-el-Rahman (1991) and it was also used by Greenaway et al. (1994,1995).

[8] This range of relative unit value chosen could be considered arbitrary. However, the use of this criterion can be justified for two reasons. First, because it seems sensible to assume that other factors other than quality differences, such as transport and other freight costs, are unlikely to account for a relative unit value as high as 15%. Second, because this threshold has already been used in the previous studies already refered to.

Then, the amount of horizontal (or vertical) IIT is then summed over all 6 digit items comprising a particular industry[9] and, finally, the IIT index is divided into each kind of IIT according to its weight in total intra-industry trade.

The results are summarised in Chart 1 and in Table 1. At an aggregated level, we can observe, first, that the share of IIT in Spain has been continuously increasing along the period analysed. This feature is shared by all types of IIT and by the two groups of countries considered. Second, we can also conclude that VIIT is more significant than HIIT, particularly with non-OECD countries. But what is really interesting is that VIIT of low-quality Spanish exports is greater with OECD countries whereas VIIT of high-quality Spanish exports is greater with non-OECD countries. We consider that these results are consistent with intuition and match the 'comparative advantage' explanation of vertical IIT. They are consistent with Spain being an economy placed below the average level of development of OECD countries and at a higher level than non-OECD countries. Finally, the relative significance of VIIT on total IIT has grown with respect to non-OECD countries and has only slightly decreased with respect to OECD countries (from 80 to 84% and from 73 to 70%, respectively).

This geographical pattern of IIT holds up, in general, disaggregating by manufacturing sectors (NACE-CLIO R25). As shown, Rubber and Plastic Products, first, and the Automobile Industry, next, are the sectors with the highest indexes of IIT in the Spanish trade with the OECD. The nature of IIT is similar in both sectors, VIIT is more significant than HIIT. With respect to non-OECD countries, the figures are considerably smaller, as expected. Only in Other Transport Equipment do IIT indexes exceed 10%.

IV. Model Specification and Econometric Results

In order to explore the industry (and country) characteristics associated with IIT and the extent to which these characteristics differ between VIIT and HIIT, we will estimate a model with the following general form:

Moreover, Greenaway et al. (1994) and Gordo and Martín (1996) found that results were not very sensitive to the range chosen, using alternatively a range of 0.75 to 1.25. The authors have also obtain the same result.

[9] Defined as a sector of the "Encuesta Industrial" (INE).

$$IIT_{ikt} = a + b_l X_{it} + g_m Z_{kt} + m_{ikt} \qquad (6)$$

where IIT_{ikt} stands for either TIIT, VIIT or HIIT , i.e. Total, Vertical or Horizontal Spanish IIT index in industry "*i*" with partner country "*k*" in year "*t*"; X_{it} includes a set of "*l*" industry-specific variables and, finally, Z_{kt} is a set of "*m*" country-specific variables.

We next explain the set of variables included in vector *X* and *Z*, and discuss the reasons that justify their inclusion as well as the expected signs. Both *X* and *Z* include variables related to both vertical and horizontal IIT models. Table 2 summarizes variable definitions and sources.

Industry characteristics

As a measure of horizontal product differentiation (HPD) in each industry we use an index of the similarity of the unit values of the varieties included in their exports:

$$HPD_{it} = \sum_{j \in i} \left[\frac{V_{jt}}{\sum_{j \in i} V_{jt}} \times \frac{min(UV_{jkt}, UV_{jk't})}{max(UV_{jkt}, UV_{jk't})} \right] \qquad (7)$$

where *UV* is unit values of Spanish exports to different markets and *V* value of exports. This measure ranges from 0 to 1. The greater the similarity in any industry between the unit values of the same varieties (6 digit CN categories) of exports to different countries, i. e. the greater the horizontal differentiation in an industry, the higher its value. This measure tends to zero as the difference in unit values increases, i. e. as more vertically differentiated an industry is[10]. We expect, therefore, a positive (negative) effect on HIIT (VIIT).

The technological intensity of sectors (TI) is proxied by the proportion of R&D staff in total employment. We expect a positive sign in relation to VIIT.

[10] We consider our proposed variable a better proxy to horizontal product differentiation than the one used by Grenaway et al. (1995): the number of 5 digit SITC categories in each industry, because such a variable is normally used as a proxy for categorical aggregation.

Although in most theoretical models the presence of scale economies is generally considered to be an essential condition for IIT to occur[11], it does not follow that the volume of IIT should be positively related to the degree of scale economies (Ethier, 1982). Moreover, it has been argued[12] that, although some degree of scale economies is necessary to induce country's specialization and, hence, IIT, a very high level may inhibit IIT (because it leads to the standardization of the product). In order to explore this hypothesis we have, therefore, used the variable of scale economies (SE) -calculated as a ratio between the minimum efficient scale of production and the relative cost disadvantage, as in Caves (1981)-, as a dummy variable, DSE, which equals 1 for those sectors with a middle range value of SE[13]. We expect a positive sign with respect to HIIT, remaining unclear the effect on VIIT[14]. In addition, since it can be also argued that the correct specification of scale economies as a determining factor of IIT is through its conjunction with the level of product differentiation[15], we will also test -in specification (2)- the interactions of HPD and DSE (HPDSE) and of TI and DSE (TIDSE).

We include the variable foreign capital in industry "*i*" (FK), proxied as the proportion of foreign share holding in the sector's total share capital, to study the likely influence of multinational activities on IIT. We presume a positive relationship.

Country characteristics

Since the pioneer study by Linder (1961), it can be reasonably assumed that the more similar the per capita income among partner countries, the greater the extent of IIT, given that similarity in income presumably implies a greater similarity in their demand pattern. We test this hypothesis by including a measure of dissimilarity between per capita income in Spain and each of its partner countries (DPCI). However, per capita income has also been used as a measure of relative factorial endowment. With regard to HIIT, this is not a serious shortcoming since the expected effect of both characteristics, differences in

[11] A relevant exception is the model of Falvey (1981) and Falvey and Kierzkowski (1987).
[12] See, for example, Somma (1994) and Davis (1995)
[13] This middle range is defined as the interval between the minimum/maximum value of SE plus/minus its standard deviation.
[14] Positive according to Shaked and Sutton (1984) and insignificant according to Falvey (1981) and Falvey and Kierzkowski (1987).
[15] See Fariñas and Martín (1988).

demand and in relative factor endowments, is the same, i.e. negative. But, in the case of VIIT it might be more problematic to the extent that, as was argued before, this type of trade could be caused by differences in factor endowments. Nevertheless, since we consider that VIIT is mainly explained by differences in relative technological and human capital endowments and we explicitly include these variables, we could expect DPCI to have a negative effect on VIIT also.

As is well known, measures of differences in relative endowments of human capital (DHK) and technological capital (DTK) are not widely available. In fact, we have only been able to obtain a measure of human capital (from Benhabib and Spiegel, 1994) for 40 countries and a measure of technological capital for OECD countries[16]. Consequently, we have decided to estimate, first the model for the complete sample of 40 countries without including the technological capital variable (Table 3) and then to replicate these estimations for the reduced sample OECD countries but including this measure (Table 4).

Our empirical model also includes a measure for the existing distance between Spain and each partner country (DIST). This variable controls for the fact that distance between countries increases both information and transport cost. We consider that distance will affect IIT more than inter-industry trade, since differentiated products will have more national substitutes (different in quality o any other characteristic) than homogeneous products. Finally, following Helpman (1981), we add a variable to test whether the difference between the sizes of the partner countries is negatively related to the extent of IIT. We test this proposition by including a variable which measures the difference between the GDP of Spain and each of its partner countries (DGDP).

As our main interest is to ascertain whether there are differences between VIIT's and HIIT's determinants, we estimate the same specifications for total, vertical and horizontal IIT indexes. We estimate these empirical models by pooling the data for the period 1988 to 1992, because some of the variables are not available for later than 1992. The data set includes 64 industries (sectors of the Encuesta Industrial) and 40 countries, 20 of which are OECD countries and 20 are non-OECD countries. The total number of

[16] The measure of human capital is an estimation based on data on years of schooling. For a further discussion on measures of human capital one can see Barro and Lee (1993).

observations in the full sample is 12800 and 6400 in the reduced sample of OECD countries.

We estimated a logistic function:

$$IIT_{ikt} = \frac{1}{1+\exp(-B'X)} + m_{ikt} \qquad (8)$$

by Non Linear Least Squares, for two reasons. First, the logistic is better than a linear or log-lineal function when, as is this case, the dependent variable takes values between a limited range (0 and 1). In fact, the predicted values of a logistic function are always within this range whereas those estimated by a linear or log-linear function might not; the estimated coefficients, although unbiased, are not efficient. Second, it is preferable to its logit transformation, estimated by weighted least squares, because it allows us to include zero observations, which are important in the sample.

We have estimated several specifications. The difference between specifications (1) and (2) is that the second includes the variables of product differentiation interacting with the variable of scale economies. Specification (3) includes DTK instead of DHK and, finally specification (4) includes both. The two first specifications are estimated both for the full sample of countries and for the OECD sample. The other two specifications are estimated only for the OECD sample.[17]

Looking at the results in Table 3, we first observe that they are almost the same for Total and for Vertical IIT with the significance of DSE and FK in specification (1) as the only exceptions. This outcome is not surprising since VIIT accounts for most of TIIT. Differences are greater, however, between Vertical and Horizontal IIT. We observe, in Table 3 and 4, that the determinants of vertical and horizontal IIT are not the same, because signs and significance of variables differ. Moreover, the estimated specifications for HIIT are, all of them, less precise than those for total and vertical ITT.

[17] Since the results for this reduced sample show the same similarity between total and vertical IIT as for the full country sample, and also with regard to specification (1) and (2), we show those for HIIT and VIIT and for specification (1). For this sample, we also present the results for the equation which includes DTK instead of DHK (specification 3) and the one which takes into account both variables (specification 4).

Beginning with industry-specific variables, technological intensity has a significant positive effect on VIIT and a negative effect on HIIT, and the contrary is true with respect to HPD, confirming our hypothesis. The results obtained for scale economies are especially notable. When we estimate for TIIT, scale economies do not appear to be significant, a common result in empirical work but which is against theoretical predictions. However, when we estimate separately for vertical and horizontal IIT, DSE has a positive influence on HIIT. This result holds up when we consider that the effect of HPD and DSE is multiplicative. On the other hand, the sign of DSE is negative with regards to VIIT, but it is positive when scale economies interact with technological intensity. Moreover, HPD has still a negative effect on VIIT in industries where scale economies have a middle range (when HPD interacts with scale economies). Finally, we find that foreign capital has a significant positive effect on both vertical and horizontal IIT. We consider this to be a remarkable result since previous empirical work had not paid very much attention to this variable[18]. With the exception of DSE which is not significant for VIIT in specifications (3) and (4), these results hold up in both samples of countries and in all the specifications estimated, suggesting that results are robust.

Turning now to the results for national-specific variables, we first note that all of them have the expected sign and are significant. Thus, differences in preferences, differences in the size of Spanish economy with respect to its partners and the geographical distance between Spain and its partner countries have a negative influence on both Vertical and Horizontal IIT. However, and what is more interesting, the effect of differences in human capital factor endowments differs between both types of IIT. VIIT seems to be stimulated by such differences between countries while their influence on HIIT appears to be negative. Again, these results appear to be robust since they hold up in all the specifications and also for the full sample of countries and for OECD countries[19]. Considering now the variable that measures the differences in relative technological capital endowment between countries, it has a positive influence on VIIT. We reach this result including this variables together with DHK and including it alone (specification 3 and 4, respectively). These results support, therefore, the hypothesis that VIIT is induced by differences in human and technological factor endowments between countries.

[18] Only recently, Greenaway et al. (1995) have analysed the effect of this variable on IIT with almost the same results.

[19] The only difference is that in the OECD sample DPCI does not appear to be significant for HIIT. Differences in human and technological factor endowments are not significant for HIIT either.

V. Concluding Remarks

Summarising, in this paper we have investigated the nature of Spanish IIT (vertical and horizontal) and tested whether the determinants of VIIT and HIIT differ. After a brief description of the level and evolution of the different types of IIT, we have explored whether disentangling the measure of IIT into VIIT and HIIT provides a better estimation of their determinants and clarifies some contradictory findings obtained in previous studies. Specifically, we have tested the extent to which comparative advantage arising from differences in technological and human factor endowments between countries may explain VIIT, while scale economies and horizontal product differentiation may account for HIIT. The results obtained here confirm the hypothesis of different determinants for vertical and horizontal IIT. Finally, we have found that foreign direct investment increases both types of IIT.

In any event, before concluding we would like to stress what seems to be the most relevant of the paper's findings, which is that the variables that can best explain the Spanish vertical IIT and -given its predominance- total IIT, are those capturing differences in factor endowments, particularly in technological and human capital. In this respect, it is important to recall that the adjustment costs derived from regional integration processes may not be as negligible as predicted by the standard monopolistic competition models of IIT.

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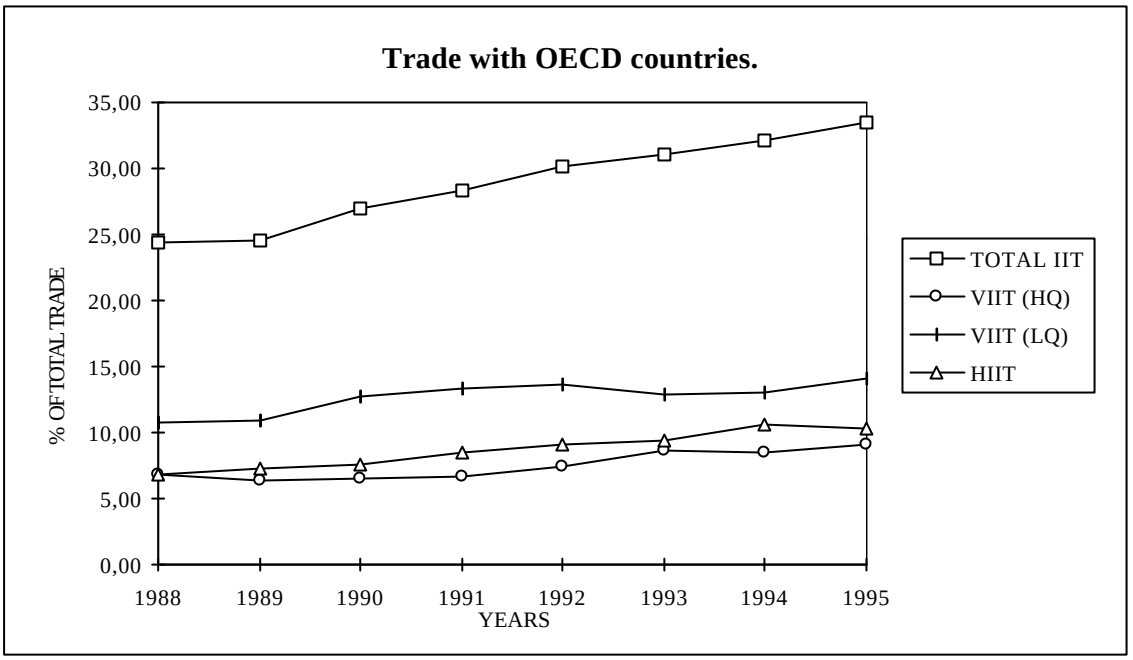
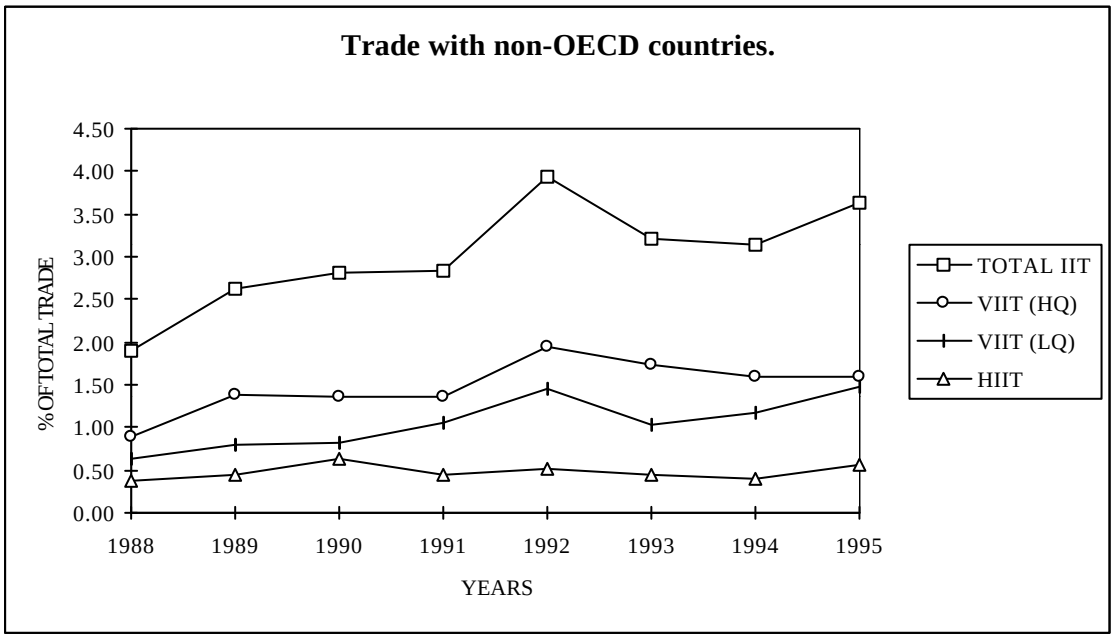
Figure 1 - Extent and dynamics of intra-industry trade (IIT) in Spain (1988-1995)





Source: Own calculations from COMEXT data base.

Table 1 - The nature of IIT in Spain by industry (% of total trade)

	OECD				NO OECD			
	TOTAL	VERTICAL		HORIZONTAL	TOTAL	VERTICAL		HORIZONTAL
		High Qual .	Low Qual.			High Qual.	Low Qual.	
Non-metallic minerals and mineral products								
1988	16,6	3,1	7,7	5,8	1,0	0,2	0,2	0,6
1992	26,6	4,6	10,6	11,3	0,8	0,2	0,2	0,4
1995	25,5	5,0	9,4	11,1	1,1	0,7	0,4	0,1
Ferrous and non-ferrous metals								
1988	18,8	5,2	10,8	2,9	1,7	0,8	0,9	0,0
1992	20,4	6,7	9,3	4,4	1,9	0,6	1,2	0,1
1995	22,9	5,2	14,5	3,1	1,7	0,8	0,8	0,1
Chemical products								
1988	21,2	6,3	10,1	4,8	2,6	1,3	1,0	0,2
1992	24,3	6,7	13,2	4,4	3,4	1,7	1,2	0,5
1995	29,9	7,7	15,5	6,7	3,7	1,6	1,4	0,6
Metal products								
1988	34,0	8,9	19,1	6,0	2,5	1,4	1,0	0,1
1992	36,3	12,5	16,4	7,4	3,6	2,5	0,6	0,5
1995	38,2	14,2	14,9	9,0	3,4	2,1	1,0	0,4
Agricultural and industrial machinery								
1988	24,4	7,1	13,3	3,9	1,7	1,2	0,4	0,1
1992	30,1	7,7	16,6	5,7	2,8	1,7	0,8	0,4
1995	33,5	10,8	17,2	5,5	3,0	1,8	0,8	0,4
Office and data processing machines								
1988	30,2	12,8	13,4	4,0	2,3	1,5	0,6	0,2
1992	32,6	16,1	12,1	4,4	7,8	5,9	1,0	1,0
1995	29,3	11,8	8,7	8,9	7,3	3,3	3,8	0,2
Electrical goods								
1988	24,4	8,8	10,3	5,3	2,6	1,5	1,0	0,1
1992	32,7	12,5	12,9	7,3	4,6	3,3	1,1	0,2
1995	36,0	13,3	15,8	6,9	4,2	2,1	1,8	0,4
Automobiles and parts								
1988	33,0	6,0	11,0	16,0	1,1	0,6	0,4	0,1
1992	39,3	3,8	17,4	18,0	8,3	7,2	0,5	0,6
1995	43,2	7,3	16,5	19,4	3,6	1,0	2,2	0,5
Other transport equipment								
1988	27,5	7,6	18,7	1,2	4,8	1,0	3,7	0,0
1992	26,0	3,0	9,7	13,3	13,3	1,1	9,2	3,0
1995	26,8	10,6	12,9	3,3	15,3	4,3	9,8	1,2
Food, beverages and tobacco								
1988	7,6	3,6	2,3	1,7	0,2	0,0	0,2	0,0
1992	12,6	4,7	5,1	2,8	1,3	0,7	0,4	0,3
1995	20,4	7,2	7,9	5,3	1,3	0,5	0,3	0,5
Textiles and clothing								
1988	18,4	5,7	7,2	5,5	1,3	0,5	0,5	0,3
1992	22,9	7,6	9,0	6,4	2,9	1,6	0,9	0,4
1995	25,8	9,6	10,7	5,5	3,3	1,9	0,9	0,5
Paper and printing products								
1988	22,0	4,8	11,4	5,9	7,4	1,8	1,4	4,1
1992	26,1	5,2	13,2	7,7	7,7	0,8	5,7	1,2
1995	24,7	6,0	12,2	6,4	6,3	1,5	3,2	1,6
Rubber and plastic products								
1988	36,1	5,3	20,5	10,3	1,9	1,1	0,4	0,3
1992	46,0	7,9	23,7	14,4	4,6	2,6	1,0	0,9
1995	47,5	14,6	16,8	16,0	6,7	3,5	1,6	1,7
Other manufacturing products								
1988	16,9	6,9	7,0	3,0	1,6	1,2	0,1	0,3
1992	17,4	5,6	9,2	2,6	1,9	0,4	1,3	0,2
1995	21,8	9,0	7,6	5,2	2,6	1,6	0,6	0,5
TOTAL MANUFACTURING								
1988	24,4	6,9	10,8	6,7	1,9	1,0	0,6	0,3
1992	30,2	7,6	13,6	9,0	3,9	2,1	1,3	0,5
1995	33,4	9,2	14,1	10,1	3,6	1,7	1,4	0,5

Source: Own calculations from COMEXT data base.

Table 2 - Variable definition, data sources and expected signs

		EXPECTED SIGN		
VARIABLE DEFINITION	**DATA SOURCE**	**TIIT**	**VIIT**	**HIIT**
HPD = horizontal product differentiation	COMEXT	+/-	-	+
TI = technological intensity in industry i: (% proportion of R+D staff in full employment)	Encuesta sobre actividades de I+D, INE	+/-	+	-
DSE = Dummy variable for industries with a middle range value of SE (defined as the interval between the minimum/maximum value of SE plus/less its standard deviation). Where SE = Scale economies: Minimum Efficient Scale/Relative Cost Disadvantage (Caves,1981)	Encuesta Industrial. INE	+	+/n.s.	+
HPDSE = HPD*DSE		+/-	-/n.s.	+
TIDSE = TI*DSE		+/-	+/n.s.	-
FK = presence of foreign capital in industry "i". (% of foreign share holding in total sector's share capital)	Martín y Velázquez (1996)	+	+	+
DPCI = difference in per capita income between Spain and country k. (Measure of Balassa,1986)	Penn World Tables 5.6	-	-	-
DHK = difference in human capital endowments between Spain and country k.	Benhabib and Spiegel (1994)	+/-	+	-
DTK = difference in technological capital endowments between Spain and country k.	FUNCAS	+/-	+	-
DGDP = differences in GDP between Spain and country k. (Measure of Balassa, 1986)	Penn World Tables 5.6	-	-	-
DISTE = geographical distance between Spain and country k (Kms.)	PCGLOBE	-	-	-

n.s.: insignificant.

Table 3 - Estimated regressions for total, vertical and horizontal IIT. Full sample of countries. Non linear Least Squares. Logistic function. 1988-1992.

	Total ITT		**Vertical IIT**		**Horizontal IIT**	
Variables	**(1)**	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**
Constant	-0.15	-0.55	-0.30	-0.84	-1.76	-1.77
	(-3.23)***	(-17.2)***	(-6.11)***	(-24.6)***	(-19.0)***	(-23.7)***
HPD	-1.63	----	-2.01	----	0.35	----
	(-17.7)***		(-20.0)***		(2.91)***	
DSE	-0.01	----	-0.06	----	0.15	----
	(-0.51)		(-1.69)*		(3.07)***	
TI	2.22	----	1.79	----	-3.13	----
	(5.80)***		(4.50)***		(-4.17)***	
HPDSE	----	-0.96	----	-1.22	----	0.79
		(-8.13)***		(-9.07)***		(6.00)***
TIDSE	----	4.47	----	4.16	----	-1.89
		(9.01)***		(8.22)***		(-1.89)*
FK	0.07	0.26	0.15	0.39	0.58	0.54
	(1.24)	(4.41)***	(2.59)***	(6.31)***	(6.13)***	(5.84)***
DPCI	-8.19	-8.53	-8.69	-8.96	-2.75	-2.71
	(-16.2)***	(-16.2)***	(-14.6)***	(-14.5)***	(-1.65)*	(-1.63)*
DHK	1.75	3.12	2.10	3.63	-7.37	-7.40
	(1.85)*	(3.23)***	(1.96)**	(3.31)***	(-2.34)**	(-2.35)**
DGDP	-2.15	-2.24	-2.38	-2.47	-1.55	-1.53
	(-27.8)***	(-27.4)***	(-27.2)***	(-26.5)***	(-7.61)***	(-7.54)***
DIST	-21.08	-22.69	-22.62	-23.99	-84.36	-83.61
	(-31.7)***	(-31.3)***	(-28.9)***	(-28.2)***	(-14.6)***	(-14.5)***
Adj. R^2	0.305	0.284	0.292	0.265	0.127	0.126
N	12800	12800	12800	12800	12800	12800
F	702.9	726.5	660.8	661.9	233.2	263.6

t statistics in parenthesis. *** 1% level of significance, ** 5%, * 10%.

Table 4 - Estimated regressions for vertical and horizontal IIT. OECD sample of countries. Non linear Least Squares. Logistic function. 1988-1992.

	Vertical IIT			Horizontal IIT		
Variables	**(1)**	**(3)**	**(4)**	**(1)**	**(3)**	**(4)**
Constant	-0.26	-0.42	-0.76	-1.77	-1.74	-1.66
	(-4.01)***	(-5.36)***	(-9.86)***	(-14.9)***	(-13.4)***	(-11.9)***
HPD	-1.91	-1.94	-1.93	0.36	0.37	0.37
	(-15.2)***	(-15.4)***	(-15.5)***	(2.37)**	(2.43)**	(2.44)**
DSE	-0.08	-0.06	-0.07	0.16	0.16	0.16
	(-1.67)*	(-1.36)	(-1.63)	(2.50)**	(2.44)**	(2.53)**
TI	1.96	1.92	1.99	-3.24	-3.25	-3.26
	(3.90)***	(3.80)***	(4.01)***	(-3.39)***	(-3.40)***	(-3.40)***
FK	0.18	0.18	0.16	0.59	0.60	0.61
	(2.44)**	(2.39)**	(2.20)**	(4.95)***	(4.99)***	(5.11)***
DPCI	-9.39	-6.76	-13.58	1.21	-0.14	2.05
	(-8.16)***	(-6.71)***	(-12.2)***	(0.54)	(-0.08)	(0.89)
DHK	7.83	----	17.97	-4.68	----	-6.67
	(3.29)***		(7.49)***	(-1.08)		(-1.48)
DTK	----	0.92	1.43	----	-0.32	-0.45
		(5.35)***	(8.20)***		(-1.17)	(-1.55)
DGDP	-2.58	-1.91	-2.26	-1.68	-2.09	-1.84
	(-18.0)***	(-13.7)***	(-16.2)***	(-5.96)***	(-8.58)***	(-6.27)***
DIST	-26.34	-37.30	-15.27	-88.76	-81.39	-89.22
	(-11.2)***	(-14.3)***	(-10.2)***	(-11.8)***	(-14.3)***	(-11.7)***
Adj. R^2	0.229	0.232	0.236	0.09722	0.09723	0.09738
N	6400	6400	6400	6400	6400	6400
F	238.7	242.0	220.3	87.14	87.15	77.71

t statistics in parenthesis. *** 1% level of significance, ** 5%, * 10%.

ABSTRACT

The Nature and Causes of Intra-Industry Trade: Back to the Comparative Advantage Explanation? The Case of Spain

The aim of this paper is to contribute empirically to the knowledge of the nature and causes of intra-industry trade (IIT), distinguishing between vertical and horizontal IIT. To this end, we estimate a more general empirical model than those used in previous studies, by introducing simultaneously both national and industry-specific variables which include measures for human and technological capital endowments. The results show that vertical IIT is positively related with industry technological intensity and differences in human and technological capital endowments between countries. On the other hand, horizontal IIT is explained by the traditional monopolistic competition model.

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