Dynamics and Nature of Intra-Industry Trade and Labour-Market Adjustment: Evidence for Spain

José Vicente Blanes Cristóbal♣

(Universitat Autònoma de Barcelona)

Paper presented at the

Workshop on Recent Developments in Research on

Intra-Industry Trade and Labour Market Adjustment

18th and 19th May, 2001

Leverhulme Research Centre

School of Economics, University of Nottingham

Abstract

This paper tests the smooth adjustment hypothesis considering the nature of intra-industry trade. It explores the link between marginal, horizontal and vertical intra-industry trade and the adjustment of employment in the Spanish manufacture industries between 1988 and 1995. Evidence is found encouraging the needs of include in further research the nature of intra-industry trade when analysing its relationship with trade-induced adjustment costs.

♣ Dept. d'Economia Aplicada, Edifici B, Universitat Autonoma de Baarcelona, 08193 Bellaterra (Barcelona) Spain. e-mail: JoseVicente.Blanes@uab.es. Fax: +34 93 581 22 92.
Until September 2001: School of Economics, University of Nottingham. University Park, Nottingham, NG7 2RD, UK. e-mail: vicente.blanes@nottingham.ac.uk, Fax. +44 (0)115 8466129. Fax: +44 (0)115 951 4159

Dynamics and Nature of Intra-Industry Trade and Labour-Market Adjustment: Evidence for Spain

I. Introduction

Since the experience of the 6 first States members of the European Union, with a predominant increase of intra-industry trade and low adjustment costs, most economist agree on the hypothesis that trade liberalisation will entail low trade-induced adjustment costs if intra-industry trade prevails[1]. The new models of trade based on monopolistic competition and assuming horizontal differentiation of products, as Krugman (1979, 1981) and Lancaster (1979), contributed to extend such idea. It was definitively established in the new model of international trade developed in Helpman and Krugman (1985) by the integration of the traditional theory of international trade (the Hecksher-Ohlin Model) and the new theories based on monopolistic competition.

The rationale behind this hypothesis can be concisely summed up as follows. According to the Hecksher-Ohlin Model, in response to the new good's relative prices, free trade induce countries to a deeper specialisation on the industries where they posses comparative advantage, that is, inter-industry specialisation. But if the relative factor endowments of countries are very similar and industries consist on a range of differentiated varieties with scale economies on its production, similarity on consumer's tastes will create an exchange of different varieties of the same products or intra-industry trade. So, in that case countries are going to experience intra-industry specialisation. In any case, the adaptation to the new situation requires de re-location of a part of the production factors. Given that the workers and managerial skills are more similar within industries than between different industries, such a re-location will be easy if it happens within the same industry. That argument is the basis for the smooth adjustment hypothesis (SAH), which we try to contrast in this paper.

Despite of the fact that this hypothesis is a conventional wisdom, the empirical evidence about a negative relationship between intra-industry trade and trade-induced

[1] Balassa (1966) opened this debate.

adjustment costs is very scarce. The first published work on that subject is Brülhart and Hine (1999). They present a set of papers about the measurement of intra-industry trade and case studies about 8 European countries, Spain being not included. However, as the authors himself express, these papers suffer from serious limitations from the measurement of adjustment cost to the econometric methodology employed. Some of those limitations were improved in the paper of Brülhart (2000).

However, there is an aspect that all the literature about intra-industry trade and trade-adjustment cost has forgotten until now[2]: the nature, vertical or horizontal, of the differentiation of the traded varieties. In that way, while the new standard model of international trade (Helpman and Krugman, 1985) assumed horizontal differentiation, recent empirical work on the nature of intra-industry trade has revealed that intra-industry trade on vertically differentiated products is significant. The models that assume vertical differentiation, as Falvey and Kierzkowski (1987) and Shaked and Sutton (1984), which were somehow ignored in past research are being considering again. As varieties differentiated vertically have different factor intensities and countries specialisation will depend on their relative factor endowment, the nature of intra-industry trade reveals as a very relevant feature for correctly test the SAH.

This paper is a first approach to this issue for the Spanish economy but also tries to improve previous work. So, apart from test the hypothesis that intra-industry trade causes lower trade-induced adjustment costs than interindustry trade, the main concern of this paper is to explore if such effect depend on the nature of intra-industry trade.

The paper is organised as follows. Next section explains the SAH and how it is affected by considering the nature of IIT. In the third section, we introduce the different indexes to measure IIT and apply them to Spanish manufacture data. In section IV we econometrically explore de relationship between IIT and adjustment costs, after introducing the proxy measure for such costs. Last section concludes.

[2] A recent exception being Brülhart and Elliot (2000)

II. The nature of Intra-industry trade and the SAH

As Brülhart (1999) says, there is not yet a theoretical model that supports the SAH. Traditional models of international trade show how the change in relative prices due to trade liberalisation will led to movements of factors of productions from industries suffering the competence of imports to industries were the country have comparative advantage[3]. In the other hand, the most generally accepted model of IIT, the one that assumes horizontal differentiation (Helpman and Krugman, 1985), eliminates that question by assuming that the varieties of a product present equal factor intensities. Brülhart (1999) do not solve that issue but he is the first to establish the SAH with precision. The hypothesis can be spelt out in four steps.

First, adjustment costs are defined as the sum of resources utilised in adapting factors to alternative uses and the resources let unemployed because of sticky factor prices. Second, assume that industries are defined in such a way that adjustment costs from a shift in production between sub-industries are lower than the adjustment costs from an equiproportional shift in production between industries. Third, define intra-industry trade in such a way that changes in world market prices or in trade barriers result in greater changes of relative demand between sub-industries than between industries, and inter-industry trade as the opposite configuration. Given the three former steps, intra-industry trade will entail lower adjustment costs than inter-industry trade, *ceteris paribus*[4].

Moreover, Brülhart (1999) also defends its measure of marginal IIT as the more relevant in an adjustment context[5].

However, this definition of the SAH and the Brülhart index of marginal IIT ignore the recent advances in the literature about the nature of IIT. There is a growing empirical evidence for the importance of vertical IIT. In two early papers, Greenaway, Hine and Milner (1994, 1995) show that most of UK IIT is on products vertically differentiated. Gordo and Martín (1996) and Blanes and Martín (2000) find the same evidence for Spain[6]. Those results

[3] If markets are not perfectly competitive, as in the cases of specific factors or wage rigidities, the adjustment process can produce unemployment, depending its duration on the degree of market imperfections.
[4] Brülhart (1999), pp. 42.
[5] Brülhart (1994). See Section III for a definition of that index.
[6] See Brülhart and Hine (1999) for evidence about other European countries.

had let attention again to the models of IIT with vertically differentiated products, as Falvey (1981), Falvey and Kierzkowski (1987), Shaked and Sutton (1984) and Motta (1994). In that kind of models, vertical product differentiation means that varieties differ in quality and in their factorial intensity and the international pattern of trade will be established according to the differences between countries in their relative factor endowments. Assuming a direct relationship between quality and capital intensity and between the relative endowment of capital and the country level of per capita income, after free trade is allowed the richest countries would specialise in the higher quality varieties and the poorest countries in the lower quality varieties.

The main implication for the SAH derived from the importance of vertical IIT is that the second of its steps don't stand any more. That is, is hard to maintain a definition of industries in a way that the adjusted costs from a shift in production between sub-industries will be lower than the adjustment costs from an equiproportional shift in production between industries. Given that vertical IIT implies the specialisation in and the trade of varieties with different factorial intensity, such a trade would cause shifts in the relative factors of production demand and would lead to a scenario similar to the inter-industry trade one. That problem has been resolved in measuring and determining the causes of IIT by the methodology proposed by Greenaway, Hine and Milner (1994) to identify its nature[7]. However, this is not the case for marginal IIT.

So, we conclude that using measures of total IIT or total marginal IIT in testing the SAH could lead to misleading results because they encompass two effects of IIT on adjustment cost that are of a different sign. Therefore, its seems necessary to include measures of IIT identifying its nature when trying to test the SAH.

[7] The identification of the nature of IIT has revealed very useful in determining the causes of IIT, as it is shown in the papers of Greenaway, Hine and Milner (1994, 1995) and in Blanes and Martín (2000). For example, in the latest paper, by estimating the determinants of IIT according to its nature, the authors resolve the elusive empirical identification of the role of scale economies as a positive determinant of IIT. More over, they find evidence that while the traditional monopolistic competition model explains horizontal IIT, differences between partners in their relative factorial endowments, especially in technological and human capital, explain vertical IIT.

III. Intra-industry trade in Spanish manufactures

To measure IIT we use the index proposed by Grubel and Lloyd (1975) adjusted for categorical aggregation (Greenaway and Milner, 1983)[8]:

$$GL_i = \frac{\sum_{j=1}^{J}\left(X_{ij} + M_{ij}\right) - \sum_{j=1}^{J}\left|X_{ij} - M_{ij}\right|}{\sum_{j=1}^{J}\left(X_{ij} + M_{ij}\right)} \times 100 \qquad (1)$$

where X are exports, M imports, i is the industry and j are varieties pertaining to the industry i. The index is equal to 100 if all trade is IIT ($X_{ij} = M_{ij}$), and it is equal to 0 if there is no IIT at all)(X_{ij} or M_{ij} are zero).

As well as for the rest of that section, we use Spanish bilateral trade data (in order to avoid geographical aggregation) with 62 countries accounting for 95% of Spain trade in manufactures and at the 6 digit level of the Combined Nomenclature (EUROSTAT). Industries are grouped according to the NACE-CLIO R25 classification and to its demand dynamics and technological intensity[9]. As shown in Table 1, though there are differences between industries, the level of IIT in the Spanish industries is important, considering the high level of data disaggregation being used. It has also been continuously increasing along the period analysed. The IIT index is higher for sectors with medium demand and technology, which are also the ones that concentrate the main amount of trade. Rubber and Plastic Products, first, and the Automobile Industry, next, are the sectors with the highest indexes of IIT in the Spanish trade. On the contrary, IIT is lower in the less dynamic demand and lower technology level industries.

Nature of Intra-Industry Trade

[8] Index of IIT are discussed in Greenaway and Milner (1981) (1983), Kol and Mennes (1989), Fariñas (1992) and Vona (1992).

As mentioned, in the last decade the need to identify IIT nature was pointed for some researchers. The models explaining horizontal and vertical IIT differ and so should be their effects on trade-induced adjustment costs. The most used methodology to identify IIT nature is the one proposed by Abd-el-Rahman (1991) and Greenaway, Hine and Milner (1994). This methodology uses relative unit values per tonne of exports and imports as a proxy for prices, assuming that price properly reflect quality. Although prices may be imperfect indicators of quality, the rationale for using unit values as its indicator is that even with the consumer's imperfect information, a product sold at a higher price must be of better quality than a product sold at a lower price[10]. So, the Grubel and Lloyd IIT index (equation 1) can be divided into horizontal IIT (HGL_i) and vertical IIT (VGL_i):

$$GL_i = HGL_i + VGL_i \tag{2}$$

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% (α):

$$1-\alpha \leq \frac{VU_{ij}^{x}}{VU_{ij}^{m}} \leq 1+\alpha \tag{3}$$

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

$$\frac{UV_{ij}^{x}}{UV_{ij}^{m}} < 1-\alpha \qquad \text{or} \qquad \frac{UV_{ij}^{x}}{UV_{ij}^{m}} > 1+\alpha \tag{4}$$

Moreover, as long as vertical IIT represents specialisation in varieties of different quality that require different factor intensity and/or technical knowledge, and it indicates dissimilar levels of development and income between partner countries, we consider it worthwhile to examine deeply vertical IIT. We want to ascertain whether Spain is specialised in low or high quality varieties. Thus, High Quality Vertical IIT ($HQVGL_i$) is defined when

[9] See Martín (1998) for a discussion of that classification.

[10] For a further discussion about the problems and advantages of using unit values indexes per tonne as an approximation of prices and quality see Greenaway, Hine and Milner (1994, 1995).

exports have higher unit values than imports $\left(\frac{UV_{ij}^{x}}{UV_{ij}^{m}} > 1+\alpha\right)$ and Low Quality Vertical IIT ($LQVGL_i$) when the contrary is true $\left(\frac{UV_{ij}^{x}}{UV_{ij}^{m}} < 1-\alpha\right)$.

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

Vertical IIT is more significant than Horizontal IIT in most of the Spanish industries (Table 2). Moreover, Spain seems to be specialisate in varieties of lower quality in all industries. Although differences between Horizontal and Vertical IIT are lower in industries with moderate demand, in those industries is were we found a higher gap between exported and imported varieties quality. Those results hold up using a wide α range (0.25), even though the ratio of HIIT in total IIT increases (see Table A1 in the Annex). This is relevant if we consider that using α=0.25 now HIIT prevails in the main Spanish trade sector: the Automobiles Industry, 1995 being an exception.

Interesting results come from a geographical break down[11]. Previous results capture only the pattern of IIT with OECD countries. With non-OECD countries, de gap between HIIT and VIIT is even greater and, more interesting, VIIT of high quality Spanish exports is greater with those countries, when the contrary is true with OECD countries. These results are relevant because they are consistent with theory, both models of HIIT and models of VIIT, provided we consider Spain as an economy placed at a more similar level of development with OECD countries than with non-OECD countries but, at the same time, placed at a lower level of development that most OECD countries and at a higher level than non-OECD countries.

Dynamics of Intra-Industry Trade

The traditional way of looking at the dynamics of IIT was to calculate it changes between two periods. From Table 1, we can conclude that IIT increased between 1988 and

1995 in all Spanish manufacturing industries, with the exception of Office and Data Processing Machines, which decreased between 1992 and 1995. Though there are differences between industries and periods, Table 2 shows a slight increase on the share of Horizontal IIIT in Total IIT and a slight decrease on the share of High quality Vertical IIT in Spain.

However, since Greenaway and Milner (1983), it has been considered that the growth of the GL index is not adequate to capture the dynamics of IIT if we aim to correctly explore trade-induced adjustment costs. The GL index is a static measure in the sense that it captures IIT for a particular year. As pointed by Hamilton and Kniest (1991), what is relevant is how IIT changes in the margin. The showed that the observation of a high proportion of IIT in one particular time period does not justify a priori any prediction of the likely pattern of change in trade flows. Even an increase in the GL index between two periods can hide a change in trade flows related more with a inter-industry specialisation than with a intra-industry specialisation, as is the case of an increase in inter-industry trade reducing industry' trade imbalance. Moreover, an increase in the GL index can be related either to a reduction in the trade surplus of an industry or to a reduction on its trade deficit[12].

The index proposed by Brülhart (1994) is the most generally used[13]:

$$MIIT = A = 1 - \frac{\left|(X_t - X_{t-n}) - (M_t - M_{t-n})\right|}{\left|X_t - X_{t-n}\right| + \left|M_t - M_{t-n}\right|} \tag{5}$$

or

$$A = 1 - \frac{\left|\Delta X - \Delta M\right|}{\left|\Delta X\right| + \left|\Delta M\right|} \tag{6}$$

This index varies between 0 and 1, where zero indicates trade in the particular industry to be completely of the inter-industry type and one completely of intra-industry type.

The index can be aggregated across k industries of the same level of statistical aggregation i by applying the following formula:

[11] These results are available from the author by request.
[12] As shown in Figure A1 from the annex.

$$A_{tot} = \sum_{i=1}^{k} w_i A_i \qquad \text{where} \qquad w_i = \frac{|\Delta X|_i + |\Delta M|_i}{\sum_{i=1}^{k} \left(|\Delta X|_i + |\Delta M|_i \right)} \tag{7}$$

According to Brülhart, the A index reveals the structure of the change in imports and exports flows. More over, if adjustment costs depend on the structure of this change, a high value of A – which results when both imports and exports increase o decrease in a similar way- would be related with low trade-induced adjustment costs since it indicates a intra-industry re-location of production factors. However, a low value of A – resulting from changes of a different sign in imports and exports – would reveal a higher inter-industry specialisation and hence higher adjustment costs.

The A indexes for Spanish manufacturing industries are shown in Table 3. The first we can infer from that table is that although the observed increase in de GL indexes of IIT, the increase on Spanish manufacture trade has been mainly of inter-industry nature. For the total of industries, A is only 0.15 for 1988-1995. The maximum value of A is 0.31 in the Automobiles and Parts industry, being lower than 0.2 in the rest of industries[14].

Although periods and categorical aggregation are not exactly the same, our results agree with Martín (1992). She found that the increase in Spanish manufacturing GL indexes between 1985 and 1992 was explained by a deterioration of the trade surplus in the sectors were it was positive before Spain jointed the EEC and not by a simultaneous increase in exports and imports.

[13] Other indexes are Hamilton and Kniest (1991) and Greenaway, Hine, Milner and Elliot (1994). Oliveras and Terra (1997) and Azhar, Elliot y Milner (1998) stress the shortcomings of the Brülhart (1994) index.

[14] The literature of Marginal IIT stresses the need of use inflation-adjusted trade flows to avoid capturing not real increases. We have followed the general methodology of using the GDP deflator to adjust imports and exports from inflation. However, as trade Spanish prices show very different evolutions for imports and exports (and also with respect to GDP), we have calculate alternative measures of A using imports and exports deflators. Results, available on request, show a slight increase in the A indexes in most industries and periods but without relevant changes in the industry ranking or temporal evolution. We can conclude that the bias due to the use of the GDP deflator is not relevant. We have also reply the results in section 4 using these measures without relevant changes being noticed.

Hence, according to the results in Table 3, it seems that trade-induced adjustment costs in Spain should be significant. They should have been more similar to the ones predicted by the traditional models of trade that the ones predicted by the models of (horizontal) IIT.

Nature and Dynamics of Intra-industry Trade

As mentioned before, to identify the nature of intra-industry trade flows could be useful to properly establish the relation between such trade and trade-induced adjustment costs. Although there is not any measure to compute marginal IIT according to its nature, a first approach to this subject could be to classify industries according to the main nature of it IIT and then calculate and compare the A indexes for the resulting industry groups. After doing that for the industry classification of the Encuesta Industrial, Table 4 shows that sectors with a share of horizontal IIT higher that 50% of total IIT present a higher A index, specially considering an α equal to 0.25.

IV. Intra-Industry Trade and Trade-Induced Adjustment Costs: Results

In this section we explorer the existence of a negative relationship between IIT and trade-induced adjustment costs. This analysis suffers for the fundamental shortcoming that theory does not equip us with a model indicating with control variables to include in a fully specified model of market adjustment. So, after presenting the measure to capture adjustment costs, we proceed to a correlation analysis before the regression analysis. The correlation analysis could help us to find relevant control variables to include in the forthcoming regression analysis.

Adjustment cost measure

According to the traditional model of international trade, a (bigger) trade aperture would cause a re-location of production factor from declining import-competing sectors to expanding comparative-advantage sectors. We can consider that labour would be the most sensible factor to these pressures. Hence, *ceteris paribus*, employment will decrease in declining sectors and it will increase in expanding sectors and these changes will be greater/lower as bigger the inter-industry/intra-industry component of trade expansion. So, we can use changes in industry employment as an indirect indicator to trade-induced adjustment costs. The papers included in Brülhart and Hine (1999) consider that IIT would have a positive effect on employment. However, we believe that this is a wrong interpretation. According to the SAH, changes in industry employment, either positive o negative, would be lower if trade expands by the simultaneous increase/decrease in exports and imports in the same industry (higher A index) rather than by increases and decreases of trade in different industries. That is why we use the absolute value of industry employment changes between the initial and final year as a proxy to adjustment cost:

$$AVEC_i = \frac{\left|E_i^{92} - E_i^{88}\right|}{0.5 \times \left(E_i^{88} + E_i^{92}\right)} \qquad (8)$$

That variable has been calculated using data from the Encuesta Industrial (INE) and, as the rest of the variables used in that section, for 75 industries or groups of industries between 1988 and 1992[15]. Our hypothesis is that IIT indexes should present a negative relationship with that measure, except for vertical IIT measures for which we expect a positive relationship.

Correlation Analysis

Although correlation analysis does not indicate any causation relationship, it offers a first sight about the existence of some relationship between the variables analysed.

As shown in Table 5, all IIT measures, without considering its nature, present a positive correlation with the absolute changes in industry employment. The correlation is significant in all cases, though the level is lower for changes in the GL index. We can expect a higher correlation coefficients for sectors more open to trade, since we can reasonably think that the impact of trade in the economic activity of those industries should be bigger that in the less opened ones. This hypothesis is confirmed by the results in column 3 and 4 of Table

[15] In 1993 the structure of that survey changed and it is not possible to connect the series at an enough disaggregated level.

5. However, in that case the correlation coefficient is not significant for changes in the GL index.

The computed correlation coefficients between AVEC and the GL indexes according to its nature, reveal different behaviours that are hide using total IIT indexes (Table 6). First, considering changes in the GL index, now only the one for horizontal IIT is significant, and, indeed, it is bigger to the one obtained for changes in total GL. The sign for changes in vertical GL even positive, as expected, is not significant. These results are robust to the range of unit values variation chosen. Second, results are less satisfactory when using GL indexes for initial and final period years, since they seem to reveal a negative and significant relationship between vertical IIT and absolute changes in employment. Third, coefficients of correlation and signification levels are bigger for the more open sectors (Table 7), with some exceptions.

Finally, we have computed the correlation coefficients between the A index and absolute value of changes in industry employment grouping industries according to its main kind of IIT (Table 8). While, the A index for all sectors together showed a negative and significant correlation coefficient, now it is only true for those industries where horizontal IIT is the most relevant type of IIT, according to our hypothesis. However, this result only hold up when classifying sectors according to 1992 trade unit value data and not with 1988 data. Although to distinguish between more and less open industries increases the value of the correlation coefficients for the first ones, none of the coefficients are significant in that case.

Regression Analysis

Because the lack of a theoretical model, our econometric model will concentrate on that variables that feature explicitly in the SAH (IIT measures) and we will also include a measure for the degree of industrial trade openness since it affected results in the correlation analysis. However, as we are very luckily to face a misspecification problem, we test fore omitted variables. We compute the Ramsey regression specification error test (RESET test) which estimate the original model augmented by the second, third and four powers of the OLS predicted values of the dependent variable. Under the assumption of no misspecification, the coefficients of the powers of the fitted values will be zero.

Hence, we estimate the following equation:

$$AVEC_i = \alpha + \beta TO_i + \gamma IIT_i + \mu_i \tag{9}$$

Where i is the industry of the Encuesta Industrial (i=1,…, 75)

AVEC is the absolute value of industry i employment change (see eq. 8)

TO is the industry degree of trade openness (see note Table 5), and

IIT is the measure of IIT included in each model specification.

We expect a negative coefficient for γ except for the measures of vertical IIT. We estimate two different groups of specifications of equation (9). First, we include alternatively the different measures of IIT considered before (Table 9). Second, we only use the index A of marginal IIT but grouping industries according to its predominant kind of IIT' nature (Table 10). In both cases we present here the results obtained by using α = 0'25[16]. In all specifications, data refers to changes between 1988 and 1992 and equations have been estimated by OLS with heteroskedasticity-consistent standard errors.

Results show that omitted-variable problems do not seem pervasive, since the RESEST test is not significant in all regressions. The coefficients for the different measures of IIT are negative except for the changes in the Vertical GL index (ΔVGL) and Low-quality Spanish exports ($\Delta LQVGL$), which are also not statistically significant. The coefficient for the Marginal IIT (A) is negative and significant at the 99% level, as well as the coefficients for initial and final GL indexes. Changes in the GL index also present a negative coefficient, but is only statistically significant at the 90% level. However, when we include in the regression that index but distinguishing the nature of IIT, we find, in accordance with our hypothesis, that only increases in horizontal IIT (ΔHGL) have a negative and statistically significant effect on employment changes. Observing, now, the initial and final values of the GL index according to the nature of IIT, the index of Horizontal IIT is negatively related with the changes in employment in both years. The coefficients for Vertical IIT are also negative, but results are less robust than for Horizontal IIT since statistical significance depends on the year and relative quality of Spanish exports considered.

If we now analyse deeply the effect of Marginal IIT (A index) on employment changes (AVEC), we observe different results depending on the kind of product differentiation prevailing in each industry, although results depend on the industry criteria classification (1988 or 1992 imports and exports relative unit values data). So, if we used data from 1988 to classify industries, results are against our hypothesis: the only negative and statistically significant coefficient is the one for sectors exchanging mainly vertically differentiated varieties and with low-quality Spanish exports. On the other hand, classifying industries according to 1992 data, results confirm our hypothesis: marginal IIT have a negative and statistically significant effect over trade-induced adjustment costs only in those industries trading mainly horizontally differentiated varieties, i.e., trading varieties with the same or similar factor intensities.

V. Concluding Remarks

In this paper we have investigated the pattern of Spanish IIT, both marginal IIT and nature of IIT, and the effects of the different measures of IIT on trade-induced adjustment costs. More precisely, we have explored whether IIT have different effects on adjustment costs depending on its nature and test if the SAH only hold up when considering horizontal IIT.

This paper provides evidence that although according to the GL index IIT has steadily grew in Spain during the period 1988 to 1995, the origin of this growth seems to be an increase in inter-industry trade flows rather than a simultaneous increase in exports and imports since values obtained for the A index are very low. However, marginal IIT is slightly bigger for these industries were trade of horizontal differentiated varieties prevails. These results confirm the ones in Martín (1992) who found that the increase in Spanish manufacturing GL indexes between 1985 and 1992 was explained by a deterioration of the trade surplus in the sectors were it was positive before Spain jointed the EEC. The paper also finds evidence that vertical IIT prevails in total Spanish manufacturing IIT. These results suggest that trade-induced adjustment costs in Spain should have been more similar to the

[16] Table A2 in the Annex shows the alternative results to Table 9 considering α = 0'15. It is not possible to estimate Table 10 using that α since we don't have enough observations for some industry groups.

ones predicted by traditional models of (inter-industry) trade than to the smooth adjustment process predicted by model of (horizontal) intra-industry trade.

However, our correlation and regression analysis seems to hold the SAH. We find negative and statistically significant coefficient for the effect of the different measure of (total) IIT on the absolute value of employment change. This evidence is less strong for changes in the GL index but, interestingly, when considering the nature of IIT results show that changes in the GL index are negatively relate to trade-induced adjustment cost when IIT is horizontal. However, distinguishing the nature of IIT also leads to results that are hard to explain by models of IIT, as the negative effect of initial level of Vertical IIT on the industry employment change. However, the pervasive results obtained for Vertical IIT indexes are not as robust (to the variation range of imports and exports unit values used to identify the nature of IIT and to the year chosen to identify it) as it is for horizontal IIT. Finally, and which we consider to be the main result, when we relate the Marginal IIT index and the nature of such trade, the effect of Marginal IIT on changes in employment differ according to the nature of IIT. The A index only have a negative and statistically significant coefficient for these industries where horizontal IIT prevails, classifying industries according to the final year. However, this result is not robust to the year chosen to classify industries.

Before concluding, we like to stress that the research carried in that paper to test the SAH suffers for relevant methodological shortcomings, both because the non existence of a theoretical model and because data limitations. So, as suggested by Brülhart and Hine (1999), better measures of adjustment cost should distinguish inter and intra-industry dimensions, as well as should use flows rather than changes in stocks. The inclusion of further time periods might also improve results, allowing using panel data techniques. It would, for example, help to capture the timing between changes in trade and effects on industry performance[17]. It would also allow introducing in the econometric analysis control variables that affect all industries, as the economic cycle. More precisely, in the Spanish economy case, a period that includes a complete economic cycle, instead of starting at an economic growth year and finish in a year of economic crisis, would avoid a possible bias. Finally, further research focused on vertical IIT instead of total IIT could be fruitful, since several papers have found that this is the prevailing kind of IIT in most European economies.

[17] Brülhart (2000) address to both subjects, improving the results obtained in Brülhart and Hine (1999).

REFERENCES

Abd-el-Rahman, K (1991): "Firms' Competitive and National Comparative Advantages as Joint Determinants of Trade Composition", *Weltwirtschaftliches Archiv*, vol. 127, pp. 83-97.

Azhar, Elliott, R. and Milner, C. (1998): "Dynamic Reasurement of Intra-Industry Trade and Adjustment: A Geometric Reappraisal", *Weltwirtschaftliches Archiv* vol. 134, n. 3, pp. 404-422.

Balassa, B. (1966): "Tariff Reductions and Trade in Manufactures Among the Industrial Countries", *The American Economic Review*, vol. 56, pp. 466-473.

Blanes, J. V. and Martín, C. (2000): "The Nature and Causes of Intra-Industry Trade: Back to the Comparative Advantage Explanation? The Case of Spain", *Weltwirtschaftliches Archiv*, vol. 136, nº 3, pp. 423-441.

Brülhart, M. (1994): "Marginal Intra-Industry Trade: Measurement and Relevance for the Pattern of Industrial Adjustment", *Weltwirtschaftliches Archiv*, vol. 130, pp. 600-613.

Brülhart, M. (1999): "Marginal Intra-Industry Trade and Trade-Induced Adjustment: A Survey", en Brülhart, M. y Hine, R. C. (eds.) (1999), cap. 3, pp. 36-69.

Brülhart, M. (2000): "Dynamics of Intra-Industry Trade and Labor-Market Adjustment", *Review of International Economics*, vol. 8, nº 3, pp. 420-435.

Brülhart, M. and Elliot, R. (2000): "Labour-Market Effects of Intra-Industry Trade: Evidence for the United Kingdom", GLM Research Paper 2000/21.

Brülhart, M. and Hine, R. C. (eds.) (1999): Intra-Industry Trade and Adjustment. The European Experience, Macmillan, London.

Falvey, R.E. (1981): "Commercial Policy and Intra-Industry Trade", *Journal of International Economics*, vol. 11, pp. 495-511.

Falvey, R.E. and Kierzkowski, H. (1987): "Product Quality, Intra-Industry Trade and (Im)Perfect Competition", en Kierzkowski. H. (ed.) (1987), Protection and Competition in International Trade, Clarendon Press, Oxford, cap. 11, pp. 143-161.

Fariñas, J. C. (1992): "La especialización comercial exterior: una tipología de índices para su cuantificación", en García, J. L. (Coord.) (1992): Economía Española, cultura y sociedad: homenaje a Juan Velarde Fuentes ofrecido por la Universidad Complutense, EUDEMA, Madrid.

Gordo, E. and Martín, C. (1996): "Integración económica, comercio intra-industrial y costes de ajuste", *Revista de Economía Aplicada*, 12, Vol. IV, pp. 151-164.

Greenaway, D. , Hine, R. C. and Milner, C. (1994): "Country-Specific Factors and the Pattern of Horizontal and Vertical Intra-Industry Trade in UK", *Weltwirtschaftliches Archiv*, vol. 130, nº 1, pp. 77-100.

Greenaway, D. , Hine, R. C. and Milner, C. (1995): "Vertical and Horizontal Intra-Industry Trade: a Cross-Industry Analysis for the United Kingdom", *The Economic Journal*, 105, pp.1505-1518.

Greenaway, D. , Hine, R. C., Milner, C. and Elliot, R. (1994): "Adjustment and the Measurement of Marginal Intra-Industry Trade", *Weltwirtschaftliches Archiv*, vol. 130, pp. 418-427.

Greenaway, D. and Milner, C. (1981): "Trade Inbalance Effects in the Measurement of Intra-Industry Trade", *Weltwirtschaftliches Archiv*, vol. 117, nº 4, pp. 756-762.

Greenaway, D. and Milner, C. (1983): "On the Measurement of Intra-Industry Trade , *The Economic Journal*, vol. 93, nº 372.

Grubel, H.G. and Lloyd P.J. (1975): Intra-Industry Trade, The Macmillan Press Ltd., London.

Hamilton, C. and Kniest, P. (1991): "Trade Liberalization, Structural Adjustment and Intra-Industry Trade: A Note", Weltwirtschaftliches Archiv, vol. 127, pp. 356-367.

Helpman, E. y Krugman P.R. (1985): Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition and International Economy, MIT Press, Cambridge (Mass.).

Kol and Mennes (1989): "Corrections for Trade Imbalance: A survey", *Weltwirtschaftliches Archiv* vol. 125, nº 4, pp. 703-717.

Krugman, P. R. (1979): "Increasing Returns, Monopolistic Competition and International Trade", *Journal of International Economics*, 9, pp. 469-479.

Krugman, P. R. (1981): "Intraindustry Specialization and the Gains from Trade", *Journal of Political Economy*, vol. 89, octubre, pp. 959-973.

Lancaster, K. (1979): Variety, Equity, and Efficiency, Columbia University Press, New York

Martín, C. (1992): "El CII español ante el Mercado Unico Europeo", en Viñals, J. et allia (eds.) (1992) La economía española ante el Mercado Unico Europeo, Alianza Editorial, Madrid, pp. 119-166.

Martín, C. (1998): España en la nueva Europa, Alianza Editorial, Madrid.

Motta, M. (1994): "International Trade and investment in a vertically differentiated industry", in *International Journal of Industrial Organization*, 12, pp. 179-196.

Oliveras, J. and Terra, I. (1997): "Marginal Intra-Industry Trade Index: The Period and Aggregation Choice", *Weltwirtschaftliches Archiv*, vol. 133, nº 1, pp. 170-178.

Shaked, A. and Sutton, J. (1984): "Natural Oligopolies and International Trade" in Kierzkowski (ed.) (1984), cap. 3, pp. 34-50.

Vona, S. (1992): "On the Measurement of Intra-Industry Trade: Some Further Thoughts", *Weltwirtschaftliches Archiv* vol. 127, nº 4, pp. 678-700.

Table 1: Intra-Industry Trade in Spain, GL Index (% Total Trade), from 6 digit CN data.

	1988	1992	1995
High Demand and technological intensive	**21.9**	**26.5**	**28.6**
Electrical goods	21.9	29.4	31.8
Office and data processing machines	27.3	29.9	26.5
Chemical products	19.0	22.0	26.9
Medium demand and technology	**27.3**	**33.1**	**36.6**
Rubber and plastic products	33.7	42.9	44.1
Automobiles and parts	32.0	38.7	41.6
Other transport equipment	25.1	24.0	25.2
Agricultural and industrial machinery	22.7	27.3	29.3
Other manufacturing products	13.7	17.2	16.9
Low demand and technology	**15.2**	**19.7**	**21.9**
Textiles and clothing	15.5	19.3	21.8
Ferrous and non-ferrous metals	14.0	22.3	21.9
Non-metallic minerals and mineral products	16.2	17.5	18.5
Paper and printing products	20.7	23.5	23.7
Food, beverages and tobacco	6.0	10.6	16.8
Metal products	31.4	32.5	33.5
Total Manufacturing	**21.9**	**27.2**	**29.7**

Source: Own calculations from COMEXT (Eurostat) database.

Table 2: Nature of Intra-Industry Trade in Spanish manufacturing industry (% in total IIT) (α=0.15)

	1988			1992			1995		
	H	VH	VL	H	VH	VL	H	VH	VL
High Demand and technological intensive	**19.6**	**35.8**	**44.7**	**18.4**	**37.4**	**44.2**	**22.5**	**32.6**	**44.8**
Electrical goods	21.2	36.1	42.7	21.9	38.6	39.5	18.7	37.3	44.0
Office and data processing machines	12.4	44.9	42.6	13.0	51.6	35.4	30.8	39.4	29.8
Chemical products	22.7	29.8	47.5	18.1	28.0	53.9	22.1	26.4	51.5
Medium demand and technology	**33.4**	**22.9**	**43.7**	**37.6**	**15.9**	**46.5**	**36.0**	**23.3**	**40.6**
Rubber and plastic products	28.4	14.9	56.7	31.1	17.9	51.0	33.4	31.5	35.1
Automobiles and parts	48.4	18.2	33.4	45.7	10.1	44.2	44.4	17.1	38.5
Other transport equipment	3.8	27.5	68.7	48.4	11.1	40.5	12.0	38.4	49.5
Agricultural and industrial machinery	16.0	29.7	54.3	18.9	26.4	54.8	16.4	33.1	50.5
Other manufacturing products	18.4	40.5	41.1	19.2	39.6	41.2	18.1	42.5	39.3
Low demand and technology	**26.7**	**29.0**	**44.3**	**25.1**	**32.0**	**42.9**	**27.6**	**32.0**	**40.4**
Textiles and clothing	30.7	30.9	38.4	18.0	36.8	45.2	20.3	42.0	37.7
Ferrous and non-ferrous metals	35.4	18.5	46.1	42.7	17.5	39.8	43.1	20.0	36.9
Non-metallic minerals and mineral products	15.0	27.6	57.4	20.9	33.0	46.2	13.3	23.7	63.0
Paper and printing products	28.6	21.8	49.6	26.3	29.4	44.2	30.4	30.2	39.4
Food, beverages and tobacco	22.4	46.3	31.2	22.4	37.8	39.8	26.9	35.0	38.1
Metal products	17.4	26.4	56.2	20.2	35.2	44.6	23.3	38.0	38.7
Total Manufacturing	**27.7**	**28.1**	**44.1**	**29.1**	**26.0**	**44.9**	**29.9**	**28.3**	**41.7**

Source: Own calculations from COMEXT (Eurostat) database.

Table 3: Marginal Intra-Industry Trade in Spain (A Index)

	1988-1995	1988-1992	1992-1995
High Demand and technological intensive	**0.15**	**0.14**	**0.15**
Electrical goods	0.16	0.18	0.14
Office and data processing machines	0.13	0.11	0.15
Chemical products	0.16	0.12	0.15
Medium demand and technology	**0.20**	**0.20**	**0.17**
Rubber and plastic products	0.27	0.19	0.24
Automobiles and parts	0.25	0.31	0.18
Other transport equipment	0.15	0.12	0.20
Agricultural and industrial machinery	0.13	0.11	0.13
Other manufacturing products	0.09	0.07	0.09
Low demand and technology	**0.12**	**0.10**	**0.11**
Textiles and clothing	0.14	0.12	0.11
Ferrous and non-ferrous metals	0.10	0.09	0.11
Non-metallic minerals and mineral products	0.11	0.09	0.10
Paper and printing products	0.12	0.08	0.14
Food, beverages and tobacco	0.10	0.07	0.08
Metal products	0.18	0.15	0.17
Total Manufacturing	**0.16**	**0.15**	**0.14**

Source: Own calculations from COMEXT (Eurostat) database and Contabilidad Nacional de España (Banco de España).

Table 4: Marginal Intra-Industry Trade in Spain (A Index) by IIT nature in 1992

	(α=0.15			**α=0.25**		
Sectors with differentiation mainly	**1988-1995**	**1988-1992**	**1992-1995**	**1988-1995**	**1988-1992**	**1992-1995**
Horizontal	0.165	0.138	0.215	0.196	0.215	0.165
Vertical	0.158	0.147	0.139	0.140	0.117	0.131
Vertical High Quality Exports	0.138	0.119	0.116	0.139	0.121	0.115
Vertical Low Quality Exports	0.163	0.155	0.146	0.141	0.115	0.139

Source: Own calculations from COMEXT (Eurostat) database and Contabilidad Nacional de España (Banco de España).

Table 5: IIT and Changes in Employment: Correlation coefficients

IIT Index	Total industries	High Trade Exposure (22)	Low Trade Exposure (53)
A	-0.23**	-0.39*	-0.16
GL88	-0.25**	-0.55***	-0.14
GL92	-0.30***	-0.56***	-0.18
D*GL*	-0.19*	-0.25	-0.14

***/**/*: Statistical significance at the 99/95/90 level.
Number of industries included in each group in parenthesis.
Trade Exposure = $[(M+X)^{88}+(M+X)^{92}]/(O^{88}+O^{92})$

Table 6: IIT (GL) and Changes in Employment: Correlation coefficients, by nature of IIT

	Total Industries	
	α=0.15	α=0.25
HGL88	-0.18	-0.19*
VGL88	-0.24**	-0.23**
HQVGL88	-0.18	-0.17
LQVGL88	-0.22*	-0.21*
HGL92	-0.35***	-0.34***
VGL92	-0.21*	-0.18
HQVGL92	-0.18	-0.18
LQVGL92	-0.17	-0.12
D*HGL*	-0.30***	-0.36***
D*VGL*	0.02	0.09
D*HQVGL*	-0.04	-0.04
D*LQVGL*	0.06	0.16

***/**/*: Statistical significance at the 99/95/90 level.

Table 7: IIT (GL) and Changes in Employment: Correlation coefficients, by nature of IIT and degree of trade exposure

	Employment			
	High Trade Exposure		Low Trade Exposure	
	α=0.15	α=0.25	α=0.15	α=0.25
HGL88	-0.31	-0.37*	-0.12	-0.13
VGL88	-0.46**	-0.48**	-0.14	-0.12
HQVGL88	-0.25	-0.28	-0.18	-0.13
LQVGL88	-0.55***	-0.60***	-0.09	-0.09
HGL92	-0.50**	-0.54***	-0.28**	-0.27*
VGL92	-0.44**	-0.37*	-0.11	-0.09
HQVGL92	-0.32	-0.31	-0.06	-0.06
LQVGL92	-0.38*	-0.27	-0.11	-0.08
D*HGL*	-0.28	-0.44**	-0.31**	-0.27**
D*VGL*	0.06	0.16	0.03	0.06
D*HQVGL*	-0.12	-0.10	0.13	0.07
D*LQVGL*	0.20	0.32	-0.06	0.01

***/**/*: Statistical significance at the 99/95/90 level.

Table 8: IIT and Labour Market Effects: Correlation coefficients for MIIT (A) by sector main nature of IIT (α=0.25)

A index for sectors with differentiation mainly	Total industries		High Trade Exposure		Low Trade Exposure	
	1988	**1992**	**1988**	**1992**	**1988**	**1992**
Horizontal	-0.42	-0.54**	-0.71	-0.78	-0.25	-0.48
	(11)	(15)	(5)	(4)	(6)	(11)
Vertical	-0.18	-0.15	-0.27	-0.33	-0.17	-0.06
	(64)	(60)	(17)	(18)	(47)	(42)
V High Q.	-0.02	-0.19	-0.32	-0.59	-0.08	-0.19
	(19)	(22)	(4)	(5)	(15)	(17)
V Low Q.	-0.18	-0.14	-0.30	-0.30	-0.16	0.02
	(45)	(38)	(13)	(13)	(32)	(25)

***/**/*: Statistical significance at the 99/95/90 level.
Number of industries included in each group in parenthesis.

Table 9: IIT and changes in employment (AVEC), (α = 0.25).
(OLS with heteroskedasticity-consistent errors, 75 obs.).

	Constant	Trade exposure	*IIT*	R^2	RESET (P values)
IIT = A	0.17^{***}	0.11	-0.37^{***}	0.06	0.99
IIT = GL88	0.18^{***}	0.01	-0.30^{***}	0.08	0.79
IIT = GL92	0.19^{***}	0.01	-0.30^{***}	0.10	0.54
IIT =* D*GL	0.15^{***}	0.01	-0.44^{*}	0.04	0.95
IIT = HGL88	0.16^{***}	0.02	-0.52^{**}	0.05	0.29
IIT = VGL88	0.17^{***}	0.01	-0.36^{**}	0.06	0.81
IIT = HQVGL88	0.16^{***}	0.01	-0.63	0.04	0.16
IIT = LQVGL88	0.16^{***}	0.01	-0.47^{**}	0.05	0.44
IIT = HGL92	0.18^{***}	0.01	-0.63^{***}	0.13	0.40
IIT = VGL92	0.17^{***}	0.01	-0.28	0.04	0.71
IIT = HQVGL92	0.16^{***}	0.01	-0.53^{*}	0.04	0.95
IIT = LQVGL92	0.15^{***}	0.01	-0.26	0.02	0.31
IIT =* D*HGL	0.15^{***}	0.00	-1.11^{***}	0.13	0.98
IIT =* D*VGL	0.13^{***}	0.01	0.31	0.02	0.64
IIT =* D*HQVGL	0.13^{***}	0.01	-0.14	0.01	0.44
IIT =* D*LQVGL	0.13^{***}	0.01	0.64	0.03	0.44

***/**/*: Statistical significance at the 99/95/90 level.

Table 10: IIT and changes in employment: A index conditioned to main sector IIT nature ($\alpha = 0.25$). (OLS with heteroskedasticity-consistent errors, 75 obs).

	Constant	Trade exposure	*A*	R^2	Obs.	RESET
IIT nature in 1988						
Horizontal	0.20**	0.10	-0.82	0.38	11	0.55
Vertical	0.16***	-0.00	-0.28**	0.03	64	0.92
V. High Q.	0.16***	0.02	-0.09	0.03	19	0.53
V. Low Q.	0.16**	-0.01	-0.27*	0.04	45	0.59
IIT nature in 1992						
Horizontal	0.16***	0.03	-0.39***	0.38	15	0.76
Vertical	0.17***	0.01	-0.34	0.03	60	0.97
V. High Q.	0.18***	0.01	-0.38	0.04	22	0.97
V. Low Q.	0.17***	0.01	-0.33	0.02	38	0.98

***/**/*: Statistical significance at the 99/95/90 level.

APPENDIX

Table A1: Nature of Intra-Industry Trade in Spanish manufacturing industry (% in total IIT) (α=0.25)

	1988			1992			1995		
	H	**VH**	**VL**	**H**	**VH**	**VL**	**H**	**VH**	**VL**
High Demand and technological intensive	**32.1**	**29.6**	**38.2**	**31.1**	**32.4**	**36.5**	**28.3**	**34.5**	**37.2**
Electrical goods	29.9	32.3	37.8	35.9	33.9	30.3	31.6	33.7	34.7
Office and data processing machines	31.7	30.8	37.4	26.1	43.1	30.8	37.3	34.9	27.7
Chemical products	34.2	26.8	39.0	29.2	24.7	46.1	22.1	35.0	42.9
Medium demand and technology	**48.7**	**18.1**	**33.3**	**57.8**	**13.3**	**28.9**	**17.4**	**52.0**	**30.6**
Rubber and plastic products	50.7	10.8	38.6	47.5	15.7	36.9	25.9	51.4	22.7
Automobiles and parts	64.4	11.2	24.4	73.2	7.6	19.1	10.5	62.6	26.9
Other transport equipment	21.9	27.5	50.6	49.3	10.8	39.9	33.7	21.3	45.0
Agricultural and industrial machinery	28.7	27.3	44.1	29.5	23.4	47.1	28.8	26.2	45.0
Other manufacturing products	25.4	37.8	36.8	31.3	34.5	34.2	37.8	27.1	35.1
Low demand and technology	**38.9**	**24.2**	**36.8**	**39.8**	**26.4**	**33.7**	**26.5**	**42.3**	**31.2**
Textiles and clothing	39.3	27.0	33.7	35.2	28.3	36.4	36.5	31.5	32.0
Ferrous and non-ferrous metals	50.4	15.2	34.4	61.5	13.1	25.4	17.0	59.0	24.1
Non-metallic minerals and mineral products	26.3	22.4	51.4	30.1	30.3	39.6	20.9	32.4	46.6
Paper and printing products	42.9	14.4	42.8	36.5	24.8	38.7	19.5	49.6	30.9
Food, beverages and tobacco	36.4	38.7	24.9	36.4	33.1	30.5	29.8	40.0	30.2
Metal products	28.4	24.3	47.2	34.6	28.9	36.5	31.5	36.2	32.3
Total Manufacturing	**41.4**	**22.9**	**35.6**	**45.7**	**22.0**	**32.3**	**23.0**	**44.5**	**32.6**

Source: Own calculations from COMEXT (Eurostat) database.

Table A2: IIT and changes in employment (AVEC), (α = 0.15).
(OLS with heteroskedasticity-consistent errors, 75 obs.).

	Constant	**Trade exposure**	***IIT***	**R^2**	**RESET (P values)**
IIT = HGL88	0.15^{***}	0.01	-0.70^{**}	0.04	0.27
IIT = VGL88	0.17^{***}	0.01	-0.34^{***}	0.07	0.85
IIT = HQVGL88	0.16^{***}	0.02	-0.64^{*}	0.05	0.37
IIT = LQVGL88	0.16^{***}	0.01	-0.41^{**}	0.06	0.46
IIT = HGL92	0.17^{***}	0.01	-0.91^{***}	0.13	0.10
IIT = VGL92	0.17^{***}	0.01	-0.28^{*}	0.05	0.75
IIT = HQVGL92	0.16^{***}	0.01	-0.47^{*}	0.04	0.49
IIT = LQVGL92	0.16^{***}	0.01	-0.29	0.04	0.52
IIT* = D*HGL	0.14^{***}	0.01	-0.97^{***}	0.10	0.53
IIT* = D*VGL	0.13^{***}	0.01	0.11	0.01	0.36
IIT* = D*HQVGL	0.13^{***}	0.01	-0.09	0.01	0.62
IIT* = D*LQVGL	0.13^{***}	0.01	0.25	0.01	0.50

***/**/*: Statistical significance at the 99/95/90 level.

Figure A1: Changes in IIT (GL index) and trade performance.

A) From surplus to deficit **B) From deficit to surplus**