Intra-industry trade and regional integration

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INTRA-INDUSTRY TRADE AND REGIONAL INTEGRATION[1]

SUMMARY

The link between regional integration and intra-industry trade (IIT) has been under scrutiny since it has been first suggested by European integration. The size of IIT in Europe softened the integration process by allowing the region to avoid harsh adjustments that would have affected asymetrically the countries engaged in the liberalization effort: reallocation of production has been rather limited. The concentration of production that had been forecasted by Balassa (1961) and Krugman (1991b) among others did not take place. In order to have a clearer picture of the outcome of integration, it is necessary to study the relationship between economic integration and IIT.

However, the lack of precise and reliable data and the difficulty to find a robust model for IIT makes this relationship difficult to investigate. This paper tackles this issue at a worldwide level, studying the case of four *de jure* or *de facto* integration zones: the European Union, NAFTA, Mercosur and East Asia. Trade flows are classified as inter or intra-industry trade and IIT is broken down into horizontal and vertical components, using a methodology proposed by Fontagné and Freudenberg (1997) based on Abd-El-Rahman (1986). Trade patterns for each zone are studied using a harmonized database drawing on the most detailed information available on a worldwide basis (BACI) from the beginning of the 1990s to 2002. The determinants of the share of vertical and horizontal IIT are investigated thanks to an econometric model which is estimated.

This paper is the first worldwide study of IIT and it's determinants. We are able to provide up to date results comparable across countries, using the most detailed information available. We find that the share of IIT in overall trade has increased throughout the 1990s, then decreased due to the emergence of new industrialized countries; that the most integrated regions (EU, NAFTA) developped a quality-layered market leading to high shares of vertical IIT; and that horizontal IIT is essentially a regional type of trade. Econometrics confirm predictions of theoretical models, and underline the importance of the non-monotonic relationship between distance and IIT in the explanation of the share of each trade type. A robust positive relationship is found between economic integration and intra-industry trade, both vertically and horizontally differentiated.

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ABSTRACT

The link between regional integration and intra-industry trade (IIT) has been under scrutiny since it has been first suggested by the European integration process. However, the lack of reliable data and the difficulty to find a robust model for IIT made this relationship difficult to prove. This paper tackles this issue using an harmonised dataset at the most detailed level of product disaggregation on a worldwide basis from the beginning of the 1990s to 2002. We study the case of four *de jure* or *de facto* integration zones: the European Union, NAFTA, Mercosur and East Asia. Trade flows are classified as inter- or intra-industry trade and IIT is broken down into horizontal and vertical components. Trade patterns for each zone are studied using a harmonized database drawing on the most detailed information available. The determinants of the share of vertical and horizontal IIT are investigated. A robust positive relationship is found between regional integration and intra-industry trade, both vertically and horizontally differentiated.

JEL classification: F12, F15
Keywords: Intra-Industry Trade, Regional Integration.

COMMERCE INTRABRANCHE ET INTÉGRATION RÉGIONALE

RÉSUMÉ

Depuis qu'il a été suggéré par la construction européenne, le lien entre intégration régionale et échanges intrabranche a suscité l'intérêt des économistes. L'importance de l'intrabranche en Europe a atténué les effets du processus d'intégration en évitant à l'Europe les ajustements difficiles et asymétriques qui auraient été causés par les mouvements de relocalisation de la production. La concentration de la production qui avait été prévue par Balassa (1961) et Krugman (1991b), entre autres, n'a pas eu lieu. Pour comprendre plus précisément les conséquences des processus d'intégration, il est nécessaire d'étudier leurs rapports avec le niveau d'intrabranche.

Le manque de données fiables et suffisamment précises, ainsi que la difficulté de trouver un modèle robuste expliquant le niveau d'intrabranche rendent la relation entre intégration et intrabranche difficile à cerner. Dans cette étude, le commerce de quatre zones d'intégration de droit ou de fait est étudié : l'Union Européenne, l'ALENA, le Mercosur et l'Asie du Sud-Est. Les flux commerciaux sont classés en trois catégories : interbranche, intrabranche horizontal et intrabranche vertical, selon la méthodologie proposée par Fontagné et Freudenberg (1997) baséé sur Abd-El-Rahman (1986). L'étude utilise une base de données harmonisée au niveau le plus détaillé possible pour une couverture mondiale (BACI) partant du début des années 1990 jusqu'en 2002. Les déterminants de chaque type de commerce sont étudiés grâce à un modèle économétrique.

Cette étude est la première à fournir une évaluation de l'importance des flux intrabranche et de ces déterminants sur une base mondiale au niveau le plus désagrégé possible. Elle met en évidence la croissance de la part de l'intrabranche dans le commerce mondial pendant les années 1990, puis la baisse depuis 1999 avec l'émergence de nouveaux pays industrialisés. On constate aussi que les régions les plus intégrées (UE, ALENA) ont développé un marché intérieur avec spécialisation selon les gammes, conduisant à des niveaux d'intrabranche vertical importants. L'intrabranche horizontal apparaît essentiellement comme un commerce intra-zone. L'analyse des déterminants de chaque type de commerce confirme les prédictions des modèles théoriques, et souligne l'impact non-monotone de la distance sur le niveau des différents types de commerce. Une corrélation positive robuste est mise en évidence entre intégration économique et intrabranche vertical aussi bien qu'horizontal.

RÉSUMÉ COURT

Ce travail analyse le lien entre intégration régionale et échanges intrabranche sur une base mondiale harmonisée au niveau le plus désagrégé possible partant du début des années 1990s jusqu'en 2002. Le commerce de quatre zones d'intégration de droit ou de fait est étudié : l'Union Européenne, l'ALENA, le Mercosur et l'Asie du Sud-Est. Les flux commerciaux sont classés en trois catégories : interbranche, intrabranche horizontal et intrabranche vertical, selon la méthodologie proposée par Fontagné et Freudenberg (1997) baséé sur Abd-El-Rahman (1986). Nous mettons en évidence la croissance de la part de l'intrabranche dans le commerce mondial pendant les années 1990, puis la baisse depuis 1999 avec l'émergence de nouveaux pays industrialisés. On constate aussi que les régions les plus intégrées (UE, ALENA) ont développé un marché intérieur avec spécialisation selon les gammes, conduisant à des niveaux d'intrabranche vertical importants. L'intrabranche horizontal apparaît essentiellement comme un commerce intra-zone. L'analyse des déterminants de chaque type de commerce confirme les prédictions des modèles théoriques, et souligne l'impact non-monotone de la distance sur le niveau des différents types de commerce. Une corrélation positive robuste est mise en évidence entre intégration économique et intrabranche vertical aussi bien qu'horizontal.

Classification *JEL* : F12, F15
Mots Clefs : Commerce intrabranche, intégration régionale.

INTRA-INDUSTRY TRADE AND REGIONAL INTEGRATION

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1 Introduction

In a world where trade is subject to significant tariffs, an industrial core is likely to develop in every country to satisfy home demand, whatever the initial allocation of factors. Conversely, in an integrated zone, and when transportation costs are not too high, production is concentrated to benefit from economies of scale, as Krugman argues from the example of the United States (Krugman, 1991b). In consequence, trade liberalization may cause a sudden reallocation of production. This raises concerns that integration processes would prompt harsh adjustments, the cost of which would affect asymmetrically industries and countries engaged in the liberalization effort. In contradiction with these conclusions, European integration was accompanied by an increase in intra-industry trade (IIT) between member countries. The mezzogiornification of southern Europe did not take place, and it is doubtful that the "true U.S.-style industrial specialization" Krugman forecasted will eventually take hold. The European integration process was followed by changes in trade patterns in Europe that generated interest from trade economists, who were led to think that the observed increase in similar product exchanges could be a result of this regional economic integration. The size of IIT in Europe suggests that in spite of almost fifty years of integration, European countries are still less specialized than U.S. regions, or are specialized in a different fashion. Instead of concentration, integration resulted in a quality layered market ; the share of vertically differentiated intra-industry trade has been increasing since the mid-1980s (Fontagné et al., 1997). It appears that countries are specializing along a quality range. A textbook example of this phenomenon is the car industry. The French firm Renault recently launched the Dacia Logan, a low-cost car built in Romania (which is set to join the EU in 2007). The purpose of this paper is to clarify this matter by exploring the empiric relationship between IIT and regional integration, through a worldwide study of the determinants of IIT in four *de jure* or *de facto* integration zones : Europe, NAFTA, East

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Asia, and Mercosur. Working at the most disaggregated level, our contribution is to provide updated information comparable across countries, on a worldwide basis.

As the traditional Heckscher-Ohlin-Samuelson (HOS) model is inappropriate to account for IIT, several models were developed in the 1980s to provide a theoretical basis for the trade of similar goods. Horizontal IIT arises between countries with similar endowments and in industries where a small minimum efficient scale of production permits the existence of a great number of varieties (Lancaster, 1980, Krugman, 1981). The case of vertical IIT is not clear-cut ; Falvey (1981) showed that vertical IIT may arise when there are no increasing returns and a large number of firms producing varieties, while Shaked and Sutton (1984) find that it can arise when a small number of firms are confronted with increasing returns. Among the determinants of IIT, economic integration turns out to be one of the most difficult to assess. Wong (1995) introduces free factor mobility in his model and finds that IIT is then lowered ; IIT occurs only if there are considerable differences in endowments. Based on these models, many studies investigated the determinants of IIT, including Balassa (1986a), Balassa and Bauwens (1987), Bergstrand (1990), Stone and Lee (1995), and Fontagné et al. (1997), just to name a few. However, little or no attempt has been made to realize a worldwide study at a highly disaggregated level. This is probably due to the difficulty in gathering coherent data at a detailed level. Thanks to a large international trade database (BACI), in this chapter we are able to take into account four dimensions : industry, time, the importing and exporting country, and product level ; the last category captures data for every country in the world, at the 6-digit level, that is, with more than 5000 product categories.

The rest of the paper is organized as follows. The next section deals with the harmonization of the COMTRADE database and the methodology used to measure IIT and quality range. The third section consists of a descriptive study of trade patterns in the world and in each of the four considered integration zones. The fourth section analyses the determinants of IIT and their economic justifications, exposes the estimated model and the regression results. Section 5 concludes.

2 Measurement of Intra-Industry Trade

The phrase "intra-industry trade" was coined by Balassa (1966) to name a phenomenon that had been described for the first time by Verdoorn (1960) in a study about Benelux. IIT refers to simultaneous export and import of similar goods in a given time. Thus, any measure of IIT must be based on a classification of products precise enough so that within one category, commodities can be assumed to be similar. Grubel and Lloyd (1975) proposed to consider similar goods that share a common production process and/or assignment. Many studies conduct analysis at a rather aggregated level, which makes little sense, since classifications with less than a few hundred categories bring together very different products. Bergstrand

(1982) pointed out that category 363 of the US Standard Industrial Classification contains such household appliances as washing machines, freezers, and stoves ; these products involve very different production processes, and cannot be considered close substitutes. Some even raised doubts about the very existence of IIT, arguing it was a mere artifact caused by the aggregation process (Finger, 1975, Lipsey, 1976).

2.1 Harmonization between exports and imports reportings : the BACI dataset

To conduct a worldwide analysis of the determinants of IIT, we need an appropriate dataset. We use the BACI database from Gaulier and Zignago (2005), which brings together and renders consistent various levels of analysis and classifications, drawing on the most detailed information available. This dataset, based on COMTRADE (United Nations), covers every country in the world from the beginning of the 1990s to 2002 and provides the quantity as well as value of traded goods. Products are classified according to the Harmonized System (HS), at the 6-digit level, representing 5017 categories of products. Trade flows are reported to United Nations in value and quantity in many cases by both exporting and importing countries. BACI harmonizes these mirror flows when they are available. This operation is necessary given the huge discrepancies between reported mirror flows. (At the 6-digit level, the median gap between mirror flows exceeds 100% for half of the observations in COMTRADE). Original procedures have been developed to harmonize data, which use an evaluation of the quality of country declarations, the conversion into tons of the other units of quantities exchanged and the evaluation of CIF rates which reconcile import and export declarations. Indeed, in COMTRADE import values are reported CIF (cost, insurance and freight) and the exports are reported FOB (free on board). In order to remove CIF, we have to estimate freight costs. Being plagued with large measurement errors, mirror flow ratios cannot be directly identified with freight costs. We use predicted mirror flows ratios from a gravity-type equation as an estimate of CIF.

We compute the IIT indexes at the 6-digit level, and then aggregate data at the industry-level according to the ISIC Rev. 2 classification, to allow sectoral analysis. In order to avoid confusion between products and industries, throughout this paper we use the letter k for the former and c for the later. We restrict our sample to 6-digit products for which we consider the reliability of data to be sufficient. Concretely, we compute for each product-year pair the standard deviation and kurtosis of the logarithm of unit values (UV). The pairs for which the standard deviation falls within 5% of the largest values (large errors) or for which the kurtosis is within 5% of the lowest values (very skewed at distribution of UV) are rejected.[5]Our hypothesis is that a very large dispersion of UV signals a high probability of classification failure due to the heterogeneity of the HS 6-digit heading (that

[5]Pairs with less than 50 observations (bilateral flows) are also rejected.

is, heterogeneous products are grouped together), or due to measurement error. Within the selected pairs we further restrict the sample to those being selected in all years in the sample. This restriction avoids breaks in time series due to products entering or leaving the sample. In the text we point out cases where differences are large between results obtained with the restricted sample and the whole available data set. Globally, results are more stable with the restricted sample, which represents 44% of world trade value, and 67% of the total number of flows. Large divergences arise only for some specific countries (often known as poor declaring countries) and industries (such as diamonds).[6] With the restricted sample we obtain better correlations between total IIT share and the Grubel and Lloyd (GL) index (weighted average of the product level GL indexes) for some important country pairs ; for US-Canada trade (1991-2002) the correlation increases from 0.86 on the full sample to 0.99 on the restricted sample. Also, with the restricted sample we override the counterintuitive result that the number of traded products declines.[7]

2.2 Measurement of Intra-Industry Trade

There are two main indicators commonly used to measure IIT : the Grubel-Lloyd index and the threshold-based method. The first indicator consists of measuring the extent of the overlap in a given flow (for given year, product, importer and exporter), while the other classifies flows as either inter or intra-industry using a threshold. The literature stresses the importance of the distinction between vertically and horizontally differentiated intra-industry trade, since those two phenomenon following different rules. Thus, both methods provide means to distinguish between the trade of goods of similar quality (and therefore similar price) and the trade of goods with different quality. Understandably, such a distinction can only be made using a threshold ; if the difference in price is below that threshold, goods are considered of the same quality, otherwise they are considered to be vertically differentiated. Following most of the literature, we set the threshold to $\alpha = 0.25$. It is important to note that this distinction between vertically and horizontally differentiated products is different from the quality ranges discussed below, which involve the world average unit price.
Grubel and Lloyd (1975) proposed the most widely used intra-industry trade index, which measures the overlap between exports and imports for a given flow :

$$GL_{ijtk} = 1 - \frac{|X_{ijtk} - M_{ijtk}|}{X_{ijtk} + M_{ijtk}}$$

where M stands for imports, X for exports, i and j for the countries and k for the product. The aggregation procedure is simple. The average Grubel and Lloyd indicator for countries i and j, year t and ISIC industry c is calculated as follows :

[6] The oil and gas industries are excluded.
[7] Changes in nomenclatures can explain this decline obtained with raw data.

$$IIT_{ijtc} = 1 - \sum_{i;j;t;c} \frac{|X_{ijtc} - M_{ijtc}|}{X_{ijtc} + M_{ijtc}}$$

This index of IIT varies between 0 (complete inter-industry trade) and 1 (complete intra-industry trade).

The Grubel-Lloyd approach does not permit us to break IIT into vertical and horizontal trade, which is necessary as those two types of trade differ in their determinants. Greenaway et al. (1994, 1995) proposed a methodology to characterize trade flows as horizontally or vertically differentiated using Grubel-Lloyd indexes. However, Fontagné and Freudenberg (1997) underlined the shortcomings of this methodology, and proposed a new methodology based on Abd-El-Rahman (1986).[8] Flows are classified in three categories : One-Way Trade (OWT), Two-Way Trade Horizontally Differentiated (TWTH), and Two-Way Trade Vertically Differentiated (TWTV). This is a two-stepped classification :

1. Flows are classified as OWT if the following equation holds :

$$\frac{Min(M_{ijtk}, M_{jitk})}{Max(M_{ijtk}, M_{jitk})} \leq \sigma$$

   where σ is a threshold (here $\sigma = 0.1$).

2. Remaining flows are considered horizontally differentiated if :

$$1 - \alpha \leq \frac{UV_{ijtk}}{UV_{jitk}} \leq 1 + \alpha$$

   where UV_{ijk} is the unit value of product k, and α a threshold (here $\alpha = 0.25$).Otherwise, they are classified as vertically differentiated.

We classify flows according to this procedure and then aggregate the data, to obtain the share of each trade type for a given i, j, year and ISIC rev. 2 industry. For a large number of data, particularly in North America (see below), quantity data is missing from the observations, so unit values cannot be calculated. We were therefore obliged to introduce a fourth "type of trade" into our breakdown, corresponding to non-classified trade flows, denoted TWTnc. In addition, some bilateral trade flows with available unit values are still not classified. Indeed, we consider that when unit values differ by a ratio higher than 10, the probability for one (or both) partner(s) having "misclassified" the trade flow, possibly due to the existence of a HS 6-digit heading grouping together products which are too heterogeneous, cannot be ignored. In that case the bilateral trade flow may be OWT rather than TWTV. Although this method cannot replace the Grubel and Lloyd indicator, it is a useful complement. While GL evaluates the intensity of overlap in trade, the threshold approach

[8] More recently Fukao et al. (2003) have used also this method.

measures the relative importance of the three trade types (see Fontagné and Freudenberg, 1997, for more details). More specifically, it permits an analysis of specialization along the quality range.

The threshold method has recently been subject to criticism, on the ground that its applicability within the Chamberlin-Heckscher-Ohlin-Samuelson model (CHOS) is doubtful (Gullstrand, 2002). There is also debate about the arbitrariness of chosen thresholds ; it is doubtful whether there exists such thing as a non-arbitrary threshold. The case is not yet clear-cut yet ; no method appears able to gather consensus. As our intention is not to prove the CHOS model right or wrong, but to study the determinants of the repartition of trade between the different types of trade, we use the threshold-based method. Furthermore, this allows us to keep the possibility to compare results with previous studies.

TAB. 1 – Decomposition of trade (adapted from Fontagné and Freudenberg (2002)

Does the minority flow represent at least 10% of the majority flow	Do export and import unit values differ less than 25%	
	Yes	No
Yes	Two way trade in horizontally differentiated products	Two-way trade in vertically differentiated products
No	One-way trade	

2.3 Quality range

To test the hypothesis that holds that regional integration is followed by a specialization along a quality range, we need to measure the quality of traded goods. We use the unit values[9] as a proxy for quality, and define three ranges : low, medium and high quality. For each HS-6 product and for each year, we compute the world unit value average (noted $\overline{UV}$). We then classify each flow :

- Flows with unit value verifying $UV \in [\overline{UV} - 15\%, \overline{UV} + 15\%]$ belong to the medium range, along with the last decile of $]min, \overline{UV} - 15\%]$ and the first decile of $[\overline{UV} + 15\%, max[$.
- The first nine deciles of $]min, \overline{UV} - 15\%]$ are considered low range.
- The last nine deciles of $[\overline{UV} + 15\%, max[$ are considered high range.

[9]Unit values in the BACI database are corrected so as not to take into account transportation costs.

This method permits to take into account the high variability of unit values, and to have a significant share of trade in the medium range. It is theoretically possible to classify any flow using this procedure, as long as the unit value is available. However, it appears wise to avoid associating flows with ranges when it was not possible to ascertain the validity of such a classification. Thus, when the variance of the unit value was too high for a product, flows were not classified.

3 Trade types shares in the world

As can be seen in Table2, there is a world trend toward the increase of IIT. The share of OWT in world trade has been falling regularly from 1989 to 1999, and has been stable since then, with the exception of 2002. OWT accounts for circa 60% of world trade, vertically differentiated IIT constitutes two thirds of remaining flows, and horizontally differentiated IIT one third. If we adopt a strict definition of the similarity of goods by restricting IIT to horizontal IIT, then inter-industry trade accounts for almost 90% of overall world trade.

TAB. 2 – Trade types shares in the world, 1989-2002 (%)

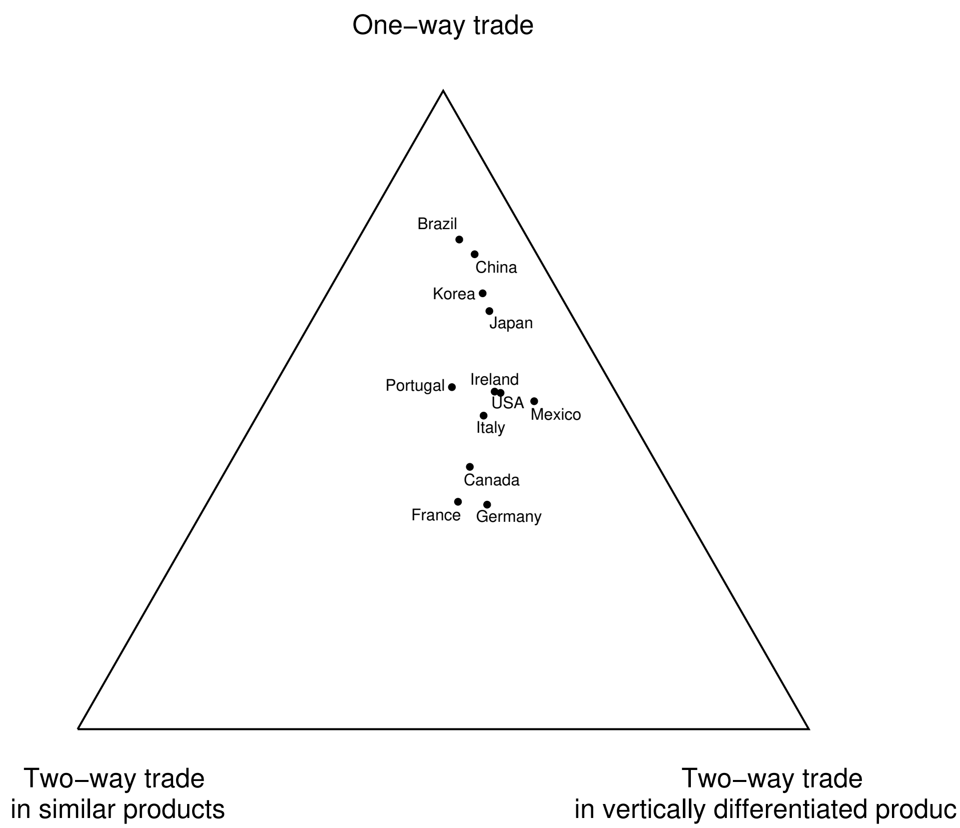
	OWT	TWTnc	TWTH	TWTV
1989	67.6	3.4	11.5	17.5
1990	65.7	3.0	12.1	19.1
1991	66.4	3.0	11.1	19.6
1992	65.0	2.9	11.9	20.2
1993	67.1	2.8	10.9	19.2
1994	65.1	2.5	12.4	20.0
1995	64.5	2.1	13.1	20.3
1996	64.0	2.2	12.9	20.9
1997	63.6	2.3	13.1	21.1
1998	61.8	2.5	13.5	22.2
1999	60.9	2.8	13.6	22.8
2000	61.8	2.9	13.1	22.3
2001	61.5	3.0	12.9	22.6
2002	62.7	2.8	12.6	21.9

This evolution of international trade toward IIT is mainly driven by Europe, NAFTA and East Asia. Figure1 shows the evolution of the composition of trade of the four studied zones, using a triangle-shaped graph ; each point is the center of mass, and vertices are weighted according to the respective share of each trade type. Arrows denote an evolution (since Mercosur's trade remained stable, it is represented by a point). As expected, Europe has the highest IIT level among the four studied integration zones, followed closely by NAFTA. East Asia and Mercosur have significantly lower IIT levels.

FIG. 1 – Evolution of the shares of the three trade types by integration zone, 1993-2002.

As seen in Figure2, IIT is quite unevenly distributed among countries. In most developing countries, OWT makes up more than 90% of trade. Not surprisingly, Brazil and China have the highest share of OWT in the set of countries selected for this graph. Korea and Japan, belonging to the least integrated zone, follow closely. European countries and members of NAFTA have a high level of IIT, with Germany and France being world leaders (along with Belgium, which is not shown in the figure).

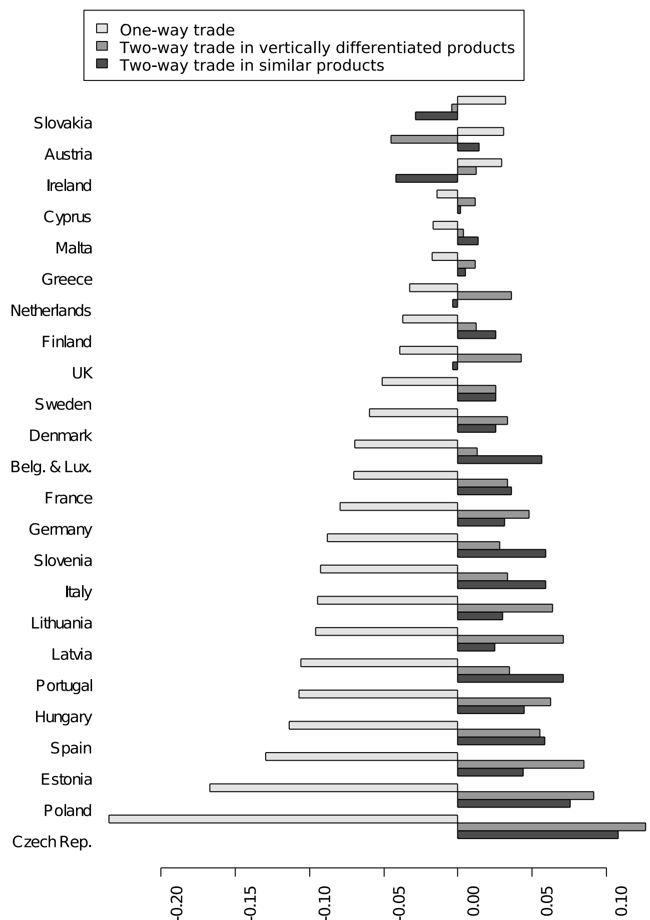
FIG. 2 – Trade types for various countries, 2002



3.1 Trade patterns in the European Union

We first focus on the EU, for which trade patterns have been extensively studied. Europe is a textbook case of intensive IIT trade ; it has economies of comparable sizes, high standards of living, small distances between partners, and strong integration. As discussed above, the share of IIT has been increasing since the beginning of the integration process. We are able to confirm previous results with updated information, and compare them with other regions. Note that there are no declarations for Belgium before 1995 and France before 1994 in our database ; therefore their trade flows are derived indirectly by using the declarations of their trade partners. In consequence, there is no bilateral trade flow between Belgium and France in 1994. These missing flows call for caution when interpreting the results for intra-EU trade before 1995.

FIG. 3 – Evolution of the shares of trade types in Europe, 1993-2002.



3.1.1 EU trade with non-members

Shares of trade by type are given for total EU trade and for individual member countries for 2002 in Table3. The appendix gives tables for 1993 and by sector. Trade is further decomposed into extra- and intra-EU. Looking first at total trade in 2002, Germany and France show the lowest shares of OWT, 40 and 41%, respectively. Belgium and Austria follow closely. The Netherlands and the UK have a share of OWT of around 49%. One newcomer in the EU does more IIT than OWT : the Czech Republic (46% of OWT in 2002). Some other EU countries also have a large share of IIT ; Spain is close to 50%, with Italy and Denmark are not far behind. In contrast, for Greece, Ireland and, to a lesser extent, Portugal, trade is largely dominated by inter-industry flows. OWT is also largely dominant for the vast majority of new EU members.

TAB. 3 – Trade types, EU 25, 2002.

	Extra-zone				Intra-zone				All			
	OWT	TWTnc	TWTH	TWTV	OWT	TWTnc	TWTH	TWTV	OWT	TWTnc	TWTH	TWTV
Austria	74.5	2.7	7.1	15.8	35.2	0.6	29.0	35.2	43.5	1.0	24.3	31.1
Belg. & Lux.	82.4	1.6	4.2	11.8	29.1	0.7	36.9	33.3	40.8	0.9	29.7	28.6
Cyprus	97.1	0.8	0.8	1.4	88.3	1.2	3.3	7.2	91.5	1.0	2.4	5.1
Czech Rep.	86.0	2.3	2.2	9.5	38.7	0.8	19.8	40.6	45.8	1.1	17.2	36.0
Denmark	83.0	1.6	3.6	11.8	47.7	1.2	19.0	32.1	58.9	1.3	14.1	25.6
Estonia	93.6	0.7	0.5	5.1	70.8	1.1	8.1	20.0	77.9	1.0	5.7	15.4
Finland	88.8	1.3	2.6	7.2	67.1	0.7	11.9	20.3	74.5	0.9	8.8	15.9
France	75.1	1.3	6.1	17.5	27.6	0.4	35.4	36.6	40.8	0.7	27.2	31.3
Germany	65.9	1.1	9.0	24.0	28.5	0.3	30.4	40.9	40.4	0.6	23.6	35.5
Greece	92.4	0.8	1.5	5.4	82.5	0.6	6.0	10.8	85.9	0.7	4.5	8.9
Hungary	85.0	1.6	3.9	9.5	55.2	0.8	13.7	30.4	62.1	1.0	11.4	25.5
Ireland	84.5	2.6	3.1	9.8	51.0	2.0	15.4	31.6	59.7	2.2	12.2	26.0
Italy	78.7	1.1	5.1	15.2	44.0	0.3	22.1	33.6	56.4	0.6	16.0	27.0
Latvia	91.7	1.1	2.0	5.2	82.2	1.1	4.7	12.0	84.4	1.1	4.1	10.5
Lithuania	87.2	0.9	3.8	8.1	83.9	0.6	4.7	10.8	84.8	0.7	4.4	10.1
Malta	97.4	0.6	0.0	2.0	85.4	3.6	3.1	7.9	87.9	3.0	2.4	6.7
Netherlands	82.4	1.8	3.4	12.4	34.1	1.1	28.2	36.7	48.5	1.3	20.8	29.5
Poland	90.9	1.3	1.6	6.2	57.1	0.5	13.8	28.6	64.1	0.7	11.2	24.0
Portugal	93.9	0.9	1.2	4.0	53.8	2.5	20.8	23.0	60.5	2.2	17.5	19.8
Slovakia	92.8	1.2	1.4	4.6	57.2	0.7	13.6	28.5	62.4	0.8	11.8	25.0
Slovenia	83.3	1.0	5.6	10.1	59.4	0.8	12.4	27.5	65.7	0.8	10.6	22.9
Spain	85.1	2.6	2.7	9.6	39.9	1.1	27.5	31.6	51.7	1.5	21.0	25.8
Sweden	71.1	1.6	9.4	17.9	52.2	1.0	17.1	29.7	58.0	1.2	14.7	26.1
UK	66.6	2.5	6.2	24.8	38.1	1.1	23.1	37.8	48.8	1.6	16.7	32.9
All	75.4	1.6	5.8	17.2	37.7	0.7	26.7	34.9	48.9	1.0	20.5	29.7

From 1995 to 2002 IIT increased in the overwhelming majority of countries (24 out of 25). This rise is the most striking for Poland (+13%), Portugal (+11%), Hungary (+8%), Slovakia (+6%) and Czech Republic (+6%). Spain (+5%) continued its catching up with core EU countries (according to Fontagné et al., 1998, Spain's IIT share gained 12% from 1980 to 1994) whereas Greece increased its inter-industry specialization, as the 1980-1994 trend did not change. Also highly specialized, Ireland was one of the rare EU countries that did not increase its share of TWTH, in spite of its tremendous economic growth during the period. The Celtic Dragon rather oriented its specialization toward trade in quality (TWTV increased by 4 points). Among the newcomers, the rise in IIT is very marked for the Central and Eastern European countries (CEECs). The Mediterranean and Baltic countries stayed relatively apart. The newcomers contributed to the rise in IIT of the EU-25, with the trade patterns of the largest among them quickly converging toward the typical trade pattern for the core countries.

3.1.2 Intra-EU trade

Two-way-trade in horizontally differentiated products is essentially a regional type of trade ; it is relatively minor at 6% of total trade when extra-EU trade is considered, except for Germany and Sweden with shares close to 9%. Two-way trade in vertically differentiated products is twice as high for trade within the EU-25 (35% in 2002) than for extra-EU trade (17%). One-way trade is around one third of total intra-EU trade for 8 countries, with the lowest shares (28%) in France and Germany. Most of the rise in TWTV stems from intra-EU trade.

Two-way trade in horizontally differentiated products is usually found between core countries, such Germany, France and Belgium (the world leaders for that trade type in 2002). After OWT, TWTV largely dominates in more peripheral countries, including the UK.

Not a single EU-25 country experienced a decrease in regional IIT from 1995 to 2002. For the whole EU, the IIT rise was mainly due to the rise in two-way trade in vertically differentiated products (+3%) whereas two-way trade in horizontally differentiated products stagnated. Within the EU, countries went into more specialization in quality ranges. From 1995 to 2002, TWTH stagnated or declined in a majority of industries, particularly in those were it was already highest. For instance, in the transport industry, TWTV rose at the expense of TWTH.

There is evidence of a specialization along quality ranges in intra-Europe trade (Table4). The trade of Ireland, as stated above, is made up of a lot of high-quality OWT, which represents 43% of its intra-zone trade. Malta specialized in export-oriented high value-added products like pharmaceuticals and electronics, thanks to foreign investments ; almost one half of the country's exports are high-quality products. Specialization along the quality range is also very clear in vertical IIT ; almost two thirds of Czech TWTV is low-quality. Low-range specialization is also predominant in TWTV in Estonia, Poland, Slovakia, Slovenia and, to a lesser extend,

TAB. 4 – Share of trade types in intra-Europe trade, taking into account quality range (1995-2002 average). *Unclassified flows are ignored.*

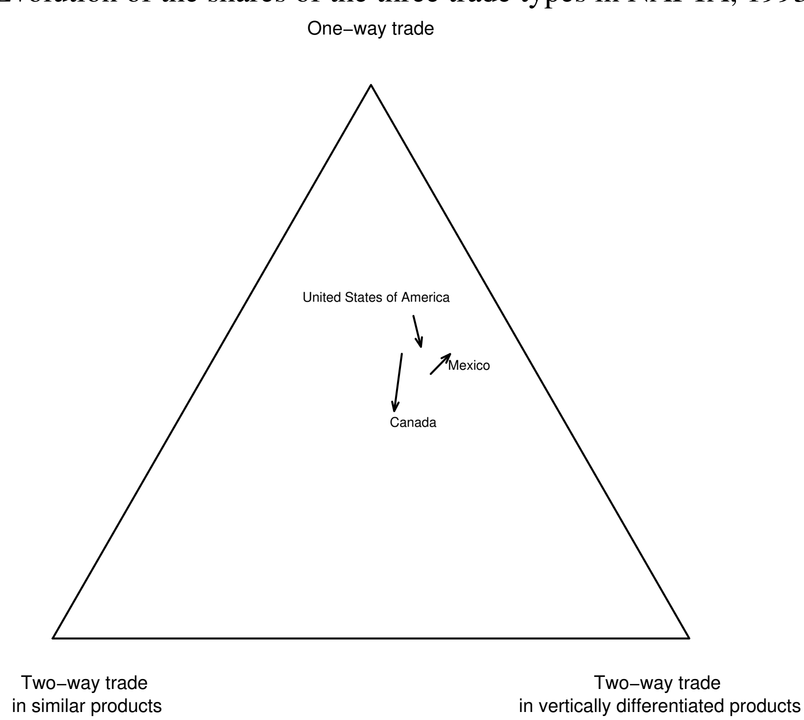
	OWT Range			TWTH Range			TWTV Range		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
Austria	7.7	15.8	14.1	3.3	13.3	8.6	9.7	11.3	16.2
Belg. & Lux.	5.6	12.5	11.2	4.8	19.8	8.5	10.0	13.3	14.3
Cyprus	21.4	17.2	20.4	1.6	5.8	2.6	9.3	10.0	11.8
Czech Rep.	19.7	13.0	6.5	9.0	7.8	2.4	26.2	9.9	5.4
Denmark	11.3	18.9	20.0	2.4	8.5	6.5	7.8	9.7	14.9
Estonia	29.5	19.8	13.8	3.6	3.5	2.8	12.7	4.8	9.6
Finland	13.9	32.1	22.5	1.6	4.9	3.5	5.4	5.9	10.3
France	5.8	11.3	11.0	5.1	19.0	9.3	10.4	12.8	15.4
Germany	5.6	11.4	12.7	3.9	15.0	9.8	10.7	13.9	17.1
Greece	22.0	25.8	23.7	1.6	4.9	3.2	6.0	4.9	7.9
Hungary	17.4	20.2	15.4	4.2	6.2	3.8	13.1	7.3	12.4
Ireland	11.2	9.5	42.6	1.6	3.7	4.3	7.7	5.5	13.9
Italy	11.7	16.1	16.4	4.6	11.0	5.3	14.4	10.2	10.4
Latvia	43.1	29.6	8.8	1.7	1.5	1.5	8.6	2.8	2.5
Lithuania	35.8	32.4	12.0	2.6	2.3	1.0	8.4	3.3	2.4
Malta	16.8	16.1	31.3	0.8	2.0	1.2	8.2	8.6	15.0
Netherlands	6.5	18.3	16.1	4.2	13.6	6.8	9.1	10.9	14.6
Poland	25.1	20.3	11.7	5.4	5.4	2.1	18.6	6.4	5.1
Portugal	10.7	18.9	20.7	3.3	13.8	5.7	9.6	7.8	9.4
Slovakia	24.9	26.9	8.3	5.9	6.5	1.6	16.4	6.0	3.7
Slovenia	19.7	18.3	12.8	4.7	7.0	3.4	17.3	6.7	10.2
Spain	10.0	17.3	10.5	7.0	17.8	5.1	14.0	9.9	8.4
Sweden	8.1	23.1	19.4	2.5	8.4	5.9	7.0	8.9	16.9
UK	5.8	14.2	11.4	3.5	13.4	7.7	11.9	14.4	17.9
All	8.4	14.9	14.3	4.2	13.8	7.4	11.2	11.6	14.3

Spain. The converse is true of Western countries like Germany, France, Denmark and Sweden.

3.2 Trade Patterns in NAFTA

Trade among members of the North American Free Trade Agreement (NAFTA) contains further evidence that there is a link between IIT and economic integration. Table5 reports trade types shares for total, extra and intra-NAFTA in 2002 and the appendix gives these shares for 1993 and by sector. Since 1995, OWT has made up less than one third of total regional trade. In 2002 it stood at 29%, but increased from a lower point in 1999. However, non-classified trade is very high within NAFTA because of the lack of reported quantities (and therefore unit values) between the US and Canada. Finally, we can be quite confident that NAFTA trade patterns are similar to EU trade patterns.

FIG. 4 – Evolution of the shares of the three trade types in NAFTA, 1993 to 2002.



Two-way trade in horizontally differentiated products is the more important between the US and Canada, which does not come at a surprise given the proximity of these two high-income countries. Mexico does more two-way-trade in vertically differentiated products. Given the non-classified trade problem, we should not overanalyze the change in TWTH and TWTV ; from 1995 to 2002 non-classified trade for Mexico within NAFTA rose by 10 points, at the expense of TWTH. It seems that IIT reached a peak in the late 1990s, thanks to a surge in TWTV as Mexico entered NAFTA, driven by regional segmentation of production along quality ranges which obviously occurred in the car industry, for example. From then on, NAFTA countries may have been re-specializing.

TAB. 5 – Trade types, NAFTA, 2002

	Extra-zone				Intra-zone				All			
	OWT	TWTnc	TWTH	TWTV	OWT	TWTnc	TWTH	TWTV	OWT	TWTnc	TWTH	TWTV
Canada	88.6	2.4	1.9	7.1	23.2	20.1	25.0	31.6	40.0	15.6	19.1	25.3
Mexico	91.0	1.8	1.5	5.8	41.1	13.1	8.9	37.0	53.2	10.4	7.1	29.4
USA	70.4	3.2	6.1	20.2	28.9	17.5	19.4	34.3	55.9	8.2	10.8	25.2
All	73.5	3.0	5.4	18.1	29.4	17.5	19.2	33.9	52.3	10.0	12.0	25.7

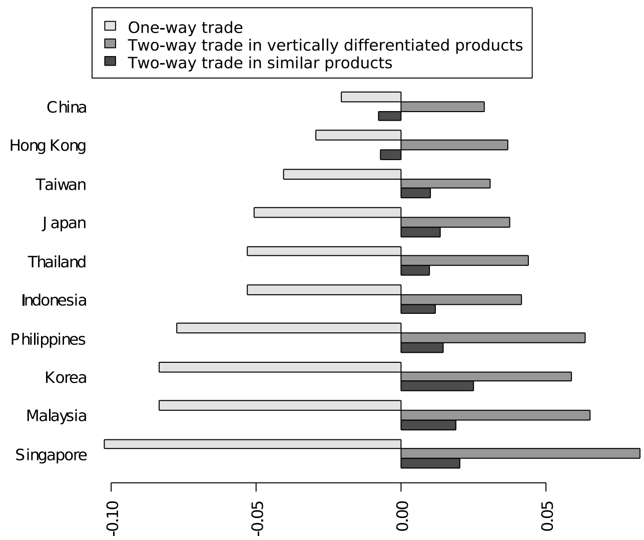
As in other regions, extra-zone trade is largely dominated by inter-industry trade. Thanks to its size and development, the US does between one-quarter and one-third of its trade in IIT, but Mexico and Canada carry out around 90% of their extra-NAFTA trade as OWT.

3.3 Trade Patterns in East Asia

The breakdown into intra-zone and extra-zone trade is particularly insightful for East Asia (China, Hong Kong, Indonesia, Japan, South Korea, Malaysia, Taiwan, the Philippines, Singapore and Thailand). Indeed, Asian countries do almost all of their IIT with their East Asian partners. Table6 reports trade types shares for total, extra and intra-zone in 2002 and the appendix gives these shares for 1993 and by sector.

Two-way-trade in horizontally differentiated products is insignificant in extra-East Asia trade, reaching only 3% in 2002 for the whole zone, and 8% for Japan. Within Asia, it remains very limited, reaching 5% in 2002, compared to 27% within EU. Korea and Singapore are slight exceptions, at 8% and 9%. respectively. All this is to be expected, given the relatively large per capita income gaps within the zone and the large geographical distances between the East Asian industrialized countries and their counterparts in the Western hemisphere. The continuous growth in East Asia should fuel further TWTH in the future. However, past growth in China has not yielded additional TWTH as a share of total trade.

FIG. 5 – Evolution of the shares of trade types in East Asia, 1993-2002.



TAB. 6 – Trade types, East Asia, 2002

	Extra-zone				Intra-zone				All			
	OWT	TWTnc	TWTH	TWTV	OWT	TWTnc	TWTH	TWTV	OWT	TWTnc	TWTH	TWTV
China	90.3	2.4	1.0	6.2	76.0	1.2	5.0	17.8	84.3	1.9	2.7	11.1
Hong Kong	85.0	3.3	1.7	10.0	74.5	1.2	5.9	18.4	78.2	1.9	4.5	15.5
Indonesia	95.0	0.6	1.0	3.4	83.3	0.8	3.9	12.0	89.7	0.7	2.3	7.3
Japan	74.3	1.2	7.6	16.8	75.0	1.4	3.6	20.0	74.6	1.3	5.8	18.3
Korea	84.6	1.4	3.0	11.1	70.2	1.0	7.6	21.2	77.9	1.2	5.1	15.8
Malaysia	86.1	2.5	2.4	9.0	63.1	4.7	7.5	24.7	74.2	3.6	5.1	17.1
Taiwan	86.1	4.9	1.4	7.6	79.4	1.5	4.2	14.9	82.6	3.1	2.9	11.4
Philippines	92.9	1.5	1.2	4.5	79.1	2.0	3.0	15.9	86.2	1.8	2.0	10.0
Singapore	78.4	2.9	3.2	15.5	59.0	3.6	8.7	28.7	67.8	3.3	6.2	22.7
Thailand	91.0	2.4	1.4	5.2	76.4	1.4	3.9	18.2	83.4	1.9	2.7	11.9
All	85.0	2.2	3.0	9.8	74.2	1.6	5.2	19.1	79.8	1.9	4.1	14.3

Two-way trade in vertically differentiated products is not very developed for extra-East Asian trade ; it reached 10% in 2002, compared with 17% for the EU. In contrast, almost all the East Asian countries do a very significant share of their intra-zone trade in TWTV. Within the East Asia, TWTV rose by 4 percentage points between 1995 and 2002, to reach 19%. It increased by 5 percentage points or more in all countries except China, Taiwan and Hong Kong. This trade type was particularly dynamic for the ASEAN countries.

Singapore, Malaysia and Korea are the leading Asian countries in IIT. Nonetheless, IIT accounts for more than a fifth of intra-zone trade for the Philippines, which is a poorer country. Within the world's major economic regions - the US, the EU and Japan - the last region is by far the most specialized.

This high level (and growth) of TWTV goes hand-in-hand with the deep regional division of production processes in the East Asia. The integration of production networks within East Asia goes beyond segmentation at the stage of production level (e.g., intermediate goods versus final goods)[10] to trade in quality ranges within products.

China and to a lesser extent other countries in Greater China (Taiwan and Hong Kong) seem to be left aside from the development of TWTV in East Asia. However, if we keep in the database products for which data is considered as unreliable (see supra), China is found to have increased its regional TWTV share by 5 points. It is common knowledge among trade data specialists that Chinese and Hong Kong trade data are unreliable, particularly because of re-exportation. Concerning Taiwan, trade flows are only reported by its partners (mirror flows) since this country does not belong to UN, to which the trade flows are reported. Consequently we should be cautious with the results for these countries. However, the integration of China into the East Asian production and trade networks seems to have more to do with a division of labor across stages of production than with intra-industry trade, including trade in quality (see Gaulier et al., 2004).

3.4 Trade Patterns in Mercosur

Among the studied zones, Mercosur (Argentina, Brazil, Paraguay, and Uruguay) is the one where the share of IIT is lowest by far, and the shares of the three trade types have been stable since 1993, as seen in Figure6. The only significant change that

[10] Gaulier et al. (2005) analyzes the rapid progress of the integration of Asian production networks, focusing on China.

can be noted is the 5 percentage point fall of Uruguayan IIT. This drop is mainly a drop of intra-zone IIT, and extra-zone IIT remains unaffected.

FIG. 6 – Evolution of the shares of trade types in Mercosur, 1993-2002.

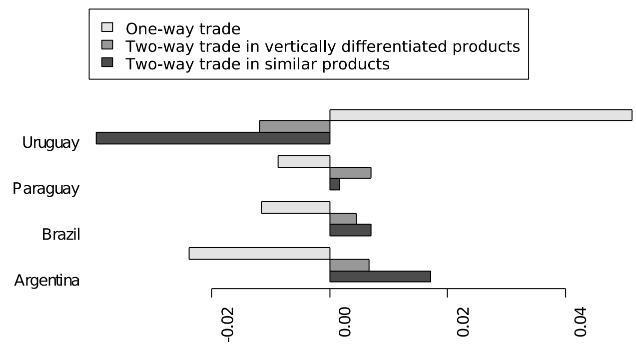


Table7 reports trade types shares for total, extra and intra-zone in 2002 and the appendix gives these shares for 1993 and by sector. Most IIT in Mercosur occurs between Argentina and Brazil. Brazil enjoys the world's tenth biggest economy, with probably the most advanced industrial sector in South America. Still, Brazil's trade is mostly OWT, at 88.9% of total trade. Intra-zone trade represents a small part of Brazilian trade, and is more IIT-oriented, with TWTV and TWTH each representing more than 14% of intra-Mercosur trade. Argentina follows the same pattern, with intra-zone IIT as high as 33%, equally divided between TWTH and TWTV. Further disaggregation shows that most intra-industry trade between Argentina and Brazil takes place within the automobile industry.

TAB. 7 – Trade types, Mercosur, 2002.

	Extra-zone				Intra-zone				All			
	OWT	TWTnc	TWTH	TWTV	OWT	TWTnc	TWTH	TWTV	OWT	TWTnc	TWTH	TWTV
Argentina	95.2	0.4	1.0	3.4	67.1	0.2	16.5	16.2	88.9	0.4	4.5	6.2
Brazil	89.6	1.0	2.2	7.2	71.3	0.3	14.4	14.0	87.7	0.9	3.5	7.9
Paraguay	99.3	0.3	0.3	0.1	96.2	1.0	0.5	2.4	97.5	0.7	0.4	1.4
Uruguay	97.5	0.5	0.8	1.3	85.1	0.4	4.2	10.2	92.4	0.5	2.2	5.0
All	91.3	0.8	1.9	6.0	73.2	0.3	13.0	13.5	88.5	0.8	3.6	7.2

Paraguay and Uruguay offer a different picture. Among the four members of Mercosur, IIT is at its lowest in Paraguay, where OWT represents 97.5% of total trade ; intra-zone trade is also mostly OWT, at 96%. Paraguay also has the lowest per capita GDP. The agricultural sector is significant, and mostly export-oriented. There is a large informal sector featuring re-exportation of imported goods to Argentina or

Brazil : IIT may therefore be underestimated. Although agriculture is less important in Uruguay, it makes up more than half of the country's exports. Uruguayan trade is mainly OWT (92%), although the country developed intra-industry trade within Mercosur, as 10% of intra-zone trade is TWTV. Yet, as stated above, both TWTV and TWTH in intra-zone trade have fallen since 1995, which may be a consequence of the integration process. This fact does not fit in the scheme proposed in this paper ; it could be explained by the great difference in size and endowments between Uruguay and its patterns.

3.5 Trade types by industries and stages of production

In the EU, as elsewhere in the world, the vast majority of new TWTV flows were concentrated in machinery (including electrical, electronic and transportation machinery) and precision apparatus. Chemical products which are also often sold on an intra-industry mode, especially within the EU and NAFTA, contributed negatively to the growth of TWTH and moderately to the growth of TWTV. Table 8 shows the distribution of world trade by types for product sections. The highest TWTH share is found in transportation machinery (further disaggregation would point to the car industry as a major contributor to TWTH). General and electrical machinery and precision apparatus have very large shares of TWTV. Consequently, the increase in IIT for aggregate trade is for a part due to composition effects : IIT increases as the share of IIT-intensive industries increases. Trade in agricultural or mining is generally OWT. More differentiated products in the food and textile industries have significant share of IIT.

As shown in Table 9, among stages of production, "parts and components" are the most IIT intensive (TWTV=37%, TWTH=15% for world trade in 2002), followed by "investments goods" (27% and 10%). "Transformed goods" and "consumption goods" have medium levels of IIT. Trade in "Primary goods" is overwhelming dominated by OWT. The main contributor to the growth in IIT is two-way trade in vertically differentiated industries, in intermediate products and among them parts and components.

4 Determinants of Intra-Industry Trade

In a Ricardian or Hecksher-Ohlin model, it is expected that trade occurs between countries with different endowments and different economic structures. However, trade between developed countries with similar endowments and structures account

TAB. 8 – Trade types by sector and stage of production, 1995 and 2002.

	1995				2002			
	OWT	TWTnc	TWTH	TWTV	OWT	TWT	TWTH	TWTV
Agriculture	86.4	0.2	6.0	7.3	84.5	0.3	6.3	8.9
Food and beverages	74.8	0.2	11.1	13.8	69.3	0.4	12.4	17.8
Mining products	89.0	0.3	5.7	5.1	86.1	0.5	5.5	7.9
Chemicals	57.9	1.6	17.3	23.2	57.6	2.3	15.4	24.8
Light industry	68.1	3.3	8.0	20.5	72.2	3.5	7.1	17.2
Wood and paper	65.6	1.2	15.0	18.2	62.0	2.2	15.1	20.7
Textile and clothing	73.0	0.6	9.1	17.3	75.6	0.9	7.4	16.1
Pottery products	65.4	2.5	9.0	23.1	64.4	3.0	8.4	24.2
Basic metals	62.2	1.5	16.7	19.6	61.7	1.9	15.4	21.0
General machinery	57.8	4.1	10.9	27.1	53.3	5.4	10.7	30.6
Electrical machinery	54.4	4.9	11.6	29.1	55.6	6.1	8.9	29.5
Precision apparatus	44.4	6.4	11.9	37.4	42.2	9.2	9.7	39.0
Transport machinery	46.2	4.8	29.3	19.7	43.1	3.8	30.5	22.5
Others	65.3	9.3	5.1	20.2	67.4	10.6	8.1	14.0
All	64.5	2.1	13.1	20.3	62.7	2.8	12.6	21.9
Consumption	68.5	1.5	12.1	18.0	66.5	2.0	12.8	18.7
Investment	60.6	3.1	11.5	24.9	58.3	4.7	10.2	26.8
Primary	87.4	0.4	5.7	6.5	87.1	0.7	6.3	6.0
Parts and components	43.3	8.1	14.9	33.6	40.0	8.5	14.5	36.9
Transformed	64.9	1.1	14.8	19.2	64.2	1.6	13.4	20.8
All	64.5	2.1	13.1	20.3	62.7	2.8	12.6	21.9

for a great part of world trade, and this trade is often intra-industry trade. This kind of trade cannot be explained by classic comparative advantage theory, because there is no such effect in this case. According to the monopolistic competition model, the appearance of intra-industry trade is caused by the desire for variety. Consumers in every country have a preference for variety. But it is not efficient to produce every variety at home : in order to benefit from economies of scale, each country produces only a small number of varieties. Intra-industry trade then occurs so that consumers can enjoy the choice between similar products. The costs of such trade, made up of transportation and other transaction costs, are lower than the benefit for the consumer. This phenomenon has been modeled by Lancaster (1980) and Krugman (1979). Helpman and Krugman (1985) developed a model to account simultaneously for inter-and intra-industry trade. This model features two countries (North and South), two factors (labor and capital), and two goods. It incorporates horizontal product differentiation, factor endowments, decreasing costs and preference for variety. Greenaway et al. (1994), using the same assumptions, and assuming that trade is balanced, show that IIT increases when differences in market size and in the labor/capital ratio are lower. It is generally accepted that the determinants of vertical and horizontal IIT are different. Horizontal IIT is often found to be more sensitive to efficient scale and monopolistic competition, while vertical IIT responds mainly to factor endowments. To quote Fontagné and Freudenberg (1997), "different countries will engage in IIT in vertically differentiated products whereas similar ones will engage in IIT of varieties within similar qualities". To test the validity of this assumption, we compute the determinants of IIT for each trade type with a different equation.

4.1 Country Characteristics

Country-related determinants of IIT can be divided into two categories. The first is the market size and endowments of the two partners. The second includes the geographical distance, the usual variable in gravity models. We have the following expectations concerning market size and endowments :

1. IIT is positively correlated with average country size ; the larger the market size, the larger the demand for differentiated products (Lancaster, 1980). Since the analysis takes place on a bilateral basis, the arithmetic mean of the GDPs is used as an indicator of country size, following the methodology proposed by Bergstrand (1990). GDPs come from the CHELEM database.[11]

2. IIT is negatively correlated with country size difference : countries with similar size will trade similar goods. On the contrary, countries with different sizes will have different abilities to produce differentiated products (Dixit and Norman, 1980, Helpman, 1981). Following Balassa (1986a) and Balassa and Bauwens (1987) we use the normalized difference in GDPs :

$$GDPD_{ij} = 1 + \frac{wln(w) + (1-w)ln(1-w)}{ln(2)}$$

   where $w \equiv \frac{GDP_i}{GDP_i+GDP_j}$. The advantage of this indicator over the absolute difference in GDPs is its insensitivity to the absolute size of the partners. However, the results are similar whichever indicator is used in the regression.

3. IIT is positively correlated with standard of living : demand for differentiated products grows as per capita income increases (Linder, 1961). PCIs come from the CHELEM database.

4. Economic distance is negatively correlated with horizontal IIT and positively correlated with vertical IIT ; absolute differences in per capita income stands

[11] See http ://www.cepii.fr/anglaisgraph/bdd/chelem.htm for more details.

for differences in resource endowments (Dixit and Norman, 1980, Helpman, 1981) and differences in demand structure (Linder, 1961).

We also introduce distance indicators that are commonly used in gravity models :

1. IIT is negatively correlated with the average level of trade barriers. Tariffs can be measured at the bilateral level and for each product of the HS6 nomenclature in the TRAINS database from UNCTAD. We base our investigation on this rather crude measurement of tariffs, namely considering weighted averages of MFN tariffs among the three partners. These tariffs are aggregated from Jon Haveman's treatment of TRAINS data[12] in order to match our ISIC rev2 industry classification using the world imports as weights for HS6 products.

2. The participation in regional integration schemes has a positive impact on IIT. A large literature has tried to provide evidence that integration schemes and trade liberalization have a positive impact on IIT. Globerman (1992) suggested from the example of NAFTA that free trade agreements could increase IIT, and Ocampo and Esguerra (1994) relate the trade liberalization of the 1980s and the rise of IIT. PTA is a dummy variable that takes one as value when both trading countries belong to the same Preferential Trade Agreement at the year t, zero otherwise[13].

3. Geographic distance has a negative impact on IIT, as it increases transport, communication and transaction cost ; consumers are likely to trade diversity for price (see for example Balassa, 1986b). We use weighted bilateral distances from Mayer and Zignago (2005).[14] As geographic distance is not a perfect proxy of these costs, we introduce two more variables from the same dataset :
   - Countries sharing a common border will have a greater share of IIT, taking account of locational advantages (Grubel and Lloyd, 1975).
   - The use of a common language reduces transaction costs and thus has a positive impact on IIT.

[12]UTBC Database, from Haveman, Nair-Reichert and Thursby (2003), http ://www.eiit.org/Protection/extracts.html

[13]105 preferential trade agreements (including bilateral trade agreements) are taken into account. EU, NAFTA, Mercosur, ASEAN are the major multilateral preferential trade agreements.

[14]Available at : http ://www.cepii.fr/anglaisgraph/bdd/distances.htm

4.2 Industry Characteristics

We introduce two sector-specific variables to test the relationship between product differentiation, scale and IIT.

1. Product differentiation allows consumers to satisfy their preference for variety (Krugman, 1979, Lancaster, 1980, Helpman, 1981), and favors higher levels of IIT. In accordance with Fontagné and Freudenberg (1997) we use the following ratio to measure product differentiation :

   $$Diff_{ijtc} = \frac{\sum_{k \in c} V_{ijtk} \frac{MAX(UV_{ijtk}, UV_{..k})}{MIN(UV_{ijtk}, UV_{..k})}}{\sum_{k \in c} V_{ijtk}}$$

   This ratio can be computed at any level of aggregation and is available for any country and industry.

2. Economies of scale increase specialization and lower production costs, and therefore have a positive impact on IIT. Several variables are proposed in the literature to measure scale economies. In this study, average establishment sizes are used as a proxy for scale economies. Those come from the "Trade and Production 1976-1999" database made available by Alessandro Nicita and Marcelo Olarreaga at the World Bank, which compiles this data for 67 developing and developed countries at the ISIC rev2 3-digit industry level over the period 1976-1999. The original data comes from UNIDO industrial statistics for production.

4.3 Estimated Model

The model is a panel data model with four dimensions : reference countries (i), partner countries (j), time (t) and industry (c). We use the Generalized Linear Model (GLM). The estimated equation is as follow, using a logit-log specification :

$$\begin{aligned} Sh_{ijtc} = \alpha_1 GDP_{ijt} + \alpha_2 GDPD_{ijt} + \alpha_3 PCI_{ijt} + \alpha_4 PCID_{ijt} \\ + \alpha_5 TARIFF_{ijtc} + \alpha_6 DIST_{ij} + \alpha_7 CONTIG_{ij} \\ + \alpha_8 COMLANG_{ij} + \alpha_9 DIFF_{ijtc} + \alpha_{10} ESIZE_{itc} \end{aligned}$$

where Sh is the share of OWT, the share of TWTV or the share of TWTH. This model is similar to a gravity model, as it relates in a multiplicative manner the dependent variable to the distance between partners and their economic size. The main difference is that this model does not have a value as dependent variable, but a share ; the purpose is to distinguish the effect of these determinants on different types of trade.

TAB. 9 – Determinants of the share of One-Way Trade, and their expected sign.

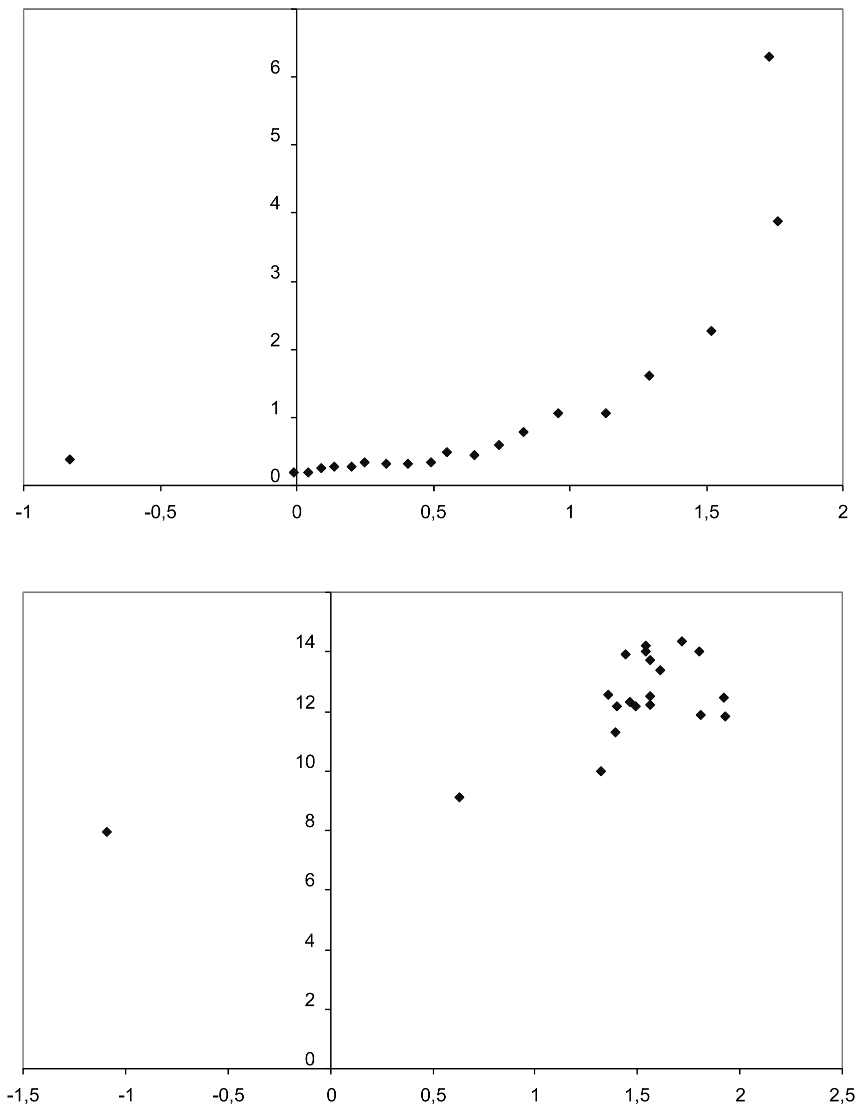
Variable	**Exp. sign**	**Indicator**
Country-specific determinants		
Size (GDP)	-	Average GDP of the two countries
Difference in size (GDPD)	+	Normalized difference of GDPs
Income per capita (PCI)	-	Average PCI of the two partners
Economic distance (PCID)	+	Differences of PCIs
Tariffs (TARIFF)	+	Bilateral tariffs
Geographic distance (DIST)	+	Weighted bilateral distances
Contiguity (CONTIG)	-	Dummy
Common language (COMLANG)	-	Dummy
Common integration zone (IZONE)	-	Dummy
Industry-specific determinants		
Product differentiation (DIFF)	-	Differentiation indicator
Economies of scale (ESIZE)	-	Average establishment size

Table9 presents the variables used and their expected signification. Independent variables, including dummies, are standardized thus allowing comparison of their respective impact on IIT ; their mean is set to zero and their standard deviation to one.

As seen in Figure7 above, variables of interest are not homoscedastic : when a logarithm specification is used, the variance of residuals is dependent on predicted values. Variances and standard errors are understated when using OLS, and observation with high shares are not given due weight. In order to stabilize the variance of dependent variables, we transform them using a logit link function (see the result in figure7). This specification is also more accurate theoretically ; by construction, the shares of the three trade types follow a binomial distribution (the parameter being the probability to belong to a given type) ; the canonical link function for binomial distributions is the logit. When all trade is completely inter-industry, it is obviously impossible to use the logit of vertical or horizontal IIT share. In these cases, we use $logit(0.005)$ (checking that $0.005 < min(TWT_f)$), where TWT_f is the share of vertical or horizontal intra-industry trade for flow f).

Countries report imports and exports to the United Nations. During the harmonization of the data, values are transformed to ensure that exports from country a to country b are equal to import of country b from country a. However, both flows

FIG. 7 – Homoscedasticity plots for the share of OWT, using a logarithm (above) or a logit specification (below), for 20 subsets. Vertical axis : standard deviation of residuals ; horizontal axis : mean of predicted values.



are included in the database ; every bit of information is reported twice. In order to avoid underestimating standard errors, we only use flows verifying $i < j$.
We introduce fixed effects, i, j, t, c, for each dimension of our panel data. Although some studies found that controlling for country effect was not useful when analyzing a homogeneous group of countries (e.g. Fontagné et al., 1997 in the case of the European Union), it appears that in the case of a worldwide study, the heterogeneity bias due to countries is not negligible. It turned out that introducing those four types of effects as random effects did not have a major impact on the results ; consequently, regressions presented here are not mixed models. In order to measure the impact of country-specific effect on IIT, we also compute the regression with only two fixed effects : t and c.
It could have been desirable to introduce more variables, or to use better proxies. For example, it is expected that IIT is negatively correlated with the degree of product standardization. Fukao et al. (2003) among others also proposed a theoretical model to link foreign direct investments and IIT, and some studies find empirical support for this view (see Aturupane et al., 1997 for the case of trade between Eastern and Western Europe). However, there is a trade-off between more variables and more observations, as most variables do not cover all countries in the world on a bilateral basis ; any worldwide study of the determinants of IIT is doomed to be plagued with missing values. We settled on a compromise that accounts for most of world trade in value, and nevertheless introduces what we considered the most important variables.

4.4 Estimation Results

As stated above, different kinds of IIT have different kinds of determinants. To take this fact into account, we computed regressions for the share of OWT, the share of TWTH and the share of TWTV. Table10 presents the results of the regression[15], without fixed effects i and j. All coefficients were statistically very significant ($p < 0.001$). A comparison with Table9 shows that for OWT all signs fit with what was expected, except for tariffs ; the coefficient is significantly negative, although a positive coefficient was expected. Yet, it is quite small compared to other coefficients. The coefficient associated with tariffs was positive for TWTV, suggesting that tariffs tend to favor vertical differentiation, for which price elasticity is arguably lower. On the contrary, the coefficient on tariffs for TWTH is negative,

[15]In all regression tables, a (1%), b (5%), and c (10%) indicate statistical significance ; standard error appear below the related coefficient in parentheses.

TAB. 10 – Results for main regressions without fixed effects for i and j.

	OWT	TWTV	TWTH
Intercept	9.306^a	-8.412^a	-10.234^a
	(0.030)	(0.029)	(0.030)
GDP	-1.664^a	1.157^a	0.955^a
	(0.008)	(0.008)	(0.008)
GDPD	0.731^a	-0.391^a	-0.570^a
	(0.005)	(0.005)	(0.005)
PCI	-0.616^a	0.504^a	0.183^a
	(0.010)	(0.010)	(0.010)
PCID	0.519^a	-0.406^a	-0.377^a
	(0.006)	(0.005)	(0.006)
Tariff	-0.088^a	0.136^a	-0.148^a
	(0.005)	(0.005)	(0.005)
Dist	1.115^a	-0.808^a	-0.821^a
	(0.006)	(0.006)	(0.007)
Contig	-0.094^a	-0.018^a	0.265^a
	(0.003)	(0.003)	(0.003)
Comlang	-0.350^a	0.050^a	0.074^a
	(0.004)	(0.004)	(0.004)
Izone	-0.357^a	0.220^a	0.227^a
	(0.003)	(0.003)	(0.003)
Diff	-0.147^a	0.163^a	0.045^a
	(0.007)	(0.006)	(0.007)
Esize	-0.120^a	0.074^a	-0.230^a
	(0.007)	(0.007)	(0.007)
N	635,973	635,973	635,973
R^2	0.51	0.37	0.36
Root MSE	486.8	469.8	495.6

suggesting that an increase in tariffs made the trade of horizontally differentiated products harder, probably because consumer then trades diversity for price. Indicators of economic distance (geographic distance, contiguity, share of a common language) have a strong impact on IIT. The coefficient for contiguity is negative for OWT and TWTV and positive for TWTH ; this is coherent with predictions of Grubel and Lloyd (1975). Small trade costs, in particular low tariffs and participation in a preferential trade agreement, unambiguously favor TWTH.

Results for the model with fixed effects for i and j are shown in Table11. If we compare Table11 and Table10, we note a lot of similarities, but also striking differences. It appears that distance indicators are very robust and have similar behavior in both tables. Distance, contiguity, and share of a common language have the same sign in both regressions, and the size of their coefficients remains comparable. This is also true for tariffs and participation to a common integration zone. Most of the literature also finds that distance is the most robust determinant of IIT. Determinants related to factor endowments and market structure are affected by the introduction of country fixed effects. GDP and per capita income are the clearest examples :

TAB. 11 – Results for main regressions with fixed effects for i and j.

	OWT	TWTV	TWTH
Intercept	7.640^a	-8.180^a	-6.128^a
	(1.238)	(1.211)	(1.293)
GDP	0.752^a	-1.301^a	-0.275^a
	(0.038)	(0.037)	(0.040)
GDPD	-0.001	0.336^a	-0.351^a
	(0.013)	(0.012)	(0.013)
PCI	0.556^a	-0.481^a	-0.143^a
	(0.026)	(0.025)	(0.027)
PCID	0.247^a	-0.234^a	-0.276^a
	(0.008)	(0.008)	(0.008)
Tariff	-0.111^a	0.195^a	-0.011
	(0.006)	(0.006)	(0.007)
Dist	1.101^a	-0.904^a	-0.397^a
	(0.009)	(0.008)	(0.009)
Contig	-0.128^a	-0.045^a	0.281^a
	(0.003)	(0.003)	(0.003)
Comlang	-0.195^a	0.135^a	0.084^a
	(0.006)	(0.006)	(0.006)
Izone	-0.299^a	0.121^a	0.489^a
	(0.005)	(0.005)	(0.005)
Diff	0.014^b	0.093^a	0.074^a
	(0.006)	(0.006)	(0.007)
Esize	-0.396^a	0.133^a	0.207^a
	(0.010)	(0.009)	(0.010)
N	635,973	635,973	635,973
R^2	0.57	0.44	0.41
Root MSE	453.6	443.6	474.0

both have their signs reversed. This result is expected, as dummies for countries attracted most of country-specific effects. The difference in GDPs has no significant impact on OWT ; however, it is positively linked with TWTV. Once country effects are taken into account, countries with different GDPs tend to trade vertically differentiated products, and countries with similar GDPs tend to trade horizontally differentiated products. The difference in per capita income has the same sign in both models, its effect being smaller when country effects are introduced.

Krugman and Venables (1990) have argued that as transportation costs fall, three different allocation patterns may exist in a two-country economy : high shipping costs lead to production in both countries, medium shipping costs lead to production in the country with high wages but good access to markets, and low shipping costs prompt allocation of production in the country with low wages but worse access to markets. There would be a U-shaped relationship between transport costs and industrial output of peripheral countries. In an attempt to test this relationship, we introduce square distance in the model. We find support for such a hypothesis in Table12. Results are very similar to those obtained in Table11. Distance has a

TAB. 12 – Results for main regressions with one additional variable : square distance (Dist2). Fixed effect for i and j are included.

	OWT	TWTV	TWTH
Intercept	7.684^a	-8.285^a	-6.128^a
	(1.238)	(1.210)	(1.294)
GDP	0.723^a	-1.222^a	-0.276^a
	(0.039)	(0.038)	(0.041)
GDPD	0.011	0.305^a	-0.351^a
	(0.013)	(0.013)	(0.014)
PCI	0.552^a	-0.469^a	-0.142^a
	(0.026)	(0.026)	(0.027)
PCID	0.252^a	-0.246^a	-0.277^a
	(0.008)	(0.008)	(0.009)
Tariff	-0.118^a	0.220^a	-0.015^b
	(0.006)	(0.006)	(0.007)
Dist	0.573^a	0.441^a	-0.367^a
	(0.062)	(0.061)	(0.065)
Dist2	0.565^a	-1.439^a	-0.033
	(0.066)	(0.065)	(0.069)
Contig	-0.137^a	-0.022^a	0.282^a
	(0.004)	(0.004)	(0.004)
Comlang	-0.199^a	0.146^a	0.084^a
	(0.006)	(0.006)	(0.007)
Izone	-0.282^a	0.077^a	0.487^a
	(0.006)	(0.006)	(0.006)
Diff	0.017^a	0.089^a	0.075^a
	(0.007)	(0.007)	(0.007)
Esize	-0.397^a	0.136^a	0.208^a
	(0.010)	(0.010)	(0.010)
N	635,973	635,973	635,973
R^2	0.58	0.44	0.41
Root MSE	453.6	443.3	474.0

significant positive impact on TWTV, while square distance has a strongly negative impact, suggesting that there is a U-shaped relationship between distance and vertically differentiated IIT. For horizontally differentiated IIT, square distance appears statistically insignificant ; the relationship is linear.

Before concluding, we discuss the main results and their implications regarding economic integration. High share of intra-industry, besides being an indicator for integration (and industrialization since it concerns mainly manufactured goods), can be viewed as desirable by promoters of currency areas as it implies a lower frequency of asymmetric shocks. Industry specific shocks are not present if the specialization is intra-industry and "intra-quality" (TWTH). As regards as symmetry of shocks, vertical intra-industry could be intermediary between horizontal intra-industry and inter-industry.

Short distances are necessary for horizontal intra-industry to take a significant share of trade. A common border is also important, particularly by allowing cross-border

trade of products which usually are not internationally traded (such as cement or other heavy materials).
Vertical intra-industry is also very sensitive to distance. The quadratic relationship between distance and TWTV implies a very high response to distance of this type of trade. The inverted U-curve is of less practical significance since its declining part is attained for very short distances. The contiguity is not significant in that case. On the contrary, the existence of a common language favors greatly vertical intra-industry : business networks and good communications may have an important role. Institutional integration (more generally preferential trade agreements ; variable $Izone$) seem to boost TWTH and TWTV, but to a lesser extent in the latter case, making trade integrated area good candidates for being Optimal Currency Areas. However, low tariffs, generally associated with PTA, are more ambiguous : they depress TWTV without having much impact on TWTH. In fact, what is required for intra-industry to develop is deep integration, stable business networks, good mutual knowledge of partners, etc. Proximity in all sense is essential, leaving only a limited impact to policies. Vertical intra-industry can develop without strong formal integration, it can accommodate barriers to trade. Within regions (in a geographical sense, notwithstanding any formal integration) a division of labor by quality emerges when firms specialize in different market segment. Proximity is crucial because it facilitates the exchange of information about the supply but, once established, the specialization by quality is less sensitive to transaction costs (products of different qualities are not substitutes, therefore the price elasticity is low).
The EU is the only region that combines short distances and deep integration of industrialized countries. The intra-industry potential of Asia is of less extent because of longer distances and heterogeneity of development levels. Yet, vertical intra-industry has been dynamic in this region, certainly taking profit of business networks (Chinese diaspora, etc.) and of the capacity of multinational firms to exploit comparative advantages along the quality range.

5 Concluding Remarks

Theory does not yet provide a framework to explain unequivocally the relationship between economic integration and the level of intra-industry trade. While early models based on monopolistic competition (Krugman, 1979) or oligopolistic competition (Brander, 1981, Shaked and Sutton, 1984) predict a positive correlation between the two phenomena, other models expect the contrary (Wong, 1995). Transportation costs certainly play a key role and affect the outcome of integration (Krugman, 1991a). In this paper, trade flows were classified as inter-or intra-industry and IIT was broken down into horizontal and vertical components. The analysis of trade patterns in the European Union, NAFTA, East Asia and Mercosur suggest that there is a positive link between IIT and regional integration, although the case of Mercosur is not clear-cut. In Europe, contrary to Brülhart and Torstensson (1996), we do not observe an increase of OWT in intra-zone trade suggesting a concentration of production in central countries. The determinants of the share of vertical and horizontal IIT were investigated. Results support the conclusion that countries with similar endowments and sizes tend to trade similar goods, that there is a non-linear negative relationship between IIT and geographic distance, and that belonging to a preferential trade agreement favors IIT between member countries. Further research will determine if the observed trend toward the increase of IIT within integrated zones will be followed by a concentration of production in economic cores and a drop of IIT, as predicted by some models.

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7 Appendix

TAB. 13 – Trade types in EU-25, by country (1993) and by ISIC industry (1995-2002)

	Extra-zone				Intra-zone				All			
	OWT	TWTnc	TWTH	TWTV	OWT	TWTnc	TWTH	TWTV	OWT	TWTnc	TWTH	TWTV
By country :												
Austria	67.0	3.8	10.2	19.1	33.7	0.5	26.2	39.7	40.5	1.1	22.9	35.5
Belg. & Lux.	84.4	3.9	2.9	8.9	35.3	0.6	31.0	33.1	47.5	1.4	24.0	27.1
Cyprus	97.0	0.2	1.0	1.8	90.9	1.2	2.8	5.0	93.0	0.9	2.2	3.9
Czech Rep.	94.8	1.1	0.7	3.4	62.7	1.6	7.8	27.9	68.7	1.5	6.5	23.3
Denmark	82.7	1.2	4.2	11.9	57.4	0.8	14.8	26.9	65.0	1.0	11.6	22.4
Estonia	99.5	0.1	0.1	0.2	87.9	0.9	1.8	9.5	91.0	0.7	1.4	7.0
Finland	89.5	1.3	2.0	7.2	71.7	1.1	8.5	18.7	78.0	1.2	6.2	14.6
France	72.4	5.8	6.0	15.8	36.2	0.6	30.7	32.5	47.1	2.2	23.3	27.5
Germany	69.1	0.9	9.3	20.7	37.5	0.3	26.3	36.0	48.3	0.5	20.4	30.7
Greece	94.6	0.5	0.9	4.0	85.5	0.4	5.0	9.1	87.8	0.4	4.0	7.8
Hungary	91.6	1.1	1.6	5.8	65.6	0.8	9.0	24.6	72.9	0.8	7.0	19.4
Ireland	85.4	2.8	2.1	9.8	50.0	1.4	19.9	28.7	57.1	1.7	16.4	24.9
Italy	80.2	4.5	3.6	11.8	54.9	0.6	13.9	30.5	64.5	2.1	10.0	23.4
Latvia	98.6	0.9	.	0.5	92.8	0.8	2.1	4.3	94.1	0.8	1.6	3.5
Lithuania	99.9	0.0	0.0	0.1	93.4	0.5	1.7	4.4	94.4	0.4	1.4	3.7
Malta	98.8	0.9	0.0	0.3	90.0	0.7	1.4	7.9	91.6	0.7	1.2	6.5
Netherlands	84.2	0.9	4.1	10.8	38.9	0.4	28.3	32.4	52.1	0.6	21.3	26.1
Poland	97.1	1.1	0.4	1.4	76.2	1.1	4.6	18.1	80.4	1.1	3.7	14.8
Portugal	95.5	0.7	0.8	3.1	66.8	0.8	12.8	19.6	71.9	0.8	10.7	16.6
Slovakia	97.5	0.4	0.2	1.9	57.2	1.2	15.3	26.4	58.9	1.2	14.6	25.3
Slovenia	71.1	2.9	6.2	19.8	75.3	0.8	4.0	20.0	74.0	1.4	4.7	19.9
Spain	90.8	0.7	1.9	6.6	52.1	0.6	20.9	26.4	63.4	0.6	15.4	20.6
Sweden	76.3	1.8	6.8	15.2	55.7	1.0	15.2	28.1	63.1	1.3	12.2	23.5
UK	70.5	1.7	7.3	20.5	41.8	0.8	23.3	34.1	52.9	1.2	17.1	28.8
All	76.3	2.1	6.1	15.5	44.8	0.6	23.0	31.6	54.8	1.1	17.6	26.5
By sector :												
Agriculture	96.5	0.2	1.3	2.0	64.5	0.2	16.6	18.7	73.3	0.2	12.4	14.1
Food & bev.	91.0	0.5	2.6	5.9	50.2	0.3	22.5	27.0	62.0	0.4	16.7	21.0
Mining prod.	94.3	0.4	1.7	3.6	68.3	0.5	11.3	19.9	79.2	0.5	7.3	13.1
Chemicals	70.1	1.2	8.2	20.5	33.5	0.6	30.5	35.4	43.4	0.8	24.5	31.4
Light ind.	77.4	1.2	4.8	16.6	42.7	0.6	19.3	37.5	54.6	0.8	14.3	30.3
Wood & paper	75.8	0.8	7.3	16.1	46.0	0.4	25.8	27.8	53.3	0.5	21.3	25.0
Textile & cloth.	85.0	0.9	3.8	10.3	43.9	1.3	19.4	35.4	59.0	1.1	13.7	26.2
Pottery prod.	80.8	1.8	3.3	14.1	47.4	0.6	17.1	34.9	56.8	0.9	13.3	29.1
Basic metals	75.7	1.1	6.9	16.4	35.5	0.3	32.4	31.8	46.7	0.5	25.3	27.5
General mach.	64.4	2.1	8.2	25.3	33.7	0.7	21.4	44.3	44.6	1.2	16.7	37.5
Electrical mach.	67.9	2.8	6.3	23.0	31.1	1.6	20.3	47.1	43.4	2.0	15.6	39.0
Precision appar.	42.3	5.2	10.8	41.8	28.8	2.6	17.8	50.9	35.0	3.8	14.5	46.7
Transport mach.	74.6	2.5	8.5	14.4	28.1	0.4	45.8	25.7	35.6	0.7	39.8	23.9
Others	59.0	12.7	7.5	20.8	48.5	5.6	13.1	32.9	54.1	9.3	10.2	26.5
All	75.0	1.5	6.3	17.3	39.5	0.6	26.3	33.6	50.0	0.9	20.4	28.7

TAB. 14 – Trade types in NAFTA, by country (1993) and by ISIC industry (1995-2002)

	Extra-zone				Intra-zone				All			
	OWT	TWTnc	TWTH	TWTV	OWT	TWTnc	TWTH	TWTV	OWT	TWTnc	TWTH	TWTV
By country, 1993 :												
Canada	90.6	2.8	1.6	5.0	33.8	22.5	17.0	26.7	49.2	17.2	12.8	20.8
Mexico	92.9	0.6	1.5	5.0	42.2	1.7	16.4	39.6	54.4	1.5	12.8	31.3
USA	73.2	4.2	5.5	17.1	35.6	16.2	17.1	31.1	62.1	7.8	8.9	21.2
All	75.5	3.9	5.0	15.5	36.0	16.2	16.9	30.9	58.8	9.1	10.1	22.0
By sector, 1995-2002 :												
Agriculture	97.0	0.2	0.7	2.2	63.4	1.1	16.5	19.0	83.9	0.6	6.8	8.7
Food and beverages	86.6	1.0	3.0	9.4	39.2	0.2	33.7	26.9	65.2	0.7	16.9	17.3
Mining products	95.7	0.3	0.7	3.3	51.9	0.1	36.4	11.6	78.4	0.3	14.8	6.5
Chemicals	62.9	2.2	9.5	25.5	26.1	12.8	29.6	31.5	44.3	7.5	19.7	28.6
Light industry	85.3	2.9	2.3	9.5	21.7	41.0	7.4	29.9	60.9	17.6	4.2	17.4
Wood and paper	79.1	0.9	3.9	16.2	48.1	8.7	18.3	25.0	59.2	5.9	13.1	21.8
Textile and clothing	82.7	0.5	5.2	11.7	22.9	1.4	31.9	43.9	59.7	0.8	15.4	24.1
Pottery products	75.0	3.6	4.4	17.1	32.6	16.9	11.1	39.3	53.8	10.3	7.8	28.2
Basic metals	75.3	2.7	5.0	17.0	26.0	5.7	27.7	40.6	46.9	4.4	18.1	30.6
General machinery	55.4	5.8	8.7	30.1	17.2	33.8	11.4	37.5	39.1	17.8	9.9	33.2
Electrical machinery	61.4	6.9	5.5	26.2	17.2	29.1	11.4	42.4	38.2	18.5	8.6	34.7
Precision apparatus	32.9	12.2	11.4	43.5	15.4	47.8	7.4	29.5	28.1	21.9	10.3	39.7
Transport machinery	67.3	2.9	11.9	18.0	16.5	32.7	9.5	41.3	37.3	20.5	10.5	31.7
Others	67.6	7.3	6.5	18.6	16.9	30.9	8.6	43.6	57.6	12.0	6.9	23.6
All	71.7	3.1	6.1	19.1	29.2	16.1	20.7	34.0	51.4	9.3	13.1	26.2

TAB. 15 – Trade types in Mercosur, by country (1993) and by ISIC industry (1995-2002)

	Extra-zone				Intra-zone				All			
	OWT	TWTnc	TWTH	TWTV	OWT	TWTnc	TWTH	TWTV	OWT	TWTnc	TWTH	TWTV
By country, 1993 :												
Argentina	95.4	0.6	0.8	3.2	77.6	0.5	8.9	12.9	91.2	0.6	2.7	5.5
Brazil	90.0	1.0	2.1	6.9	82.9	0.4	6.6	10.1	88.9	0.9	2.8	7.4
Paraguay	99.5	0.1	0.0	0.3	98.4	0.1	0.4	1.1	98.9	0.1	0.2	0.7
Uruguay	98.1	0.4	0.9	0.7	78.1	0.5	10.6	10.8	87.2	0.5	6.2	6.2
All	92.1	0.8	1.6	5.5	81.9	0.4	7.3	10.4	89.9	0.7	2.8	6.5
By sector, 1995-2002 :												
Agriculture	98.9	0.0	0.5	0.5	98.1	0.1	0.5	1.3	98.7	0.1	0.5	0.8
Food and beverages	97.7	0.1	0.7	1.6	78.1	0.1	7.8	13.9	95.4	0.1	1.6	3.0
Mining products	96.5	0.2	0.3	3.1	93.1	0.0	4.7	2.2	96.0	0.2	0.9	2.9
Chemicals	86.0	0.7	4.2	9.2	51.3	0.2	29.4	19.0	77.2	0.6	10.6	11.7
Light industry	93.9	0.7	1.0	4.5	81.6	0.3	5.4	12.6	91.7	0.6	1.8	5.9
Wood and paper	93.0	0.6	1.7	4.7	76.7	0.1	7.7	15.4	89.5	0.5	3.0	7.0
Textile and clothing	94.9	0.5	1.3	3.3	74.1	0.5	14.2	11.2	87.7	0.5	5.8	6.1
Pottery products	86.8	1.3	1.9	10.0	72.3	0.2	8.7	18.8	83.5	1.1	3.4	12.0
Basic metals	91.4	0.8	2.1	5.8	64.4	0.3	16.2	19.1	87.6	0.7	4.1	7.6
General machinery	79.4	1.6	3.9	15.1	54.5	0.4	14.7	30.4	75.8	1.4	5.5	17.4
Electrical machinery	83.2	1.9	3.0	11.8	57.9	0.7	15.8	25.6	78.6	1.7	5.4	14.3
Precision apparatus	86.8	3.0	1.4	8.9	73.9	2.7	5.2	18.2	86.1	3.0	1.6	9.4
Transport machinery	83.7	1.1	4.2	10.9	55.2	0.0	20.8	24.0	72.8	0.7	10.5	15.9
Others	90.1	1.7	1.1	7.0	91.7	0.3	.	8.0	90.3	1.6	1.0	7.2
All	91.0	0.7	2.1	6.2	72.8	0.2	12.9	14.0	87.1	0.6	4.5	7.9

TAB. 16 – Trade types in East Asia, by country (1993) and by ISIC industry (1995-2002)

	Extra-zone				Intra-zone				All			
	OWT	TWTnc	TWTH	TWTV	OWT	TWTnc	TWTH	TWTV	OWT	TWTnc	TWTH	TWTV
By country, 1993 :												
China	94.4	1.9	0.7	3.0	77.9	3.4	5.9	12.8	85.6	2.7	3.5	8.2
Hong Kong	86.9	3.2	1.2	8.7	75.6	3.8	7.3	13.3	79.7	3.6	5.1	11.7
Indonesia	97.9	0.3	0.3	1.5	91.9	0.5	2.3	5.3	95.2	0.4	1.2	3.2
Japan	77.2	0.8	5.6	16.3	83.3	1.4	3.0	12.4	79.8	1.1	4.5	14.6
Korea	89.7	1.2	1.6	7.5	81.8	1.2	4.0	13.0	86.1	1.2	2.7	10.0
Malaysia	92.7	2.7	0.9	3.8	71.5	8.0	4.9	15.5	80.5	5.8	3.2	10.6
Taiwan	88.2	5.1	1.1	5.6	84.2	2.6	2.6	10.7	86.0	3.7	1.9	8.4
Philippines	95.6	1.6	0.4	2.4	92.3	1.3	0.9	5.5	94.1	1.5	0.6	3.8
Singapore	83.0	6.6	1.8	8.7	66.9	9.2	5.7	18.2	74.0	8.0	4.0	14.0
Thailand	93.9	1.4	0.6	4.2	83.2	2.4	3.0	11.4	88.7	1.9	1.8	7.7
All	86.4	2.1	2.6	9.0	80.0	3.1	4.3	12.6	83.2	2.6	3.5	10.8
By sector, 1995-2002 :												
Agriculture	97.7	0.2	0.5	1.6	91.8	0.4	2.1	5.8	95.6	0.3	1.0	3.1
Food and beverages	90.9	0.2	2.0	6.9	84.7	0.4	3.8	11.2	88.2	0.3	2.8	8.7
Mining products	97.9	0.4	0.3	1.4	87.0	1.8	4.0	7.1	93.2	1.0	1.9	3.9
Chemicals	77.1	1.6	5.6	15.7	75.7	1.1	6.7	16.6	76.3	1.3	6.2	16.2
Light industry	91.9	1.5	1.0	5.6	82.7	1.3	3.7	12.3	88.1	1.4	2.2	8.4
Wood and paper	85.1	1.2	1.9	11.9	78.9	1.9	6.4	12.9	81.9	1.5	4.2	12.4
Textile and clothing	94.5	0.7	0.9	3.9	77.0	0.6	6.0	16.5	84.4	0.6	3.8	11.2
Pottery products	80.3	2.9	2.9	13.9	74.8	3.9	3.0	18.3	77.7	3.4	2.9	16.0
Basic metals	86.6	2.0	2.4	9.1	73.3	1.5	7.3	17.9	79.4	1.7	5.0	13.8
General machinery	74.8	4.9	3.8	16.5	67.9	5.0	3.0	24.0	71.7	5.0	3.5	19.9
Electrical machinery	75.8	4.7	3.1	16.5	54.9	5.5	8.7	31.0	64.8	5.1	6.0	24.1
Precision apparatus	53.1	11.3	6.1	29.6	57.9	8.5	4.3	29.4	54.6	10.4	5.5	29.6
Transport machinery	86.0	0.8	5.3	8.0	82.2	1.3	4.9	11.6	84.9	1.0	5.2	9.0
Others	89.2	5.1	0.8	4.9	95.9	2.2	0.5	1.4	89.8	4.8	0.8	4.6
All	84.2	2.3	2.9	10.6	74.8	2.0	5.6	17.6	79.5	2.2	4.2	14.1