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Intra-Industry Trade: Methodological Issues Reconsidered

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RESUME

La mise en évidence d'échanges intra-branche entre économies de niveau de développement similaire limita considérablement, dans les années soixante, la portée des théories traditionnelles du commerce international basées sur la logique d'avantage comparatif. A l'origine, cette simultanéité d'importations et d'exportations au sein d'une même branche déboucha sur "un phénomène à la recherche d'une théorie nouvelle". Depuis lors, une synthèse des déterminants du commerce inter- et intra-branche a été réalisée, mais les progrès au cours des quinze dernières années ont été tels que c'est aujourd'hui la théorie qui est à la recherche d'outils de validation empirique adéquats.

La synthèse contemporaine est basée sur la perception commune selon laquelle la concurrence monopolistique et les économies d'échelle (internes) sont associés au commerce intra-branche entre pays similaires, alors que le principe d'avantage comparatif continue à conserver son pouvoir explicatif pour des économies séparées par une grande distance économique, c'est-à-dire par une forte différence dans les proportions de facteurs, les niveaux technologique, etc. Cette synthèse s'intéresse essentiellement aux produits différenciés horizontalement : les produits sont disponibles pour les consommateurs dans différentes variétés et le commerce international, élargissant le marché, permet simplement de disposer d'une plus grande variété et éventuellement de réaliser des économies d'échelle. Dans un tel contexte, le commerce inter-branche augmente avec la distance économique, et le commerce intra-branche diminue en proportion.

Mais les produits ne sont pas seulement différenciés (horizontalement) par des caractéristiques secondaires ; leur qualité ainsi que leur prix peuvent différer. Et dans un tel contexte de différenciation *verticale* de produits, les explications théoriques doivent être renouvelées. En termes "d'équilibre intégré", la distance économique n'est plus le déterminant de la seule spécialisation des pays sur des branches selon leur avantage comparatif, mais également celui de leur spécialisation sur les gammes au sein de ces branches.

Combinant ces deux types de différenciation au sein d'un modèle synthétique de concurrence imparfaite - au sein duquel les consommateurs choisissent le niveau de qualité puis entre les variétés d'une même qualité - on obtient le résultat suivant: des pays différents s'engageront dans un commerce intra-branche en différenciation verticale et des pays similaires dans un commerce intra-branche en différenciation horizontale. La distance économique, représentée ici par la différence d'allocation de ressources sur le spectre de qualité, est donc compatible avec un commerce intra-branche en différenciation verticale.

Contrastant avec une complexité croissante des modèles de concurrence en concurrence imparfaite, l'essentiel des travaux empiriques continue pourtant à utiliser des indicateurs de type Grubel & Lloyd, indicateurs fondés sur le degré de recouvrement des échanges. Un certain nombre de difficultés traditionnelles peuvent en être aisément corrigées, en utilisant une décomposition fine des nomenclatures au niveaux bilatéral,

voire en distinguant entre les deux types de différenciation. Ceci n'enlève rien pourtant aux difficultés intrinsèques de tels indicateurs.

La méthode proposée décompose le commerce total en trois types : commerce croisé de produits similaires, commerce croisé de produits différenciés verticalement et commerce univoque. Chaque paire de flux élémentaire (exportation-importation) n'appartenant qu'à un seul et même type, la cohérence entre théorie et empirie est préservée. Utilisant des données relatives aux 11 pays européens et leurs 10 partenaires, pour quelque 10 000 produits, cette méthode met en évidence le rôle central du commerce croisé en différenciation verticale dans la progression récente de l'intra-branche.

Afin de mieux caractériser la spécialisation des pays sur les gammes, et sous l'hypothèses que les différences de prix par rapport à une norme européenne reflètent des différences de qualité, on définit trois segments : bas, milieu et haut de gamme pour lesquels la spécialisation des pays européens est identifiée. En dépit de l'utilisation commune des valeurs unitaires, un tel instrument de comparaison ne doit toutefois pas être confondu avec la notion, indépendante, de types de commerce.

SUMMARY

In the 1960s, the evidence of *intra-industry trade* (IIT) between countries of similar development levels severely limited the scope of traditional theories of international trade based on the concept of comparative advantage. Originally, such simultaneous exports and imports *within* industries led to a concept "in search of a (new) theory". Today, a synthesis of determinants of IIT and inter-industry trade is attained. And progress during the last 15 years has been such that today, it is the theory which is in search of an appropriate empirical methodology.

The contemporary theoretical synthesis is based on the widespread view that monopolistic competition and (internal) increasing returns lead to IIT between similar countries, whereas the old comparative advantage is still be at work for countries separated by a high economic distance, i.e. a large difference in factor endowments, technology levels etc. These studies consider products to be horizontally differentiated: products are available to consumers in different varieties, and international trade, as it increases the size of the market, simply leads to a greater variety of goods and possibly to the achievement of economies of scale. Here, the economic distance increases inter-industry trade and conversely reduces IIT.

But products are not only (horizontally) differentiated by secondary attributes, but also differ by quality and price: this is a case of *vertical* product differentiation. Such a distinction modifies the theoretical framework: using the "integrated equilibrium" approach, the economic distance between countries is no longer the basis for specialisation between industries along a comparative advantage scheme only, but also the basis for a specialisation along ranges of quality, within industries.

Combining these two kinds of product differentiation into a single model of imperfect competition -in which consumers choose first among qualities and then among varieties of each quality- yields the following central result: different countries will engage in IIT in vertically differentiated products whereas similar ones will engage in IIT of varieties within similar qualities. Here, the economic distance - here the difference among countries in the allocation of specific resources along the quality spectrum - is compatible with IIT in vertically differentiated products.

Contrasting with an increasing complexity of models of trade under imperfect competition, the bulk of empirical work still uses Grubel and Lloyd-type indicators, based on the *degree of overlap* in trade. General shortcomings of such indicators can easily be corrected, e.g. using a strict bilateral basis at the most detailed level of sectoral breakdown, eventually distinguishing between horizontal and vertical differentiation. However some specific shortcomings of indicators remain due to its very construction.

The proposed methodology breaks down total trade into three trade types: two-way trade in similar products, two-way trade in vertically differentiated products, or one-way trade. Both exports and imports being part of the same type, a single explanation is associated to each flow registered, offering a guaranty of coherence between theoretical insights and empirical measurement. Using a data set embodying data flows of 11

European countries facing 10 partners for around 10 000 products, the methodology emphasises that the recent increase in IIT in Europe is entirely due to a trade in vertically differentiated products.

To better apprehend the countries' specialisation along the quality ranges, it is assumed that differences in prices reflect quality differences. Thus, flows for the same product with a given trade partner can exist in three different price/quality ranges: up-, middle- or down-market, depending on the difference to the European average price. The specialisation of each country is then characterised. Finally trade types and price/quality ranges are two distinct and strictly independent notions, despite their common use of unit values.

INTRA-INDUSTRY TRADE METHODOLOGICAL ISSUES RECONSIDERED

Lionel Fontagné, Michael Freudenberg

INTRODUCTION

The revelation of simultaneous exports and imports *within* industries (defined as *intra-industry trade* - IIT[1]) between countries of similar development levels is one of the most important empirical finding of the 1960s concerning international trade. It may be seen as the starting point of the renewal of international trade theory, the theoretical base in understanding this phenomenon being considerably enlarged since then.

Originally, this empirical evidence has given support to a rejection of traditional theories of international trade based on the concept of comparative advantage: if countries export and import products belonging to the same industry, the specialisation process might not be the core phenomenon of internationalisation. With the methodology implemented in pioneering studies, the bulk of trade among industrial countries was intra-industry.

As a result of a debate concerning the measurement of the phenomenon on the one hand, and its determinants on the other hand, the original opposition between specialisation and IIT has been smoothed:

(a) correcting the shortcomings of original methods, the share of IIT in total trade has been largely reduced, while in addition IIT itself has been divided into two parts: IIT in horizontally differentiated products and IIT in vertically differentiated products;

(b) models of IIT, originally fed by the reference to the former type of differentiation, have rapidly turned towards the latter type of differentiation, accounting for specialisation along ranges of quality within industries (Falvey, 1980).

Meanwhile, a synthesis of determinants of IIT and inter-industry trade seems to be accepted by scholars. It is based on the view that monopolistic competition and (internal) increasing returns lead to IIT, whereas the old comparative advantage is not disqualified for countries separated by a large difference in factor endowments: "To use a terminology that has been widely accepted, we can have a Heckscher-Ohlin view of interindustry specialisation but a scale economy view of intraindustry trade" (Helpman and Krugman, 1985).

But, basically, the bulk of empirical work is still based on the methodology introduced by Balassa, even improved, and it is not clear whether such a methodology remains the most adapted given the complex view of IIT that has been attained. The

[1] Economists have been quite inventive to qualify this phenomenon. Among others, we find expressions like "intra-industry trade" (Balassa, Grubel et Lloyd), "two-way trade" (Gray), "overlap trade" (Finger), "horizontal trade" (Kojima), "cross-hauling" (Brander), or "two-way trade in similar products" (Abd-El-Rahman).

purpose of this paper is to challenge such methodologies, emphasising the determinants on IIT of both types (horizontal versus vertical differentiation).

It is advocated that a methodology which breaks down total trade in different trade types, calculated on a strict bilateral basis at the most detailed level of sectoral breakdown, is to be preferred. It minimises different biases and gives a single explanation to each flow registered, offering a guaranty of coherence between theoretical insights and empirical measurement.

Whatever the methodology implemented is, a distinction between horizontal and vertical differentiation of products traded has to be made, since determinants of both types of IIT are controversial: a monopolistic competition framework based on a two stage budgeting (quality/variety) yields a negative relationship between the economic distance, proxied by the concentration of resources, of two countries and the share of overlap in trade of similar qualities. Would both countries allocate their resources in the same manner along the quality spectrum, trade would be only IIT in horizontally differentiated products.

Thus, different countries will engage in IIT in vertically differentiated products whereas similar ones will engage in IIT of varieties within similar qualities. Their economic distance is therefore a determinant of IIT in vertically differentiated products, and empirical methods have to account for a distinction between both types of IIT.

The paper is organised as follows:

Theoretical foundations of the debate are examined in a first section; the "new classical view" is surveyed, before proposing a simple model where "quality matters".

Traditional indicators such as the Grubel and Lloyd indicator are examined in a second section. It is concluded that a certain number of shortcomings can, and have been, corrected in recent research; but inherent problems remain with such a tool.

In the third section, a method which disentangles trade in three *trade types* is proposed, where both exports and imports are part of either two-way trade in similar products, two-way trade in vertically differentiated products, or one-way trade. Traditional measures and this approach are supplementary rather than substitutes, since each one tries to answer a specific question. Grubel and Lloyd related indicators yield information on the *intensity of overlap* in trade, whereas the approach proposed here measures the *relative importance of each of the three trade types in all trade*.

Finally, some empirical evidence is given for intra-EC trade, drawn from a recent CEPII report for the European Commission.

1. THEORETICAL FOUNDATIONS OF THE EMPIRICAL MEASUREMENT OF IIT

Originally, the empirical evidence of simultaneous exports and imports of similar products was understood as an invalidation of traditional theories of international trade based upon the principle of comparative advantages. Today, things have changed: neither the very existence of IIT, nor the need for both comparative advantage and preferences based theories of international trade are questioned. The modern debate addresses much more the measurement of the phenomenon and the integration of theoretical advances related to the differentiation of products.

During the late 1970s and early 1980s, new models of international trade were designed, using three distinctive frameworks: the models of monopolistic competition launched by Spence-Dixit-Stiglitz (SDS) and Lancaster, and the small number market structures. As a result, a new orthodoxy emerged —referred to below as the "new classical view"— highlighting gains in variety, increasing returns to scale and competitive pressures associated with international trade. This orthodoxy was originally aimed to substitute for the old one, as inter-industry trade, measured with traditional indicators, appeared to account for a residual share of international trade.

But rapidly, a need for a synthesis of this burgeoning literature appeared, based on two complementary concepts (Helpman and Krugman, 1985): the integrated equilibrium, clarifying the conditions for the factor price equalisation scheme, and the net factor content of trade, a central feature of higher dimensionality models. As a result, a clear theoretical scheme associating differences in country sizes or factor endowments with inter-industry trade and similarities with IIT was popularised.

A synthetic presentation of this scheme is given below. What is striking is the discordance between such a theoretical scheme and the correlative developments of empirical analysis of IIT: from the mid-1980s onwards, the empirical literature refined the distinction between IIT of horizontally versus vertically differentiated products, and highlighted the prominent feature of IIT, namely bilateral two-way flows of products having different prices/qualities at the most detailed level of product nomenclatures. We present a renewed theoretical framework, authorising for both types of IIT and highlighting their differing consequences and determinants.

1.1. Net factor content of balanced trade: The new classical view

A *new classical view* based on an horizontal differentiation scheme has emerged as a result of the synthesis proposed by Helpman and Krugman. Along the integrated equilibrium principles, the net factor content of inter-industry trade is positively related with the difference in relative factor endowments between trade partners; in contrast, IIT, negatively related to the latter difference, will be more developed between similar countries. This view is nevertheless challenged on the ground of a possible IIT in vertically differentiated products, using a Falvey-type differentiation scheme.

1.1.1. The integrated equilibrium

One view of trade types is associated with the synthesis done by Helpman and Krugman (1985), using as core concept the "integrated equilibrium".

Along this presentation, the "integrated economy" appears to be a benchmark that will be used as a framework linking different approaches, of which Heckscher-Ohlin and monopolistic competition. The definition of such a benchmark is well known and deserves much attention: it corresponds to a situation in which goods and factors would be perfectly mobile internationally, a situation associated to an allocation of world resources that will be used as a benchmark. Following the traditional view of a larger mobility of goods, the question is whether the latter mobility associated with an immobility of factors might achieve the same allocation.

In order to tackle this synthesis, let us use the following notations, j for industries, i for differentiated products and k for countries and take into account m products, n varieties of each, and l countries.

Consider an input/output structure involving F primary factors under a "perfect competition on all markets" assumption: a set $\overline{V}$ of m input vectors u_j corresponding to the general producer equilibrium exist for each vector ω of factor prices. Each product being defined[2] by a u_j. In such a framework, the conditions under which the international economy replicates the result of a theoretical world integrated equilibrium can be synthesised as follows.

Consider l countries with factor endowments represented by a vector υ_k of primary inputs.

The question to address is the following: is $\overline{V}$ compatible with the set $\overline{\overline{V}}$ of endowments in the perspective of uniqueness of ω? The integrated equilibrium can be replicated by free trade between countries if the answer is positive.

At the elementary level of dimensionality i.e. j = (1, 2), the two vectors define a diversification cone (McKenzie, 1955; Chipman, 1966) ; if the endowment vector belongs to it for all countries one can find a solution associating positive outputs for all goods to a unique ω_k.

Assuming a higher dimensionality (l countries, m final goods et 3 primary factors), this result is robust only in the same triangle of diversification (Leamer, 1987). The "natural friend principle" (Ethier, 1974) does therefore no longer establish a one to one

[2] Technology is free here, and it is not useful to add a subscript k to u_j. In addition the absence of external economies lead us to consider that the size of countries does not matter: in contrast, if external economies had to be accounted for, a subscript k would be necessary even in the case of internationally free technology.

relationship between inputs and outputs. And the same price movements will have different results in different triangles of diversification (Rybczynski derivatives...).

Internal economies of scale can be introduced in this theoretical scheme without modifying fundamentally the principle of factor content of net trade flows. Under the monopolistic competition scheme, the zero profit condition is fulfilled at equilibrium, while (horizontally) differentiated products belonging to an industry share the same production function.

At the elementary level of dimensionality, consider for simplicity a two countries world (*k=1, 2*); two products are traded (*j=1, 2*) of which the more capital intensive good (*1*) is horizontally differentiated whereas good (*2*) is homogenous. The integrated equilibrium reproduces situations in which trade of goods only is associated with a full employment equilibrium where*w* is identical in both countries.

For a given vector *w* of prices for the two primary factors *K* and *L*, a set *V* of vectors $v_j = \left[a_{Kj}(r), a_{Lj}(w)\right]$ define the factor price equalisation set, in which goods are produced at the full employment general equilibrium. Graph 1 illustrates this set: in a one period model where income is used in consumption only, both income and consumption are simply given by $Y_k = rK_k + wL_k$. Point *C* thus shares the world income/consumption given by *OO** into a national share *OC* and a foreign share *CO**. Here the world integrated equilibrium is based on the fact that the endowment point D lies within the factor price equalisation set defined by the vectors v_j. The factor contents of production and consumption can be identified for each country and each industry, and then the net factor content of balanced trade.

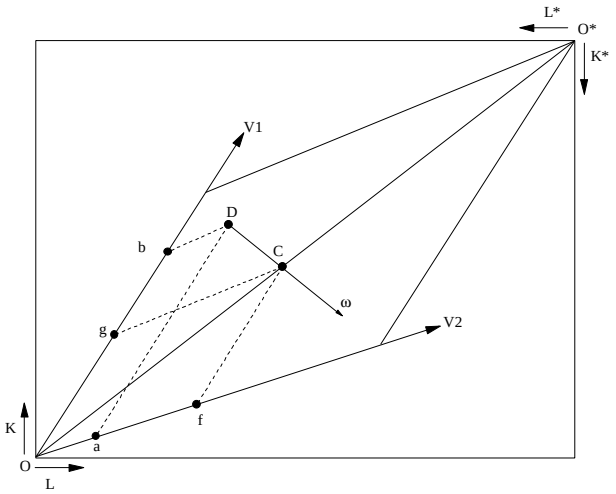
Consider home country for example: *Of* and *Og* are the factor contents of national consumption in homogenous and differentiated goods, and respectively *Oa* and *Ob* for production. Thus the net factor content of balanced trade is given by *DC*. The domestic country exports, on the whole, the services of its abundant factor, and imports the ones of its scarce factor, along the Vanek theorem.

1.1.2. Economic distance in an horizontal differentiation framework

Since it is accounted here for horizontal differentiation only —remember that all varieties of good 1 have one and the same production function— *gb* is the net factor content of exports of the differentiated product by the home country. The domestic economy is engaged in IIT of good 1, but it is not balanced[3]. In contrast *fa* accounts for the net factor content of a one way flow of homogenous good 2[4].

[3] Here a net export of good 1 by the domestic economy.
[4] Import by the home economy.

Graph 1
Economic distance and IIT:
the case for *horizontal* differentiation



It should be emphasised that *DC* also accounts for the economic distance, i.e. the differences in national factor endowments between the two countries. Thus, the larger the economic distance, the greater the net factor content of balanced trade: inter-industry trade is positively related to the economic distance which is here simply the comparative advantage of nations. Having in mind that crossed flows of similar products are registered in industry *1*, the share of IIT in total trade is finally *negatively* related to the economic distance.

Clearly, international trade between countries having identical *relative* endowments in factors would be characterised by a net factor content of balanced trade equal to zero, trade being exclusively of an intra-industry type.

The "new classical view" associates inter industry trade with comparative advantage and IIT with the monopolistic competition scheme. As a result, benefits and costs associated with trade are popularised as follows:

(a) Inter-industry trade leads to a reallocation of resources between industries leading to efficiency, whereas consumers face a new set of relative prices. These benefits are associated with internal redistributive mechanisms, detrimental to the factor largely engaged in industries contested by imports.

(b) Intra-industry trade leads to gains in variety for consumers (and for producers if intermediate goods are traded), adjustments occurring within industries and not between industries. Thus, no redistributive mechanism is associated with such a trade, while economies of scale are achieved.

This vision is not only a text-book version: it has deeply affected the perception of specialists, as e.g. illustrated in *ex ante* studies on the Single European Market (Commission of the European Communities, 1988).

1.2. IIT and economic distance: Where differences in quality matter

Turning to vertical differentiation, the theoretical scheme becomes more complicated: it must now be explained why goods within an industry can be sold at differing prices, and also why prices differ.

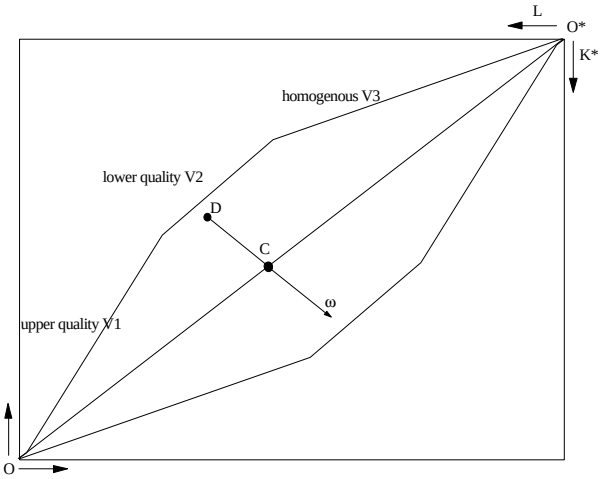
For example, the vertical differentiation scheme proposed by Falvey (1981) and Falvey and Kierzkowski (1987) suggests that differences in prices have to be found in differences in production functions, leading to differences in quality. They assume that a higher quality means a larger unit input in capital for a given input in labour [5]. Therefore, each variety has to be associated with a given vector of input, in contrast to what has been referred to above under the horizontal differentiation scheme: using a two industries framework the number of goods increases for a given number of primary factors, and a dimensionality problem has to be faced (Ethier, 1974).

Consider for simplicity a two (low, high) qualities framework in the differentiated industry: the Vanek theorem, ascertains that the net factor content of balanced trade will remain *DC* (Graph 2). But in contrast to what has been concluded before, IIT will now be associated with a net factor content of balanced trade which will no longer be zero: as for inter-industry trade, IIT now carries internal redistributive pressures due to differing factor contents of qualities exported and imported.

Finally, the economic distance between countries is no longer exclusively associated with inter-industry trade: IIT in vertically differentiated products is also concerned.

[5] Here a better quality is attained through higher variable costs, and differences in prices reflect differences in production costs. An other line of research is to consider a quality improvement implying increasing fixed costs, what would have in addition implications for the market structure (for a discussion see Sutton, 1986).

Graph 2
Economic distance and ITT:
the case for *vertical* differentiation



Thus, the "new classical view" can be questioned on the basis of three considerations:

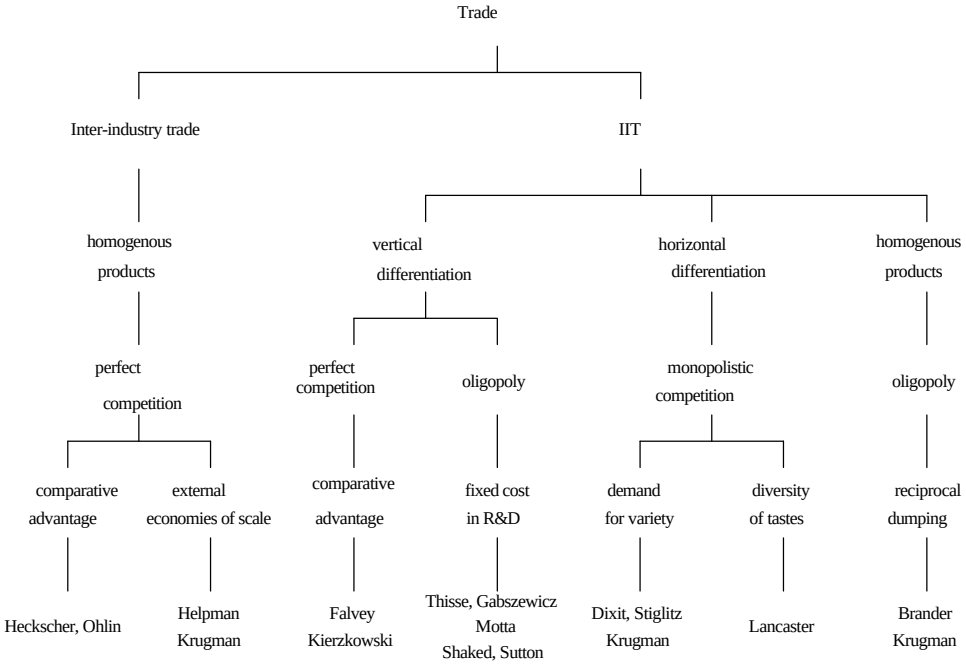
(a) *Inter-industry trade* can occur *without comparative advantage* as a result of external economies of scale -leading to mono-location of industries- or agglomeration effects if factors are mobile internationally.

(b) *Intra-industry trade* can occur *without product differentiation* since highly concentrated market structures lead to two-way flows of homogenous products.

(c) Finally, as referred to before, IIT in vertically differentiated products appears to be a specialisation within industries along the quality spectrum, a phenomenon which has consequences somewhere in between the traditional view of IIT and the one of comparative advantage. Using a Falvey-type representation of the vertical differentiation, differences in prices between qualities are based on differences in production function. It will be demonstrated below that a vertical differentiation based on a content in a specific factor leads to the same result. Thus, the comparative advantage, since it is captured within industries along ranges of quality, does explain IIT and induce a net factor content of balanced trade which cannot the one associated with a SDS type world.

Finally, determinants of trade (surveyed in Graph 3) are rather complex and the type of differentiation of products appears to be a central feature to clarify the determinants patterns and consequences of IIT.

Graph 3
Market structure, differentiation of products and the determinants of trade



1.2.1. Quality and variety: A stylised approach

It is possible to give a theoretical basis for determinants of IIT with both horizontal and vertical differentiation, in a world where two symmetric countries differ in their specialisation along ranges of qualities, combining in a same model SDS-type consumers (Dixit and Stiglitz, 1977) and ranges of quality.

The basis for a simple presentation is to associate each level of quality to a specific composite factor in which countries are not endowed identically.

Consider the elasticity of substitution σ between pairs of varieties of the same quality[6], and take the CES subutility function given by $C_j = \left(\sum_i C_{ij}^{s-1/s} \right)^{s/s-1}$ where $j=1,2,...,m$ is an index of (increasing) quality, $i=1,2...,n$ a subscript associated with varieties of each quality, and C_{ij} the quantity of the variety i of quality j purchased by a representative consumer.

In a one period model where individuals getting an income r do not spare, they purchase a quantity r/np of each variety sold at (the same) price p if there is only one

[6] $\sigma>1$.

quality. Here this result of their maximisation program is complicated by a two-step budgeting: we will assume that they choose first between two (low, high) qualities and then between varieties within each quality.

For simplicity, we use the following principle of aggregation of subutility levels associated with low (*j=1*) and high (*j=2*) quality:

$$U = \prod_{j=1}^{m} C_j^{1/m}$$

Clearly, the variety of products of the same quality is valued *per se*, whereas choice among qualities is not.

The solution to the consumer's maximisation of utility leads the representative consumer to spend an equal share of its budget on each quality. Thus, the level of subutility associated with the consumption of a given variety is:

$$U_j = \frac{1}{2} r n^{1/s-1} p^{-1} .$$

Given the large number of varieties of each quality, each firms individually faces a constant elasticity of demand given by $s + (1-s) n_i^{-1}$ approaching s when n_i approaches infinity[7].

1.2.2. Increasing returns

Turning to the supply side, the traditional assumption of internal returns to scale (increasing returns without optimal efficient scale) is used, given that each quality uses a specific quality *j* of a composite factor *L*. Thus, the unit input in specific factor in each of the low quality differentiated products is a_{L1}, and respectively a_{L2} for high quality products. For simplicity, the fixed cost g and the constant marginal cost m are the same for both levels of quality:

$$a_{Lj} = \frac{g + mQ_{ij}}{Q_{ij}}$$

Under these assumptions the (constant) mark up for each level of quality is given by

$$P_{ij} = mr_j \frac{s}{s-1} \quad ; \forall \text{i} .$$

[7] See Helpman and Krugman (1985) for a proof of this classical result.

Free entry in this monopolistic market structure guaranties that the equilibrium size of firms associated with the zero-profit condition is $Q_{ij} = \frac{g(s-1)}{m}$. The higher the fixed costs, the more concentrated is the market structure for quality j.

Under the assumption of full employment of the composite factor, the market structure for each quality is finally given by $n_j = \overline{L_j} \big/ gs$.

The latter result also gives the weight of imports in an open economy since all varieties of each quality are equally valued whereas only a part of them are produced domestically. Let us now turn to this problem, considering two symmetric economies having identical size, technology and tastes, and differing only by their endowment in the specific factor in each industry along the classical "mirror-image assumption"(Krugman, 1981; Ricci, 1995).

1.2.3. Concentration of resources along the quality spectrum

Turning to specialisation of countries along the quality spectrum, the Hirschman-Herfindahl index of concentration, with an application to the allocation of resources along the quality spectrum, is very useful.

Given the share $l_{Lj} = \frac{Lj}{\overline{\overline{L}}}$ of quality j-goods in employment, the concentration index is $h = \sum_j l_{Lj}^{\,2}$.

If each country is fully specialised, one quality accounts for the full employment and $h = 1$. In contrast, if countries are strictly not specialised, factors are distributed uniformly along the quality range and $\mathrm{h} = 1/\mathrm{m}$. Thus $\frac{1}{m} \le h < 1$ under the traditional incomplete specialisation scheme.

Finally, the factor endowment $\overline{\overline{L}}$ of the domestic economy is distributed among sectors following

$$\begin{cases} \sum_{\mathrm{i}} \mathrm{L}_{\mathrm{i}1} = \overline{\mathrm{L}_1} = \mathrm{h}\overline{\overline{\mathrm{L}}} \\ \sum_{\mathrm{i}} \mathrm{L}_{\mathrm{i}2} = \overline{\mathrm{L}_2} = (1-\mathrm{h})\overline{\overline{\mathrm{L}}} \end{cases}$$

and reciprocally in the foreign economy.

The domestic market structure is given by n_1 and n_2. It is symmetrical to the one in the foreign economy:

$$\begin{cases} n_1 = h\bar{L}/gs = n_2 * \\ n_2 = (1-h)\bar{L}/gs = n_1 * \end{cases}$$

Each variety of quality *j* being equally valued by the consumer, the penetration ratio is given, for the domestic economy, by:

$$\frac{n_j *}{(n_j + n_j *)}.$$

Half of income *R* in each economy being purchased on each quality and each consumer purchasing the same amount of each variety of a given quality, be it produced domestically or imported, imports of low quality products by the domestic economy are finally given by:

$$M_1 = \frac{R}{2}\frac{n_1 *}{(n_1 + n_1 *)} = \frac{R(1-h)}{2} = M_2 *$$

and symmetrically for the foreign country.

In the same way $M_2 = \frac{Rh}{2} = M_1 *$

1.2.4. IIT in vertically differentiated products and economic distance

We can now tabulate a trade overlap ratio *GL* giving the share of cross flows of similar qualities between the two economies, following the Grubel and Lloyd principle[8]

$$GL = 2(1-h)$$

Thus, if both countries allocate equally their resources along the quality spectrum, $h = \frac{1}{2}$ and $GL = 1$. Trade is simply IIT in horizontally differentiated products.

[8] When tabulating this ratio, it must be kept in mind that, for *j = (1,2)* and under balanced trade, $\sum_i X_1 > \sum_i M_1$ if $\sum_i X_2 > \sum_i M_2$.

In contrast, as the allocation of resources along the quality spectrum diverge between countries, the share of IIT in vertically differentiated products increases: if each country narrows the full specialisation on a single quality, thus $h \to 1$ and $GL \to 0$.

We conclude that different countries will engage in IIT in vertically differentiated products whereas similar ones will engage in IIT of varieties within similar qualities. The *economic distance* is therefore a determinant of IIT in vertically differentiated products.

In addition, IIT in vertically differentiated products has internal distributive effects, whereas IIT in horizontally differentiated products does not. A simple view of this phenomenon is to remember that half of national income is used to purchased each quality. Thus, the distributive scheme, simply given by $\frac{r_1}{r_2} = \frac{\overline{L_2}}{\overline{L_1}} = \frac{1-h}{h}$ for the domestic economy, will be the more affected by trade the lower is h. If countries do specialise along the quality spectrum, internal distributive effects will adversely affect the composite factor engaged in the quality contested by imports, a negative impact partially or totally compensating for the benefits associated with IIT of similar qualities.

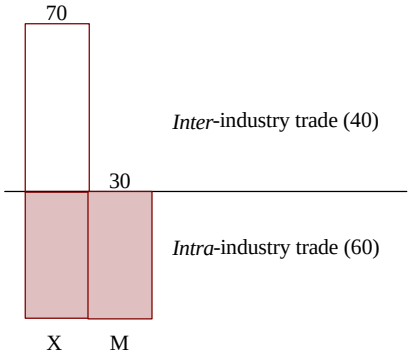
These arguments lead us to relax the traditional association of IIT to a zero factor content of trade: given the distinction between the horizontal and vertical differentiation on products, the consequences of an IIT are necessarily more complex than generally supposed, a result that has to be accounted for when defining the empirical methods to be used when handling IIT. The following points will examine shortcomings of traditional measurements and develop a methodology coherent with the theoretical results referred to here.

2. TRADITIONAL MEASURES AND THEIR SHORTCOMINGS: THE DEBATE ON GRUBEL AND LLOYD TYPE INDICATORS

The most widely used indicator to measure the extent of intra-industry trade is that put forward by Grubel and Lloyd. It calculates the part of balanced trade (overlap between exports and imports) in all trade in a given industry *j*:

$$GL_j = \frac{X_j + M_j - |X_j - M_j|}{X_j + M_j} = 1 - \frac{|X_j - M_j|}{X_j + M_j}$$

Suppose that the majority flow (here: exports) is equal to 70 and the corresponding minority flow (imports) is 30. The GL coefficient measures the overlap between the two flows (30+30) in all trade (100), and stands at 60% in this example. The overlap of 60 is considered to be *intra*-industry trade, the remaining 40 being *inter*-industry flows. Clearly, this imbalance of 40 has to be compensated for by a symmetric one in another industry: thus the notion of inter-industry trade for industry j has only a sense given this symmetric flow.



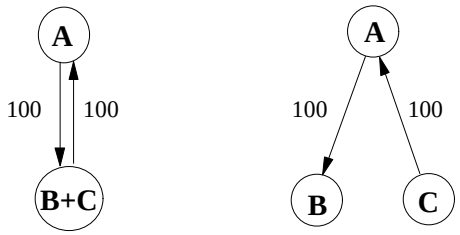
2.1. Empirical shortcomings: biases arising from aggregation

If we are interested in the *degree of overlap* in trade, this indicator is valid in the sense that it measures what it is supposed to do. And we made use of such a calculation in the theoretical model developed above. However , on empirical grounds, studies often made poor use of the Grubel and Lloyd or similar indicators. Very simple empirical shortcomings have been discovered progressively, and may be classified under two headings: geographical and sectoral biases. In fact, an important part of intra-industry trade may be due to an insufficient disaggregation, be it geographic or sectoral.

2.1.1. Geographical bias

Geographical bias arises when different partner countries are put together before doing the calculations, and in the extreme case, only a country's trade relations with "the rest of the world" are examined. However, the sign of the trade balance for a particular product may change for trade from one partner to another, corresponding to the accumulation of various inter-industry flows for the same item of the product classification, and will show up a "multilateral" intra-industry flow, which is a pure artefact. This is why empirical research ought to be done on a strict bilateral basis as will be emphasised below.

For example, in a given industry, country A's trade with partners B and C considered as a single trade bloc may be qualified as intra-industry trade, since exports and imports of 100 show up a perfect overlap. In contrast, a strict bilateral analysis reveals that A's trade is one-way with either partner, as A exports to B and imports from C.



2.1.2. Sectoral bias

Likewise, sectoral bias stems from insufficient disaggregation in the trade classifications: the lesser the detail of the nomenclature used, i.e. the more products are lumped together into a single "industry", the more trade becomes of an intra-industry nature. This is a well known problem that deserves further developments.

Also important, but less highlighted in the literature, is the fact that a specific problem arises when an exchange of intermediate goods (e.g. motors) for final goods (e.g. cars) belonging to the same industry is considered as "intra-industry" trade. Apprehending IIT at the "industry" level may therefore blur, rather than clarify, two distinct, analytical notions: (1) the international splitting of the value-added chain, and (2) simultaneous exports and imports of "substitutable" product items ("two-way trade in similar products").

Graph 4 tries to shed some light on these different concepts.

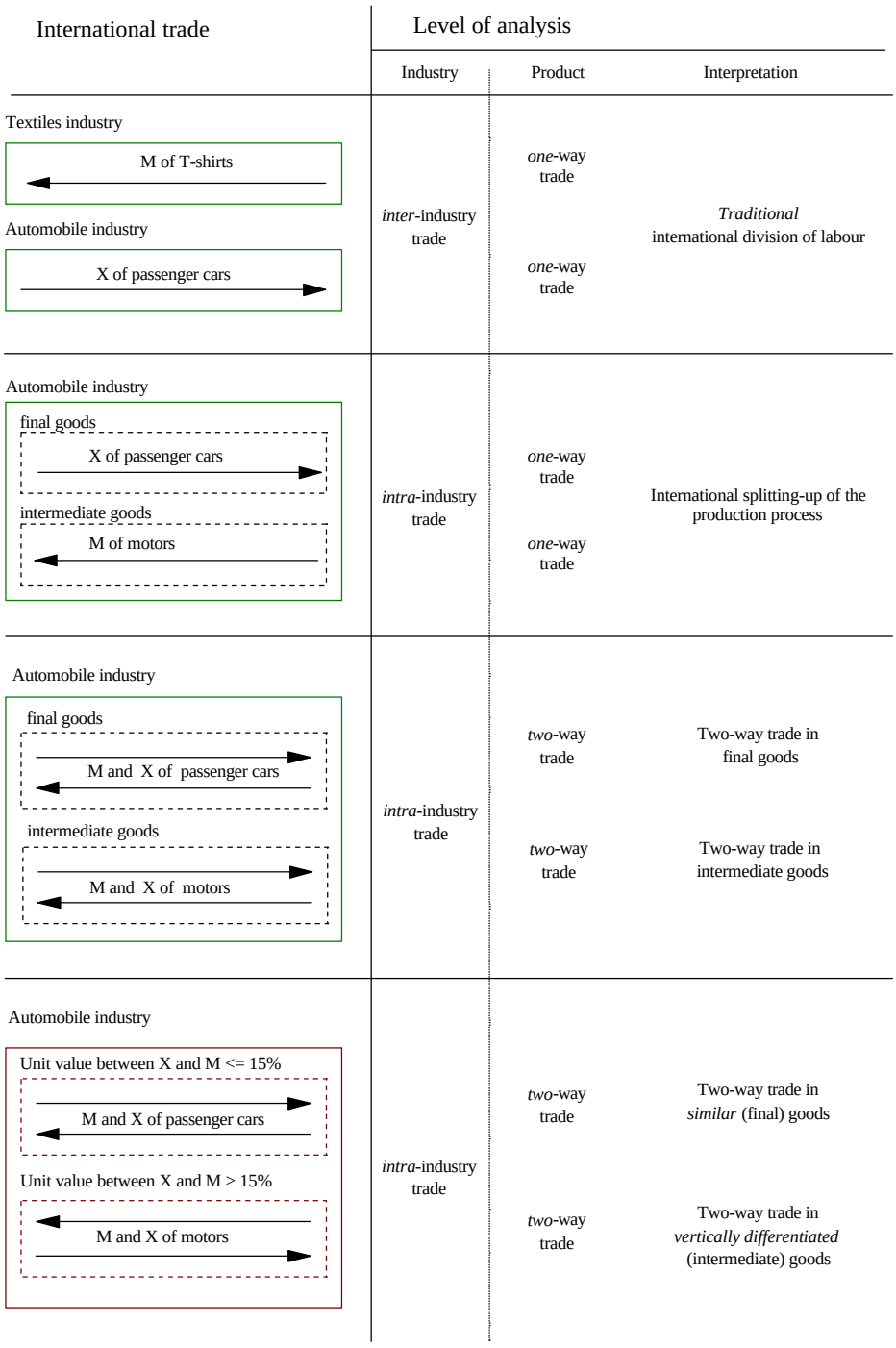
(a) The *traditional* international division of labour corresponds to the classical theory of trade leading to inter-"industry" flows. Here, it does not matter whether we apprehend trade at the industry level (textiles for automobiles) or at the product level (T-shirts for cars): trade is one-way in either case.

(b) The second case of trade in the *same industry* (here: automobiles), but for *different products* (imports of motors and exports of cars) creates the above mentioned confusion, as it gives way to two different interpretations. Analysing trade at the industry level would show up trade overlap and thus intra-industry trade. However, apprehending trade flows at the product level shows that trade for each product is one-way: we are in presence of one-way trade of intermediate goods for final goods in the same industry. *To us, simultaneous exports and imports within an industry, but at different production stages, must not be considered as intra-industry trade, but as an international splitting-up of the production processes.*

(c) IIT (i.e. two-way trade) needs thus to be apprehended at the product level. Only simultaneous exports and imports of products having the same principle, technical characteristics can be considered as being "two-way trade". Trade of motors for motors (of a certain cylinder capacity) represents two-way trade in intermediate goods (in the automobile industry), likewise, trade of cars for cars (of a certain cylinder capacity) can be considered two-way trade in final goods (in that same industry).

(d) Finally, -and discussed in more detail further below- the analysis of unit values (as proxy for quality differences) allows to give a practical definition of two theoretically important concepts: two-way trade in similar products (i.e. in horizontally differentiated products corresponding to an exchange of varieties) and two-way trade in vertically differentiated products(exchange of qualities).

Graph 4
Interpretations of trade flows depending on the level of analysis



2.2. Is there a need to correct for overall trade imbalances?

In theory, the Grubel and Lloyd indicator can take values between 0 and 1. However, as soon as overall trade is imbalanced, trade can never be completely of an intra-industry nature, since exports cannot match imports in every industry.

Economists arguing in favour of a correction for total trade imbalances decompose international trade in three categories:

(a) intra-industry trade (balanced by definition)

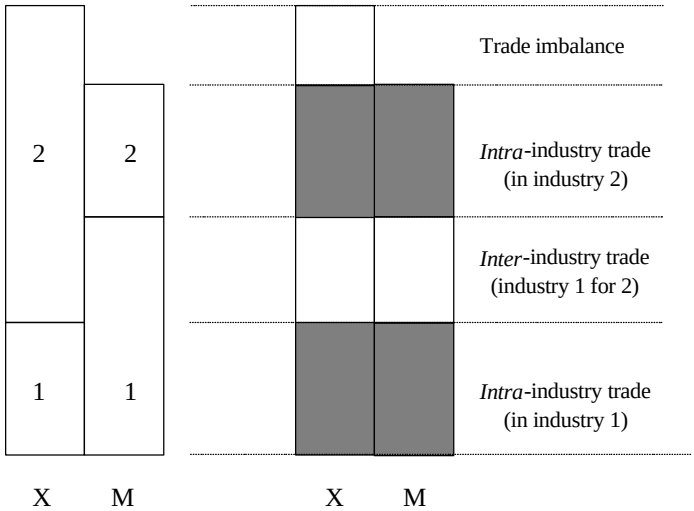
(b) inter-industry trade, which becomes balanced at the aggregate level as soon as we separate it from the

(c) trade imbalance

Grubel and Lloyd themselves proposed a way to correct for this phenomenon, by subtracting country *k*'s global trade imbalance from total trade. In that case, IIT does not represent any more the share of overlap trade in total trade, but in total, *balanced* trade:

$$GL_k^{corrected} = \frac{\sum_j \left(X_{jk} + M_{jk}\right) - \sum_j \left|X_{jk} - M_{jk}\right|}{\sum_j \left(X_{jk} + M_{jk}\right) - \left|\sum_j \left(X_{jk} - M_{jk}\right)\right|}$$

The Grubel and Lloyd correction simply excludes this last, disturbing, element.



Aquino (1978) criticises this correction and proposes an indicator based on *theoretical* exports and imports at the elementary level. These theoretical values (superscript "e") are:

$$X^{e}_{jk} = X_{jk}\frac{\frac{1}{2}\sum_{j}\left(X_{jk}+M_{jk}\right)}{\sum_{j}X_{jk}};\ M^{e}_{jk} = M_{jk}\frac{\frac{1}{2}\sum_{j}\left(X_{jk}+M_{jk}\right)}{\sum_{j}M_{jk}}$$

Aquino then applies these theoretical values to the unadjusted Grubel & Lloyd indicator:

$$Aquino_{k} = \frac{\sum_{j}\left(X_{jk}+M_{jk}\right)-\sum_{j}\left|X^{e}_{jk}-M^{e}_{jk}\right|}{\sum_{j}\left(X_{jk}+M_{jk}\right)}$$

As remarked by Aquino himself, this new measure it is in fact identical to the Michaely indicator.[9]

$$\text{Michaely \& Aquino}_{k} = 1-\frac{1}{2}\sum_{j}\left|\frac{X_{jk}}{\sum_{j}X_{jk}}-\frac{M_{jk}}{\sum_{j}M_{jk}}\right|$$

The Michaely indicator, however, is generally used to compare trade composition, i.e. similarity of import and export structures. By construction, this indicator evacuates trade imbalances by reasoning in relative terms, i.e. comparing the share of elementary exports in total exports and the share of elementary imports in total imports: finally it is no longer related to the pattern of trade (Vona, 1990).

This is one of the reasons why most economists prefer the unadjusted Grubel & Lloyd indicator to (Grubel & Lloyd- or Aquino-) adjusted measures. In that case, considering the trade imbalance as part of inter-industry trade flows reduces trade flows to only two categories: inter- and intra-industry trade.

2.3. Inherent problems

However, the unadjusted Grubel and Lloyd indicator may be inappropriate for *empirical* purposes as it gives a double explanation to the majority flow. A second problem arises when a same (here: the Balassa) indicator is used both to measure the extent of IIT and of "revealed comparative advantages": here the bulk of the literature tries to kill two birds with one stone.

2.3.1. Double explanation of the majority flow

The Grubel & Lloyd indicator may set an analytical problem, in the sense that its interpretation has caused some confusions in the literature. Explanations of international trade have been inspired by the decomposition of total trade in *trade overlap* (representing intra-industry trade) and the *imbalance* (inter-industry trade). In this case, the flows

[9] By the way, the Aquino indicator is also structurally equivalent to the Finger-Kreinin (1979) indicator which compares export structures of two countries, as shown by Pomfret (1982).

related to inter-industry trade remain largely explained by traditional theory, whereas intra-industry trade is explained by the "new international economics". This helps to reconcile what are *a priori* two incompatible paradigms (Helpman and Krugman, 1985), but raises the problem that there are *two different explanations for the same (majority) trade flow*, one being under perfect competition, the other under imperfect competition.

Let us go back to the example on the Grubel & Lloyd indicator. Here, we are not interested whether the analysis is made at the industry or the product level, but in its *interpretation*. As already mentioned, exports of 70 and imports of 30 yield an overlap of 60 which is considered to be intra-industry trade, the remaining 40 being inter-industry flows. In that traditional method, a single flow, namely the *majority flow* (here: exports), is *both* of an intra- and inter-industry nature. This creates a problem of the interpretation of the majority flow: its inter-industry part (40) is due to perfect competition, whereas the intra-industry part (30) due to imperfect competition...

The method which will be proposed in the next section avoids this problem: (bilateral) trade (for a given product) will be *either* inter-industry *or* intra-industry: when a certain (arbitrary) degree of overlap is attained, then *both exports and imports* are considered as being part of two-way trade. Otherwise, both flows would be considered as being part of one-way trade.

2.3.2. Double interpretation of Balassa and similar indicators

Another conceptual problem is that the Balassa indicator —of which the GL and related indicators are derived— is used in the literature both as an indicator of IIT and of "revealed comparative advantages". For a single industry j the Balassa indicator is:

$$B_j = \frac{X_j - M_j}{X_j + M_j}$$

This indicator is just a modified version of the export-import ratio of industry j, and thus does not give any additional information, as can be seen below:

$$B_j = \frac{\frac{X_j}{M_j} - 1}{\frac{X_j}{M_j} + 1}$$

The Balassa indicator allows two interpretations (Table 1): *inter*-industry trade flows correspond to *specialisation*, and *intra*-industry trade is an *absence of specialisation*[10].

[10] Some authors qualify this situation as "intra-industry specialisation".

Table 1
Two interpretations of the Balassa indicator

Value of the	Interpretation as a measure of	
Balassa indicator	IIT	Revealed comparative advantage
-1	Inter-industry trade	Comparative disadvantage
0	Intra-industry trade	None
1	Inter-industry trade	Comparative advantage

To us, these are two distinct, analytical concepts, as there are situations where IIT can coexist with comparative advantage and inter-industry trade without such advantages. Two concepts should thus be measured by two distinct indicators.

(a) To measure "revealed comparative advantages", there are more appropriate indicators such as the "contribution to the trade balance" (Lafay, 1990).

(b) As already briefly mentioned, the method concerning IIT which will be proposed in the next section considers -depending on the degree of overlap- *both* exports and imports as *either* one-way *or* two-way trade. In contrast to the GL indicator, a surplus or deficit may thus appear for two-way trade.

3. TRADE TYPES: AN ALTERNATIVE MEASURE OF THE NATURE OF TRADE FLOWS

To resolve the problems put forward here, it is necessary to use a method that:

(a) minimises the bias arising from sectoral aggregation by using far more disaggregated classifications;

(b) minimises the bias of geographic aggregation by only considering bilateral flows;

(c) considers, depending on the degree in overlap, *both* exports and imports as being as being part of *either* two-way trade *or* one-way trade; and lastly

(d) distinguishes between vertical and horizontal differentiation by incorporating price differences.

Therefore, our analysis of intra-EC trade is principally based on a methodology first put forward by Abd-El-Rahman in 1984 and subsequently refined by Freudenberg and Müller (1992). While the original, triangular, approach is well suited to analyse a particular country's situation, it needs further refinement for a systematic, country by country analysis, which is what we propose here. As underlined above, there is a need for a strictly bilateral approach of the phenomenon.

3.1. Product similarity and trade overlap

The basic idea is to give a definition of intra-industry trade which is closer both to reality and economic theory. On a conceptual level, the aim is to apprehend the phenomenon of "intra-industry trade" better at the product level, and at the same time to distinguish between horizontal and vertical product differentiation. To operationalise the notion of "two-way trade in similar products", it is necessary to define what a "product" is empirically, what a "similar" product is, and lastly what "two-way trade" is. The following definitions are used here.

3.1.1. Product

The detailed composition of the classification is the best guarantee for avoiding the empirical problems of sectoral aggregation. The data published by Eurostat for European countries in the classification of the 8-digit "Combined Nomenclature (CN)" (and, until 1987, the 6-digit Nimexe) provide some 10,000 items, which are sufficiently detailed for products to be distinguished by their technical characteristics. For each elementary flow (exports or imports of the declaring country to/from the partner country for a given product item) two criteria are applied.

3.1.2. Product similarity

Even inside an item of the "combined nomenclature", products may differ clearly by their quality. Here, it is assumed that differences in prices (unit values) reflect quality differences. Therefore, products whose unit values are close (in a given year) are considered as similar. Traded products are considered to be similar (or *horizontally* differentiated) if the export and import unit values differ by less than 15% [11], i.e. if they fulfil the following condition:

$$\frac{1}{1.15} \leq \frac{UV^{X}_{kk'it}}{UV^{M}_{kk'it}} \leq 1.15 ,$$

where UV stands for unit value, superscripts *X* and *M* refer to exports and imports and indices *k* representing the declaring country, *k'* the partner country and *i* the product in year *t*. When this is not the case, products are considered to be *vertically* differentiated.

[11] Following Abd-El-Rahman (1991), Greenaway, Hine and Milner (1994) also used the 15% (as well as a 25%) threshold to distinguish between similar products and vertically differentiated products, despite a more limited degree of classification disaggregation. The latter authors apply a "dispersion factor (α)" in the following manner:

$$1-\alpha \leq \frac{UV^{X}_{ki}}{UV^{M}_{ki}} \leq 1+\alpha \quad \text{(where } \alpha \text{ or}$$

To us the left side of this condition is incoherent with the right side, and this incoherence increases with the value of α. For example, the threshold of 25% means that export unit values can be 1.25 times higher than those for imports to fulfil the similarity condition. The lower limit in that case is 0.75: import unit values need to represent at least 75% of export unit values. But this last statement can be formulated in a different way: export unit values can be 1.33 (1/0.75) times higher than import unit values, a condition which is incompatible with the condition on the right.

3.1.3. Trade overlap

Trade in an item is considered to be "two-way" when the value of the minority flow (for example imports) represents at least 10% of the majority flow (exports in this case), i.e. if they fulfil the following condition, where *X* and *M* stand for the value of exports and imports:

$$\frac{\mathrm{Min}\left(X_{kk'it}, M_{kk'it}\right)}{\mathrm{Max}\left(X_{kk'it}, M_{kk'it}\right)} > 10\%,$$

Below this level, the minority flow cannot be considered significant as it does not represent a structural feature of trade.

If trade flows of a particular product with a partner country fulfil the two criteria of similarity and overlap, we qualify *exports as well as imports as "two-way trade in similar products".* The two (arbitrary) thresholds will be discussed further below.

3.2. Three trade types

The method allows for each year total trade to be broken down into different categories according to the similarity in unit values and to the overlap in trade:

(a) two-way trade in similar products (significant overlap and low unit value differences);

(b) two-way trade in vertically differentiated products (significant overlap and high unit value differences);

(c) one-way trade (no or no significant overlap).

This approach permits the *totality* of trade to be broken down according to these criteria, *both imports and exports being part of one and the same* of these types. A surplus or a deficit may thus appear for each of the three types. Table 2 syntheses this typology. As the calculations are done for each year, bilateral trade flows for a given product can be defined as two-way trade in similar products in one year, and part of two-way trade in vertically differentiated products in another year.

Table 2
How to define bilateral trade types at the product level?

Degree of Overlap between Export and Import Values	**Similarity of Export and Import Unit Values:** Do export and import unit values differ less than 15%?	
Does the minority flow represent at least 10% of the majority flow?	Yes (horizontal differentiation)	No (vertical differentiation)
Yes	***Two-way trade in similar products***	***Two-way trade in vertically differentiated products***
No	***One-way trade***	

3.2.1. Once again: trade should be analysed from a *bilateral* point of view

As already mentioned, this methodology is based upon the one first put forward by Abd-El-Rahman in his PhD dissertation in 1984 (see also 1986a, 1986b, 1991). While this (triangular) approach is well suited to analyse a particular country's situation, it needs further refinement for a systematic, country by country analysis.

In Abd-El-Rahman's way of defining trade types, for each product, two criteria are applied in three steps[12]:

(1) Elementary trade flows are classified according to a criteria of " *product similarity*", i.e. trade flows with similar unit values are identified. The trade flows are ranked (in decreasing order) according to their unit values and then classified by "tiers" of unit values of 15%. The upper limit of the first "tier" corresponds to the highest unit value, and the lower limit is 1/1.15 of the upper one. All trade flows being part of that first "tier" represent products of comparable qualities. The procedure is repeated for the remaining flows to establish a second, third, fourth etc. tier, until all trade flows are classified. Each product may thus be composed of one or several, distinctive quality segments representing "similar products".

(2) A criteria of *overlap* between the value of exports and imports is then applied *within each tier:* the minority flow needs to represent at least 10 percent of the majority flow for trade to be qualified as "two-way".

(2a) The analysis is first done in a *bilateral* way: if exports and imports for a given partner are within the same "tier" (criteria of similarity) and if their values are sufficiently close (criteria of overlap), then both trade flows are considered *bilateral two-way trade in similar products*. This procedure is subsequently applied to each partner.

[12] See also Freudenberg and Müller (1992).

(2b) Then, and still within the same tier, the overlap criteria is applied to all remaining trade flows (i.e. all those not identified in 2a). If the sum of exports and imports over all partners shows up significant trade overlap, each of these flows is considered *triangular two-way trade in similar products*.

Steps 2a and 2b are then subsequently applied to the remaining "tiers".

(3) Finally, the overlap criteria is applied to all remaining trade flows (i.e. all those not identified in 2a and 2b). If the sum of exports and imports over all partners and "tiers" shows up significant trade overlap, each of these flows is considered *two-way trade in vertically differentiated products*, otherwise as *one-way trade*.

This rather complicated —though fruitful—procedure may be improved since:

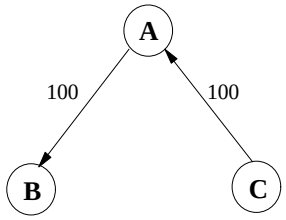
(a) it does not give the same importance to the different trade types, as the order in which the calculations are made does matter[13];

(b) the definition of bilateral two-way trade in similar products depends on *other* trade flows and is too restrictive[14];

(c) the triangular method introduced by Abd-El-Rahman is not suited for a systematic, multilateral analysis.

Concerning the latter point, even if it is excluded right away lumping together various partner countries into a single group to avoid the geographical aggregation bias (i.e. we make a bilateral analysis), there are still two ways of handling the information on bilateral trade flows, namely a strict *bilateral* or a *triangular* interpretation.

This point might be clarified using the trade structure referred to above: again, let A, B and C represent three countries which trade a given product at unit values that are fairly similar: country A exports 100 to B and imports an equivalent amount from C. It is assumed that there is no trade between B and C.



[13] Given Abd-El-Rahman's primary interest in bilateral two-way trade in similar products as a stepping stone for traditional trade theory, these flows are identified first. The subsequent steps are then applied always on the *remaining* flows, and this in a triangular way within a given "tier" (triangular two-way trade in similar products) and then over all "tiers" (two-way trade in vertically differentiated products or one-way trade).

[14] Bilateral flows being part of this trade type are necessarily in the same "tier" (where unit value differences are less than 15%). However, in some cases, bilateral flows might have unit value differences of less than 15% and at nevertheless be situated in *different* "tiers". This undesired feature stems from the very construction of the "tiers", where unit values for all trade flows (of a given product) are ranked in decreasing order, the upper limit of the first "tier" corresponding to the highest of all unit values.

(a) A strictly *bilateral* interpretation of trade between A and B would consider this to be one-way trade. Here, it matters not whether trade is analysed from A's point of view (one-way exports) or from B's (one-way imports), as is also the case for trade between A and C.

(b) However, a *triangular* interpretation of A's bilateral trade (which takes into account all bilateral flows between different partners) shows up an overlap in trade of A's exports to B and imports coming from C: Abd -El-Rahman qualifies these flows as being part of a "triangular two-way trade in similar products". This latter interpretation may be preferable if we are particularly interested in country A's situation. Yet, this approach is not suited for a systematic analysis, as these flows are one-way from B and C's point of view.

The problem with a triangular analysis lies in the fact that a single flow may be defined in different ways, depending on the point of view adopted. In this case, the same flow may be recorded as a component of triangular, two-way trade for the declaring country, and as a one-way flow for its partner country. Yet, a particular trade flow cannot change its nature simply because the point of view changes.

Therefore, only a bilateral analysis is a methodologically robust way of defining two-way trade. In addition, the adjustment proposed here is both coherent and simple, and makes it more suitable for international comparisons.

3.2.2. How to aggregate the results?

As already mentioned, the elementary trade flows have 4 dimensions: country-partner-product-year. The aggregation procedure is straightforward. For example, the average Grubel and Lloyd indicator of intra-EC trade flows for industry j in year t is obtained by summing up over declaring countries k, partner countries k' and the products i being part of industry$j$:

$$GL_{EC,EC,j,t} = 1 - \frac{\sum_{k\in EC}\sum_{k'\in EC}\sum_{i\in j}\left|X_{kk'it} - M_{kk'it}\right|}{\sum_{k\in EC}\sum_{k'\in EC}\sum_{i\in j}(X_{kk'it} + M_{kk'it})}$$

Likewise, the *value* of two-way, intra-EC trade in similar products in industry j in year t is

$$TWHDvalue_{EC,EC,j,t} = \sum_{k\in EC}\sum_{k'\in EC}\sum_{i\in j}\sum_{z\in TWHD}\left(X^{z}_{kk'it} + M^{z}_{kk'it}\right)$$

where z is one of three categories depending on the corresponding trade type (TWHD, TWVD, OW).

The *share* of two-way, intra-EC trade in similar products in industryj in year t is

$$TWHDshare_{EC,EC,j,t} = \frac{\sum_{k\in EC}\sum_{k'\in EC}\sum_{i\in j}\sum_{z\in TWHD}\left(X^{z}_{kk'it} + M^{z}_{kk'it}\right)}{\sum_{k\in EC}\sum_{k'\in EC}\sum_{i\in j}\sum_{z}\left(X^{z}_{kk'it} + M^{z}_{kk'it}\right)}$$

3.2.3. Discussion on thresholds for the definition of trade types

The criteria referred to above are based on the degree of overlap in trade and on differences in unit values. Inevitably, the thresholds of 10% for trade overlap and 15% for unit value differences are to a large extent arbitrary. One of the possibilities would have been to apply e.g. different similarity criteria for different product groups [15], but applying one and the same criteria to all products leads to more understandable results. Sensitivity tests showing how trade types can be influenced by the choice of different thresholds will be presented below.

Threshold of overlap in trade

Table 3 shows the share of intra-EC trade flows according to the degree of overlap in trade (the minority flow in percentage of the majority flow), again calculated at the most detailed level. It shows that cases of extreme overlap between exports and imports are rare: for example, less than 4% of all bilateral trade has an overlap of more than 90%. On the other hand, almost 10% of intra-EC trade is one-way in a strict sense, i.e. exports with no corresponding imports, and *vice versa*. About 60% of intra-EC trade has an overlap of more than 10%.

The highest value is for overlap between 0 and 10%, representing almost a third of all intra-EC trade. It is exactly this category which will be eliminated with the 10% threshold. The reasoning behind this is that below 10%, minority flows cannot be considered significant as they do not represent a structural feature of trade. Of course, any other threshold (20% might be a good candidate as well) could have be used. But in fact, what matters here is not so much *which* value is chosen as threshold, but *that* one is chosen. As already mentioned, the problem associated with the interpretation of the Grubel and Lloyd indicator is that the majority flow (exports or imports, whichever is larger), is both of an intra- and inter-industry nature. Trade types avoid this problem: *both* exports and imports will be*either* inter-industry *or* intra-industry.

[15] For each product in intra-EC trade, the authors tested an indicator for the average unit value dispersion around the European average. As expected, the dispersion is low for e.g. crude oil (less than 3%), natural gas, cereals, and meat and fish, and high for e.g. specialised machines, pharmaceuticals, precision instrument or electronic components (by a factor of 3!). There are some outliers though, such as the rather low unit value dispersion for cars (17%), and high values for basic organic and inorganic chemicals (the statistics are probably not detailed enough to capture product heterogeneity).

Table 3
Share of intra-EC trade flows according to different classes of trade overlap, 1994

Trade overlap	Share of total trade	Cumulated share
]90+	3.6	3.6
]80-90]	4.4	8.0
]70-80]	4.8	12.9
]60-70]	5.3	18.2
]50-60]	5.3	23.4
]40-50]	6.4	29.8
]30-40]	7.5	37.4
]20-30]	11.1	48.5
]10-20]	11.9	60.4
]0-10]	29.8	90.2
0.0	9.8	100.0

Source: Eurostat-Comext, calculations by the CEPII.

Threshold for unit value differences

Table 4 shows the share of intra-EC trade flows according to the unit value ratios of bilateral trade flows (measured by dividing the larger unit value by the smaller one). Of course, for the 9.8% of trade which are completely one-way (see Table 3), no differences can be calculated. More than a quarter of total intra-EC trade concerns bilateral imports and exports with differences in unit values between 0 and 15%. Some trade flows show up extreme differences in unit values: for about 1% of all intra-EC trade, the unit value ratio is higher than 15, i.e. a difference of more than 1400%! This suggests that -leaving aside statistical discrepancies in declarations-, even a 10,000 product nomenclature does not seem detailed enough to consider goods exchanged under a given heading to be homogeneous.

Table 4
Share of intra-EC trade flows according to different classes of export and import unit value differences, 1994

Unit value ratios	Share of total trade	Cumulated share
[1-1.15]	27.6	27.6
]1.15-1.30]	14.9	42.5
]1.30-1.50]	14.0	56.5
]1.50-1.75]	9.1	65.6
]1.75-2.0]	5.5	71.1
]2-3]	10.3	81.4
]3-4]	3.4	84.7
]4-5]	1.6	86.3
]5-10]	2.5	88.8
]10-15]	0.6	89.4
]15+	0.9	90.2
not available	9.8	100.0

Source: Eurostat-Comext, calculations by the CEPII.

Table 5 shows the distribution of intra-EC trade flows once the two criteria are applied simultaneously. The share of each of the three trade types is obtained by summing up the corresponding cases. One-way trade (no or no significant overlap) represents some 40%. Of the remaining 60% for two-way trade, about 20% are in horizontal differentiation (significant overlap and small unit value differences) and 40% in vertical differentiation (overlap and large unit value differences). The lower part of Table 5 shows the cumulated shares of this trade type in function of the two criteria.

Table 5
Share of intra-EC trade according to the criteria of overlap in trade and similarity of unit values, 1994

Similarity: Yes / No — Overlap: Yes / No

	[1-1.15]	]1.15-1.3]	]1.3-1.5]	]1.5-1.75]	]1.75-2]	]2-3]	]3-4]	]4-5]	]5-10]	]10-15]	]15+	na	Total
]90+	1.4	0.6	0.6	0.3	0.2	0.3	0.1	0.0	0.1	0.0	0.0	0.0	3.6
]80-90]	2.0	0.5	0.6	0.4	0.2	0.4	0.2	0.1	0.1	0.0	0.0	0.0	4.4
]70-80]	1.5	1.0	0.6	0.5	0.3	0.5	0.2	0.1	0.1	0.0	0.0	0.0	4.8
]60-70]	1.6	0.7	0.8	0.6	0.4	0.8	0.2	0.1	0.2	0.0	0.0	0.0	5.3
]50-60]	1.6	0.8	0.8	0.7	0.3	0.6	0.2	0.1	0.1	0.0	0.0	0.0	5.3
]40-50]	1.8	1.1	1.3	0.6	0.4	0.8	0.2	0.1	0.1	0.0	0.0	0.0	6.4
]30-40]	2.5	1.1	1.5	0.7	0.4	0.8	0.2	0.1	0.2	0.0	0.0	0.0	7.5
Overlap: Yes]20-30]	3.7	2.1	1.9	1.0	0.6	1.0	0.3	0.2	0.3	0.0	0.0	0.0	11.1
Overlap: Yes]10-20]	3.7	2.0	1.5	1.3	0.7	1.5	0.5	0.2	0.4	0.1	0.1	0.0	11.9
Overlap: Yes]0-10]	7.9	4.9	4.5	3.0	2.0	3.6	1.3	0.7	1.0	0.3	0.5	0.0	29.8
Overlap: No 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.8	9.8
Total	27.6	14.9	14.0	9.1	5.5	10.3	3.4	1.6	2.5	0.6	0.9	9.8	100.0

Two-way trade in similar products (19.7%)
Two-way trade in vertically differentiated products (40.7%)
One-way trade (39.6%)

Cumulated shares for two-way trade in similar products

	[1-1.15]	]1.15-1.3]	]1.3-1.5]	]1.5-1.75]	]1.75-2]	]2-3]	]3-4]	]4-5]	]5-10]	]10-15]	]15+	na
]90+	1.4	1.9	2.6	2.9	3.1	3.4	3.5	3.5	3.6	3.6	3.6	3.6
]80-90]	3.4	4.4	5.6	6.4	6.8	7.5	7.8	7.9	8.0	8.0	8.0	8.0
]70-80]	4.8	7.0	8.8	10.0	10.7	12.0	12.4	12.6	12.8	12.8	12.9	12.9
]60-70]	6.4	9.3	11.9	13.7	14.8	16.8	17.4	17.7	18.0	18.1	18.2	18.2
]50-60]	8.0	11.7	15.1	17.5	18.9	21.6	22.4	22.7	23.2	23.3	23.4	23.4
]40-50]	9.8	14.6	19.3	22.3	24.1	27.5	28.6	29.0	29.6	29.7	29.8	29.8
]30-40]	12.3	18.2	24.3	28.1	30.3	34.5	35.8	36.3	37.0	37.2	37.4	37.4
]20-30]	16.0	23.9	31.9	36.7	39.5	44.7	46.3	47.0	48.0	48.2	48.5	48.5
]10-20]	19.7	29.7	39.2	45.2	48.7	55.4	57.5	58.3	59.8	60.1	60.4	60.4
]0-10]	27.6	42.5	56.5	65.6	71.1	81.4	84.7	86.3	88.8	89.4	90.2	90.2
0.0	27.6	42.5	56.5	65.6	71.1	81.4	84.7	86.3	88.8	89.4	90.2	100.0

Source: Eurostat-Comext, calculations by the CEPII.

3.3. Comparison with traditional measures of intra-industry trade

The traditional GL measure and the one applied here are supplementary rather than substitutes, since each one tries to answer a specific question. The first one is interested in the *intensity of overlap* in trade, whereas the latter approach measures the *relative importance of each of the three trade types in all trade*. Therefore, each indicator should be used in an appropriate way: GL to account for the trade overlap, trade types to disentangle IIT. Another difference is the way to treat the supposed product "quality" associated to trade flows (e.g. high, low).

3.3.1. The dividing line between intra-industry and inter-industry trade

Table 6 will be used to illustrate these differences. The upper part of that table shows a country's trade relations for a given product with four partners (A, B, C, D), and the lower part the sum of the different components (balanced as well as total trade in horizontal and vertical product differentiation, as well as the three trade types).

Table 6
Numerical example for GL-related indicators and trade types

Partner	Value		Unit value		Ratio	Product Differentiation	Balanced trade		Total trade		Overlap	Trade types		
	X	M	UV X	UV M	UVX / UVM							TW -HD	TW -VD	OW
							H	V	H	V				
A	20	10	8	8.4	0.95	H	20		30		yes	30		
B	50	10	5.5	5	1.10	H	20		60		yes	60		
C	10	150	5	4	1.25	V		20		160	no			160
D	120	30	6	8	0.75	V		60		150	yes		150	
Total	200	200					40	80	90	310		90	150	160

Summary statistics and indicators

		GL-related			Trade types		
		H	V	H+V	TW-HD	TW-VD	OW
Values	Balanced trade	40	80	120			
	Total trade	90	310	400	90	150	160
Indicators	GL	44.4	25.8	30			
	GHM	10	20	30			
	Trade types				22.5	37.5	40

Note: Total trade: $(X + M)$
Balanced trade: $(X + M) - |X - M| = 2Min(X, M)$
H: Horizontal product differentiation
V: vertical product differentiation
TW-HD: Two-way trade in horizontal differentiation
TW-VD: Two-way trade in vertical differentiation
OW: One-way trade

The Grubel and Lloyd indicator could easily be adapted to calculate the degree of IIT in horizontal (44.4%) as well as in vertical differentiation (25.8%). In that case, the overall GL would be a weighted mean of the two. By taking the example of Table 6, this yields

$$GL_j = \underbrace{\frac{90}{400}}_{\substack{\text{Share of trade in}\\ \text{horizontal differentiation}}} \underbrace{44.4\%}_{\substack{\text{GL in horizontal}\\ \text{differentiation}}} + \underbrace{\frac{310}{400}}_{\substack{\text{Share of trade in}\\ \text{vertical differentiation}}} \underbrace{25.8\%}_{\substack{\text{GL in vertical}\\ \text{differentiation}}} = 30\%$$

In contrast, the indicator recently adapted by Greenaway, Hine & Milner (GHM, 1994, 1995) adds up the two components (proportion of horizontal and vertical IIT in total trade) to obtain the same, *global*, result: the latter authors split it up into overlap in similar products and overlap in vertically differentiated products. That is, for a single industry j:

$$GL_j = IIT_j^{horizontal} + IIT_j^{vertical} = 1 - \left(\frac{\left|X_j^H - M_j^H\right| + \left|X_j^V - M_j^V\right|}{X_j + M_j} \right)$$

$$= 1 - \left(\underbrace{\frac{X_j^H + M_j^H}{X_j + M_j}}_{\substack{\text{Share of trade in}\\ \text{horizontal differentiation}}} \underbrace{\frac{\left|X_j^H - M_j^H\right|}{X_j^H + M_j^H}}_{\substack{|\text{Balassa}| \text{ in horizontal}\\ \text{differentiation}}} + \underbrace{\frac{X_j^V + M_j^V}{X_j + M_j}}_{\substack{\text{Share of trade in}\\ \text{vertical differentiation}}} \underbrace{\frac{\left|X_j^V - M_j^V\right|}{X_j^V + M_j^V}}_{\substack{|\text{Balassa}| \text{ in vertical}\\ \text{differentiation}}} \right)$$

Using the example referred to above, it gives

$$GL_j = \underbrace{10\%}_{\substack{\text{Share of IIT in horizontal}\\ \text{differentiation in total trade}}} + \underbrace{20\%}_{\substack{\text{Share of IIT in vertical}\\ \text{differentiation in total trade}}} = 30\%$$

Thus, strictly speaking, as long as it is used for one kind of product differentiation separately, the indicator cannot be called Grubel and Lloyd indicator, since each component no longer gives information on IIT (compare 10% with 44.4% for example).

Using such a methodology, Greenaway, Hine and Milner show, in the case of the United Kingdom, that the component of IIT in vertical differentiation is about twice as important as IIT in horizontal differentiation. This, however, does not mean that the trade overlap is more important in vertical than in horizontal differentiation: *this may be due only to the fact that the volume of trade in vertically differentiated is large*, since the related indicator can simply be written using the absolute value of the Balassa indicator tabulated for each type of differentiation .

Actually, the indicator used by Greenaway, Hine and Milner is somewhere in between the Grubel and Lloyd indicator and our approach. In fact, Table 7 summarises these different indicators of IIT taking into account product differentiation.

Table 7
Different indicators of IIT taking into account product differentiation

	Horizontal (H)	Vertical (V)	Total
Modified Grubel & Lloyd	$\frac{BT^H}{TT^H}$	$\frac{BT^V}{TT^V}$	$\frac{BT^H + BT^V}{TT^H + TT^V}$
	Degree of horizontal IIT	Degree of vertical IIT	Degree of (horizontal and vertical) IIT
Greenaway, Hine & Milner	$\frac{BT^H}{TT^H + TT^V}$	$\frac{BT^V}{TT^H + TT^V}$	$\frac{BT^H + BT^V}{TT^H + TT^V}$
	Proportion of horizontal IIT in total trade	Proportion of vertical IIT in total trade	Degree of (horizontal and vertical) IIT
Abd-El-Rahman, Fontagné & Freudenberg	$\frac{TT^H}{TT}$	$\frac{TT^V}{TT}$	$\frac{TT^H + TT^V}{TT}$
	Share of two-way trade in similar products in total trade	Share of two-way trade in vertically differentiated products in total trade	Share of two-way trade in total trade

Note: Total trade: $TT = (X + M)$

Balanced trade: $BT = (X + M) - |X - M| = 2Min(X, M)$

Graph 5 is a synthesis of the approaches following Grubel and Lloyd as well as those following Abd-El-Rahman.

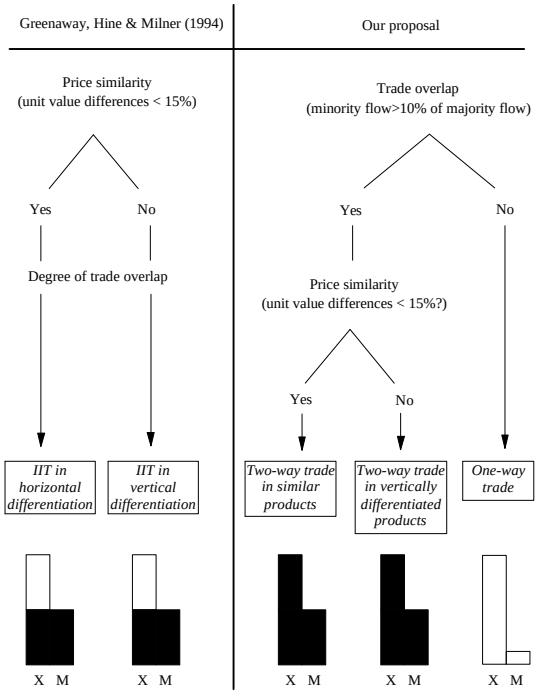
(a) Greenaway, Hine and Milner focus on the extent of trade overlap, in the line of Balassa and Grubel and Lloyd, which interprets IIT as the *balanced* part of trade flows (here in black). In these "traditional" approaches, the majority flow is *both* of intra- and inter-industry nature: the dividing line is thus *within* the majority flow.

(b) In contrast, trade types reject the traditional dividing line between intra - and inter-industry trade. If the minimum (arbitrary) threshold of overlap is attained, *both* exports and imports are part of two-way trade (here in black), be it in horizontal or vertical differentiation, otherwise both flows are considered as part of one-way trade (here in white).

As already mentioned, these two approaches are supplementary rather than substitutes, since each one tries to answer a specific question. Grubel and Lloyd related indicators yield information on the *intensity of overlap* in trade, whereas the approach proposed here measures the *relative importance of each of the three trade types in all trade.*

Turning to the dynamics of trade patterns, trade types are a straightforward tool, as they give directly the changes in trade patterns. In contrast a GL related methodology based on the degree of trade overlap can be modified to account for the patterns of *marginal* IIT[16]. For example, starting with a trade surplus in an industry, an increase in imports leaving exports unchanged will reduce the trade surplus: thus an increase in the GL level -tabulated on total trade flows- may be associated with an inter-industry *marginal* trade. This difficulty with the traditional GL and consequently the need for a "marginal" indicator are simply due to a definition of IIT based on the trade overlap, as referred to above: any such a definition of IIT will face similar problems.

Graph 5
Measuring "intra-industry" trade in horizontal and vertical differentiation: traditional versus new approaches



Note: The dividing lines are intra-industry trade (black) and inter-industry trade (white).

3.3.2. Where IIT and specialisation in vertically differentiated products have to be distinguished

Another frequent shortcoming in empirical studies is the way to treat the supposed product "quality" associated to trade flows. For example, Greenaway, Hine and Milner define as "high quality vertical IIT" the share of trade in "products for which the unit

16 Basically, a GL indicator is tabulated for the variations in trade flows (see Hamilton and Kniest-1991, Brülhart-1994 and Greenaway, Hine, Milner and Elliott-1994).

value of UK exports is >1.15 that of UK imports" (1994, p. 84, Table 2). Clearly, this methodology introduces a confusion between two different problems: the *type of IIT*, and *the measured quality of trade flows*

In the example in Table 8, Greenaway, Hine & Milner would treat country's trade with partner D as "low-quality vertical IIT", because export unit values are significantly lower than import unit values. Obviously, this approach has an undesired feature, as there is not a same criteria for the different partners. Reasoning in relative, bilateral terms thus yields information on relative, bilateral quality (are exports of a higher quality than imports with a given partner?), but this does not tell anything about the "true" quality. If quality were measured by comparing the unit value of each elementary flow to a same average (e.g. the average of intra-EC trade), a more "objective" measure could be obtained. In fact, in our example, though export unit values to D are lower than import unit values (6 compared to 8), these exports are of a "high quality", as they are sufficiently higher than the EC-average of 5.

In addition, Greenaway, Hine and Milner apply this quality measurement only to vertical IIT, i.e. where unit values differences are at least 15%. This, however, is only part of all trade, as horizontal IIT and inter-industry trade are not analysed. According to the method proposed below, *all* trade flows can be classified.

Table 8
Numerical example

					Greenaway, Hine & Milner		Our approach			
	Value		Unit value		UV Ratio (bilateral)	"Relative" Quality	UV Ratio (EC)		Quality based on EC-average	
Partner	X	M	X	M	UVX / UVM		UVX / UV	UVM / UV	X	M
A	20	10	8	8.4	0.95	---	1.60	1.68	High	High
B	50	10	5.5	5	1.10	---	1.10	1.00	Medium	Medium
C	10	150	5	4	1.25	High	1.00	0.80	Medium	Low
D	120	30	6	8	0.75	Low	0.80	1.60	High	High

Note: The European average unit value (UV) for this product is supposed to be 5.

Let us compare unit values for each trade flow to a European norm (see Freudenberg and Müller, 1992). As we did for the definition of trade types, let us assume that differences in prices (unit values) reflect quality differences. As exports and imports are analysed separately, flows for the same product with a given trade partner can exist in different European price/quality ranges:

(a) *up-market* products (with unit values exceeding the Community average by at least 15 %),

(b) *down-market* products (more than 15% below the norm), as well as

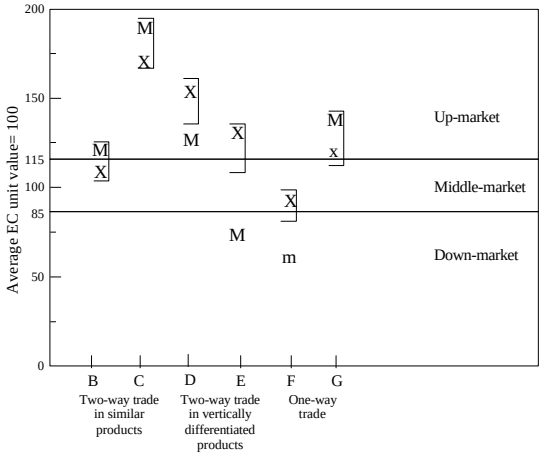
(c) *middle-market* products (between +/- 15% around the average).

Being carried out at the most detailed level of the classification, this allows headings to be aggregated to any desired level, so that a break down all trade into three trade types and three price/quality ranges may be obtained.

It is important to mention that *trade types and price/quality ranges are two distinct and strictly independent notions*: e.g. two-way trade in *similar* products can be done in *different* European price segments.

Let us consider country A's trade relations with partners B to G for a given product (Graph 6). *Price/quality ranges* are defined using the 15% thresholds around the average European unit value. In this illustration, A's trade with partners B and C is two way -trade in similar products, and two-way trade in vertical differentiation with D and E (since the trade flows are outside the brackets). There are one-way exports to F (with only little imports) and one-way imports from G (with little exports). The two notions are thus strictly independent. For example, two-way trade in *similar* products can be done in *different* European price segments (with partner B). Likewise, two-way trade in *vertically differentiated* products can be done in the *same* market segment (with country D).

Graph 6
Different configurations of trade types and price/quality ranges



Note: Exports and imports indicated in uppercase (XM) means that there is significant overlap, and thus two-way trade. In case of one-way trade, only the majority flow is in uppercase, and the corresponding minority flow in lowercase (Xm, xM).
The brackets indicate the maximum gap between unit values for exports and imports for be considered similar. If two flows are within such a bracket, we consider them as horizontally differentiated, otherwise as vertically differentiated.

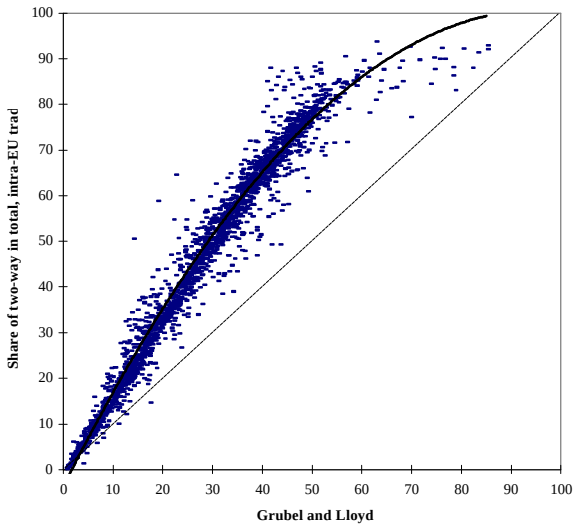
4. SOME EMPIRICAL EVIDENCE

To illustrate the methodology proposed here, the following empirical evidence is drawn from a recent report for the European Commission on the impact of the Single European Market on trade patterns inside Europe (Fontagné, Freudenberg and Péridy, forthcoming, and Fontagné *et alii*, forthcoming). This study is based on bilateral, intra-EC trade flows on the most detailed level of nomenclatures from 1980 to 1994.

4.1. GL and trade shares give a coherent information

Graph 7 indicates the GL indicator and the share of (horizontal and vertical) two-way trade in intra-EC trade from 1980 to 1994 for 2310 observations (15 years-11 countries-14 industries), which are aggregated from bilateral intra-EC trade flows for some 10,000 products. At this semi-aggregated level, the fit is impressive![17]

Graph 7
Comparison of the Grubel & Lloyd indicator and the share of two-way in all trade



Source: Eurostat-Comext, calculations by the CEPII.

[17] The two indicators being bounded at 100%, a rough regression estimate has nevertheless been ran in a quadratic form to illustrate the fit. The regression yields $y=-3.66+2.17x-0.011x^2$, with $R^2=97.11\%$. While the GL measures the *degree* in overlap, trade types consider - where the threshold of 10% is attained - *all* trade as being part of two-way trade: it therefore yields values which are higher (at this level about twice as high) as the GL. This "over-estimation" is particularly manifest for small and medium GL figures. Notice the very small quadratic term which comes into effect only for large GLs: the larger the GL, i.e. the more there is overlap, the less there is a possibility for this "overestimation".

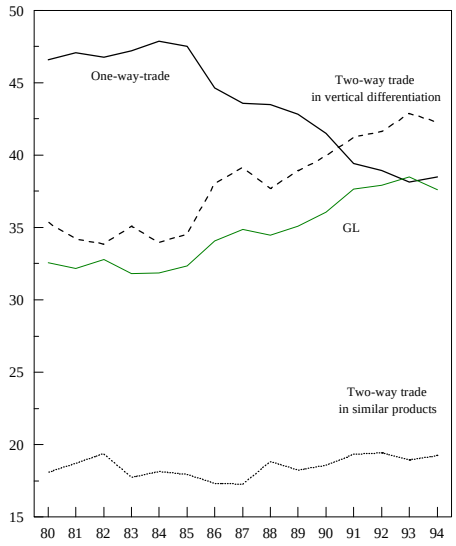
4.2. IIT in the EU is fuelled by trade in vertically differentiated products

Graph 8 indicates both the evolution of the GL indicator as well as the share of the three trade types in intra-EC trade from 1980 to 1994. The considered time period was characterised by an increase in intra-industry trade: the GL was around 33% until the mid eighties, and rose about five points until 1994.

The most important trade type in the beginning of the 1980s was one-way trade (with a share of some 45%). However, from the mid-1980s onwards, it started to decline. In that sense, the evolution of one-way trade (which is the complement of two-way trade) is symmetric to the GL indicator.

The value added of trade types is to disentangle the correlative increase in intra-industry trade. At this level of presentation (all countries and products taken together), *in contrast to what is often implicitly assumed, the rise in intra-industry trade in intra-EC trade does not concern horizontally differentiated products, but products which are vertically differentiated.* In fact, two-way trade in similar products remains rather stable and represents less than 20% of all intra-EC trade, whereas two-way trade in vertically differentiated products -associated with a qualitatively division of labour- increased from less than 35% in 1980 to 1985 to more than 40% in 1994.

Graph 8
Evolution of trade types and the GL indicator in intra-EC trade, 1980-1994



Source: Eurostat-Comext, calculations by the CEPII.

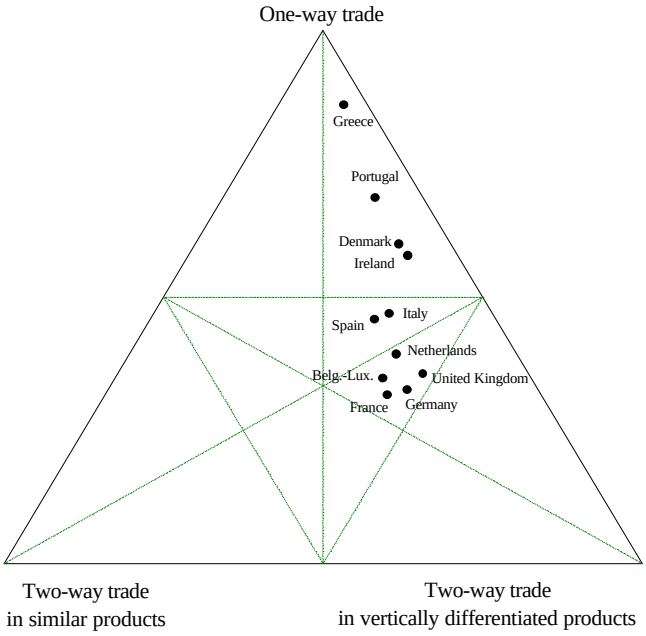
Graph 9 displays the shares of the three trade types for each country in 1994. Two groups of countries can roughly be distinguished,

(a) the first group is composed of countries for which one-way trade accounts for more than half of all trade. These countries are characterised by an inter-industry specialisation. As far as they engage in intra-industry trade, two-way trade is predominantly done in goods differing by quality. At the exception of Denmark, the countries in this group (Greece, Portugal Ireland) have rather low levels of economic development.

(b) the European core-countries are in the second group characterised by a high share of two-way trade. While two-way trade in similar products is more important in this group than in the first one, intra-industry trade is again mostly done in vertically differentiated products, suggesting a specialisation within products by quality ranges.

Notice that *all* countries are on the right side in the triangle: independent of the share of two-way trade in all intra-EC trade, *for each country, two-way trade is more important for vertically differentiated products than for similar products*. However, this phenomenon, the pre-eminent feature of intra-European trade, has received little attention in the theoretical literature when compared to intra-industry trade in horizontal differentiation. It nevertheless underlines the particular interest of the question on which market segment different member states are positioned.

Graph 9
Share of trade types in intra-EC trade by country, 1994



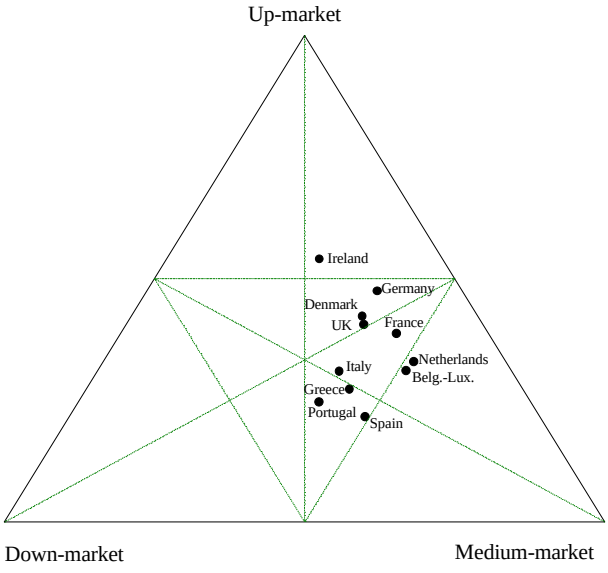
Source: Eurostat-Comext, calculations by the CEPII.

4.3. The "qualitatively" division of labour inside Europe

In 1994, the structure of *exports* in intra-EC trade, according to the price/quality criteria used here. The Southern countries which joined the EC in the 1980s (Greece, Portugal and Spain), plus Italy, are primarily exporters of down - or middle-market products. On the other extreme, more than 50% of Irish exports are in the up -market segment, followed by Germany, Denmark, the United Kingdom, and, to a lesser extent, by France.

If these preliminary results for Germany seem to be compatible with the image of the label "made in Germany", expensive but supposedly high -quality products, it is more difficult to identify the reasons associated with the performance of Ireland. In this latter case, the role of foreign affiliates using this country as a location of assembly lines devoted to the furniture of the European market is certainly leading. The import content of high quality exports is relatively high is this case[18]. Of course, these results at a macroeconomic level have to be interpreted with care, but more thorough analyses at a more detailed level confirm these first results.

Graph 10
The structure by price/quality ranges in intra-EC exports



Source: Eurostat-Comext, calculations by the CEPII.

[18] See Fontagné, Freudenberg, Ünal-Kesenci (1996).

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