Demand Patterns and Vertical Intra-Industry Trade With Special Reference to North-South Trade

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Abstract
Demand patterns have been considered important driving forces of intra-industry trade (IIT) ever since the emergence of IIT literature. The distribution of income within countries and per capita income differences between countries are regarded as major explanatory factors behind vertical IIT. This paper focuses on North-South trade, and we are particularly interested in the role of income distribution and per capita income as demand-side determinants of vertical IIT. We test hypotheses on differences in income distribution, differences in per capita income, and average market size in three different empirical approaches; an economy wide, a multi-industry, and a sector level approach. The results show evidence of the role of income distribution and per capita income, that there is an important interaction between these two variables, and that the average market size matters.

Introduction

Demand patterns constitute an important theoretical dimension of IIT, and the conditions behind these patterns have been discussed ever since the emergence of IIT literature. Critical aspects of demand patterns are preference diversity, overlap in taste, and income distribution. Income distribution is especially important in models that explain vertical IIT flows, i.e. two-way trade in quality-differentiated products.[1] These models underscore a specialisation pattern regarding the localisation of the production of different quality levels. If this is the case, IIT arises if consumers of both trading partners demand the varieties produced by them. If demand for a certain quality level is steered by a consumer's income level and if total income is unequally distributed, there will be a diversified aggregated demand and total demand for a given variety will depend on income distribution within the country. The demand for varieties produced by a trading partner depends, however, on the standard of living of the importing country. A country with a very low standard of living, for example, may not have any consumers able to afford the quality produced by its trading partner.

Yet there are no empirical studies that consider both these aspects within the same analysis. The purpose of this paper is to test how well demand patterns explain IIT flows in vertically differentiated products. We will therefore use a modified version of the model by Falvey and Kierzkowski (1987) to disentangle income distribution within and between countries, and to illustrate the interaction between these two variables. Bilateral trade flows between 8 EU members (North) and 52 lower income countries (South) are used to test the hypotheses econometrically.[2] The focus on North-South trade is motivated by the fact that these trade flows are more in line with an assumption regarding the specialisation pattern in production, i.e. South (North) produces, on average, low (high)-quality varieties. We compare three empirical approaches that are found in the literature; an economy wide, a multi-industry, and a sector level approach.

The rest of the paper is structured as follows. The first section discusses some previous studies of IIT between North and South. The second provides a formal foundation for this paper while the third discusses the methodology of measuring IIT and the independent variables. The fourth section presents the econometric results and the fifth concludes and summarises the paper.

Demand Patterns in Previous North-South Studies

Two studies that consider demand patterns, as determinants of IIT of a vertical nature between North and South, are Ballance *et al* (1992) and Tharakan and Kerstens (1995). Both studies use the share of total IIT in total trade within an industry (i.e. the Grubel-Lloyd index) as a target variable, but they use different control variables. The former study uses income similarities to catch the demand aspect, and ratios between the unit values of exports and imports to catch quality differences in trade flows. Tharakan and Kerstens, on the other hand, use similar income distributions within countries to catch the demand aspect, and a dummy to indicate vertical differentiation (built on interviews of industry-spokesmen). Moreover, Ballance et al look at total manufactures at four-digit level subgroups while Tharakan and Kerstens concentrate on trade in toys. They come up with different conclusions, with the former study maintaining that North-South IIT is of a vertical nature and the latter suggesting that it is of a horizontal nature.

One explanation for these differing conclusions could be the choice of industry in the analysis of Tharakan and Kerstens (i.e. toys) since Ballance *et al* also reject the assumption of a vertical nature of IIT flows in some industries (e.g. clothing) after a decomposition of the data. An alternative explanation could stem from the fact that they focus on only one of the aspects affecting the overlap in demand. That is, they either focus on similarities in income or in income distribution, but not on both at the same time. This may be important since both the distribution of income between countries and within countries can affect the flow of IIT. Moreover, similarities in income (measured as the absolute difference in GDP per capita) may also indicate similarities in factor endowments, in which case we should expect larger differences to increase (decrease) IIT of a vertical (horizontal) nature. But, of course, it is always difficult to differentiate between demand and supply-side effects with such a blunt proxy.

Is there any IIT to be explained between North and South? Ballance *et al* argue that there are important North-South IIT flows and that these are increasing over time. They show that the weighted average of bilateral Grubel-Lloyd (G-L) indices between 20 "northern" countries and 25 low-income countries at a 4 digit level of SITC increased from around 7% in 1970 to around 15% in 1985. Another study that provides similar evidence is Nilsson (1999), showing that IIT flows between EU and low-income countries increased in value, and as a share of total trade, between 1980 and 1992. Moreover, Tharakan and Kerstens calculated G-L indices at a rather disaggregated level (at NIMEXE 6-digit level), and found that around half of the bilateral trade flows in toys between 8 EU members and the South had an G-L index value equal to or higher than 20 %.

These studies emphasise the fact that IIT is non-negligible between North and South and that it increases over time. Besides, we believe that this trend will be strengthened by the deeper integration between North and South; due to the multiplication of regional trade agreements, the reduction of tariffs in different multilateral trade negotiations, and the fact that trade agreements in agriculture and textiles are now integrated within the WTO system.

The Theoretical Foundation

The formal model used to explain vertical IIT has a framework similar to the model used in Falvey (1981), and Falvey and Kierzkowski (1987).[3] We restrict, however, the number of qualities to two in the differentiated industry (x), instead of a continuous range of different qualities, and these are called the high (*h*) and the low-quality (*l*) variety respectively. The quality difference is universal for all consumers, who are restricted to consuming only one of the two qualities, and the two varieties are substitutes in consumption. The quality difference is also indicated by a price difference since we assume that the high-quality variety is more expensive per unit than the low-quality variety. In this paper we assume that the price difference is due to a difference in technology, and that the high-quality variety needs a higher capital-to-labour ratio per unit of output due to, for example, a more R & D intensive production. Compared to the Falvey and Kierzkowski model, we model the demand structure differently in order to illuminate the importance of considering both income distribution within, and average per capita differences between countries.

Demand

The utility function of consumer *j* consists of a nested Cobb-Douglas-Stone-Geary function:

$$U^j = \begin{cases} A(y - y^m)^{1-\phi}(x_h - x_h^m)^{\phi} \Leftrightarrow i^j \geq P_h x_h^m + P_y y^m \\ (y - y^m)^{1-\phi}(x_l - x_l^m)^{\phi} \Leftrightarrow i^j < P_h x_h^m + P_y y^m \end{cases},$$

where *h* (*l*) represents the high(low)-quality variety, *y* is the consumption of the homogenous good, *m* represents the minimum consumption level of both *y* and *x*, i^j is consumer *j*'s disposable income, and $\phi \in (0,1)$. Parameter A (>1) is a monotonic transformation of the utility function so that a consumer who can afford to consume a high-quality variety is more than compensated for the loss of utility resulting from the smaller quantity consumed due to the higher price compared to the low-quality variety.

We have two different types of consumers in the economy. One type is "rich", the other has a lower income level, and they create two different income strata that are called the high (h) and the low-income (l) stratum respectively. The income of the rich consumer (e^{hj}) consists of a wage and a share of the total capital rent, and is defined as $e^{hj} = w + rK/\rho L$; where w and r are the rent for labour (L) and capital (K) respectively, and ρ is the share of the total population (which equals L) that belongs to the high-income stratum. The income of the other consumer type (e^{lj}) consists of a wage only. But there is an authority that redistributes income without any transaction costs, through collecting a share of the income of consumers in the high-income stratum and redistributing this among those in the low-income stratum. That is, the disposable income of a representative consumer from the high-income stratum (hj) after redistribution is defined as $i^{hj} = e^{hj}(1\text{-}\iota)$, and the income of a representative consumer from the low-income stratum is defined as $i^{lj} = w + (e^{hj}\iota\rho)/(1\text{-}\rho)$. Parameter ι reflects the redistribution scheme and we will define the inequality measure (IM) of this scheme as the ratio between the share of the total income (1-z) and the share of total population (1-ρ) found in the low-income stratum. That is, $IM = (1\text{-}z)/(1\text{-}\rho) \in (a,1)$, where a equals $wL/(wL+rK)$ (i.e. when ι equals zero) and is the most unequal situation. However, the income of a consumer in the low-income stratum is restricted to be smaller than the amount necessary to purchase the minimum consumption level of both the homogeneous good and the high-quality variety (i.e. $P_l x_l^m + P_y y^m \leq i^l < P_h x_h^m + P_y y^m$). To sum up, the redistribution scheme is not shaped to redistribute from the low to the high-income stratum, and is not large enough to erase demand for the low-quality variety.

Finally, we assume that the share of the total population that belongs to any income stratum depends on the level of the capital-to-labour ratio within a country. That is, we define the share of a country's population in the high-income stratum as $\rho = f(k) \in [0,1]$, and we assume that it is increasing in k (i.e. $\rho_k = f'(k) > 0$). In other words, a large difference between the capital-to-labour ratio of two countries implies that they have different shares of their total population in the high-income stratum, since a larger amount of capital is distributed among a smaller number of individuals in the capital-abundant country.

If each representative consumer maximises his/her utility function subject to the budget restriction, the overall demand in the economy becomes:

$$X_h = [\phi(i^{hj} + I^{hmj})(P_h)^{-1}]\rho L,\ \ X_l = [\phi(i^{lj} + I^{lmj})(P_l)^{-1}](1-\rho)L,\ \text{and}$$
$$Y = (1-\phi)L[w + rk + \rho I^{hmyj} + (1-\rho)I^{lmyj}], \tag{1}$$

where I^{vmj} = $[(1-\phi)/\phi]P_v x_v^m - y^m$ and I^{vmyj} = $[\phi/(1-\phi)]y^m - P_v x_v^m$ (v = h,l), and all prices are expressed in terms of y (i.e. P_y = 1). Equation (1) implies that important forces behind the demand for different qualities are the redistribution scheme and the capital-to-labour ratio. These variables affect the income of a representative consumer in each income stratum and the distribution of the total income between the strata. And the capital-to-labour ratio drives the distribution of the population between different income strata as well as the average per capita income level. Equation A1 in the Appendix shows how a representative consumer's income level changes after a change in the redistribution scheme and the capital-to-labour ratio.

Production

The production of the homogeneous good (y) is modelled as in a Ricardo-model and the production of one unit of y requires α^p units of labour, where p is either North (n) or South (s). The differentiated industry produces two qualities (x_h and x_l), which both have a fixed ratio between capital and labour. The production of these two qualities, which is the same in both countries, is normalised so that each unit of output requires one unit of labour and β_h or β_l units of capital (where $\beta_h > \beta_l$). The economy is characterised by perfect competition and full employment, i.e. the following conditions hold:

$$P_v \le w^p + \beta_v r^p,\quad 1 \le \alpha^p w^p,$$
$$L^p = Y^p \alpha^p + \sum_v X_v^p,\ \text{and}\ \ K^p = \sum_v \beta_v X_v^p,$$

where v=(h,l), p=(n,s), and capital letters indicate total production and factor endowments. In other words, if factor prices are not equalised, the country with the lowest unit cost in production determines the prices of the commodity.

Trade Pattern

Now, assume that North has a technological advantage over South (i.e. $\alpha^s > \alpha^n$), and that both countries produce y under free trade. In this case the wage level in North will be α^s/α^n

times higher than in South since the price of *y* will be the same in both countries. If capital rent is higher in North as well, producers in South will enjoy lower unit costs in the production of both qualities in the differentiated industry. But this implies that the full employment condition does not hold. Hence, capital rent must be lower in North than in South, but it cannot be so low so that producers in North can produce to a lower unit cost in all different qualities.[4] In other words, the location for the production of each quality level will be unique, and the production of the high (low)-quality variety will be located in North (South) as long as the return to labour is higher in North.[5]

This implies that we may determine IIT flows of different qualities, by two times the minimum of North's import demand for the low-quality variety and South's import demand for the high-quality variety. Balanced trade implies that total trade is defined as two times the maximum of the two trade-flows above. This discussion leads us to the supply-side hypothesis:

A specialisation in production of different qualities, either due to differences in factor proportion or in technology, is necessary for vertical IIT to arise. *H1*

That is, we define, given that North exports *y* due to its technological advantage, the volume of IIT, total trade (TT) and inter-industry trade as follows:

$$IIT = 2P_h X_h^s, \quad TT = 2P_l X_l^n, \quad \text{and } \textit{inter-industry trade} = TT - IIT, \tag{2}$$

where X_v^p is defined in equation (1), and all are measured in units of *y*.

We start off with the presumption that both countries are identical in all respects, except for the technological difference. The important demand factors that we will consider in this model are small changes in income distribution, relative endowments, and economic size since these affect the trade volume between partners. If we keep all other variables and parameters fixed, the total differential of IIT and TT becomes:

$$\begin{aligned} dIIT &= d\iota^s 2\phi L^s \rho^s i_{\iota^s}^{hsj} + dk^s 2\phi L^s (i_{k^s}^{hsj} \rho^s + \rho_{k^s}^s (i^{hsj} + I^{mhj}) + dL^s (IIT[L^s]^{-1}) \\ dTT &= d\iota^n 2\phi L^n (1-\rho^n) i_{\iota^n}^{\ln j} + dk^n 2\phi L^n [i_{k^n}^{\ln j}(1-\rho^n) - \rho_{k^n}^n (i^{\ln j} + I^{mlj})] + dL^n (TT[L^n]^{-1}), \end{aligned} \tag{3}$$

where dV^p ($V = \iota, k, L$) represents changes in the variable we are interested in.

We can see that if South's (North's) redistribution changes so that its demand for the high (low)-quality variety increases, the share of vertical IIT in total trade increases (the partial differentiation of the consumer's disposable income is found in equation A1 in the Appendix). That is, a small decrease (increase) in t^s (t^n) (i.e. $-dt^s = dt^n$, and $dk^p = dL^p = 0$) will increase the share of IIT in total trade, since trade in the differentiated product increases while it will not have any effect on demand for the homogeneous product (see equation (1)). However, an increased share of IIT is dependent on an overlap in demand. For example, a low capital-to-labour ratio in South may imply that the share of the total population in the high-income stratum is zero, and hence South only imports the homogenous product from North. That is, even if we assume that the income level is unequally distributed within each income stratum. Any change in IIT due to a change in income distribution within a country is conditional on the existence of an income stratum that demand the variety produced by its trade partner, and vice versa, so that there is a demand overlap. The second hypothesis is therefore:

If South and North are similar in their capital-to-labour ratios,
the share of vertical IIT in total trade increases when South's
redistribution becomes more unequal compared to North's. *H2*

If South (North) becomes less (more) capital abundant (i.e. $-dk^s = dk^n$, $dt^p = dL^p = 0$), *ceteris paribus*, import demand for the high-quality variety in South decreases due to a fall in per capita income and a reallocation of the population towards the low-income stratum. The reallocation effect may increase the disposable income, and hence also the demand for the high-quality variety, of each consumer that still belongs to the high-income stratum, since the total capital rent is split among fewer. The total demand for the high-quality variety falls, however, as long as we assume that the minimum level for consuming x and/or that the wage level that the consumer takes with him/her to the other income stratum are large enough. That is, a consumer leaving the high-income stratum results in a large fall of demand for the high-quality good. The capital rent that is transmitted from this consumer to the consumers still belonging to the stratum results in a smaller rise of the demand for the high-quality variety, since this extra income is split between the differentiated and the homogenous products. Import demand for the low-quality variety in North either increases, due to a higher per capita income, or decreases, due to a reallocation of the population towards the high-income stratum.[6] Moreover, a decrease (increase) of South's (North's) capital-to-labour ratio increases (decreases) the return of capital in South (North), which will have an offsetting effect on the direct income effect since it tends to improve (dampen) South's (North's) average per capita income. This secondary effect will also affect the subsistence level, since any change in the return to capital will change the relative price structure.

If we make the presumption that the secondary income effect does not offset the direct income effect, IIT unambiguously decreases. Moreover, if we, for simplicity, assume that the impact of reallocation of the population is similar in both countries, the fall in total trade will be smaller than in IIT (total trade may even increase if ρ_k is small). If this is the case, the effect of a divergence in capital-to-labour ratios is similar to the Linder-hypothesis. That is, a more dissimilar capital-to-labour ratio diverges the average per capita income, and the share of IIT in total trade decreases due to a smaller overlap in demand between the two countries. Moreover, the negative effect on the volume of IIT is larger the more unequal (equal) South's (North's) income distribution is, since it enlarges the change of South's (North's) demand for the high (low)-quality variety.

A more dissimilar capital-to-labour ratio, especially if South's (North's) income distribution is more unequal (equal), decreases the share of vertical IIT. *H3*

Finally, if we increase the economic size of both countries (i.e. $dL^s = dL^n$, $dt^p = dk^p = 0$) while we keep all other variables fixed, we can see that the effects on the share of vertical IIT in total trade (*SV*) are ambiguous. If we rewrite equation (3), it can be simplified to:

$$dSV = \frac{IIT}{TT}\left(\frac{dL^s}{L^s} - \frac{dL^n}{L^n}\right).$$

If both countries are initially identical in size, the effect of an increase of the economic size in both countries becomes zero.[7] But if there is a difference initially, the effect depends on the size of the two countries.

The effect on the share of vertical IIT in total trade, of an increase of average economic size, is ambiguous. *H4*

Method and Data

Vertical IIT

The earlier studies of North-South IIT, that we discussed above, used total IIT flow as the target variable and tested if this flow was vertical or horizontal in nature. But since there have been suggestions for a more refined measure of IIT, we would like to separate IIT flows of a vertical nature from total IIT.[8] In this study we use unit values as a quality indicator, a rather common approach which implicitly assumes that the price (or the unit value) of a product reveals its quality and that consumers have full information. Caves and Greene (1996) show that there is a positive correlation between price and quality, and vertically differentiated products show a higher correlation than other products.[9] They found that the median correlation between list price and quality was 0.38. However, a large number of the products were clustered around +1, and vertically differentiated products were found to be a highly significant positive determinant of the correlation variation.

There are, however, different ways of calculating unit values, and Torstensson (1991) uses the unit value per piece, but one major drawback is that this measure's availability is rather limited. Another approach is to calculate unit values per tonne, which has been used, *inter alia*, by Abd-el-Rahman (1991) and by Greenaway, Hine and Milner (1994). This measure is more easily calculated, since trade data is available for both value and quantity. One potential flaw of this approach, which could provide us with a biased measure, is that we have to assume that there is no correlation between the quality and weight of a product, so that the unit price for high-quality products becomes lower than for low-quality products. Greenaway, Hine and Milner (1994), however, found a relative high correlation between price per piece and tonne.

In this paper we shall use the second approach, i.e. unit values per tonne, and trade data from OECD's set of CD-ROMS volume I/1998 containing bilateral trade flows for 1992 at a 6-digit level of the Harmonised System.[10] The ratio between the unit values for exports and imports (measured in f.o.b. and c.i.f. respectively) is used as an indicator of the type of product differentiation in that particular flow. If the ratio turns out to be outside a certain range ($1 \pm \alpha$), then this product is defined as vertically differentiated. The "arbitrary" value of the parameter (α) used in this paper is the same as in similar studies, i.e. $\alpha = 0.15$ and 0.25.[11]

After sorting out the products that have large unit value differences, we calculate the share of vertical IIT in total trade for a particular industry. We minimise the categorical aggregation problem by using the ratio between the sum of all vertical IIT at a disaggregated level and the total trade in a particular industry, and we do not correct for trade imbalances.[12] The share of vertical IIT in total trade is therefore defined as:

$$VB_{jb} = \frac{\sum_{p \in \Omega_j^v} 2\min(X_{pb}, M_{pb})}{\sum_{p \in \Omega_j^T} (X_{pb} + M_{pb})}, \tag{4}$$

where Ω^v_j is the set of products in industry *j* (NACE industries) that are defined as vertically differentiated at the 6-digit level of the HS nomenclature, Ω^T_j is the total set of products in this industry, *b* indicates the two bilateral partners, and finally *X* and *M* represent the value of export and import respectively. We define each NACE industry at a 2-digit level, and we only consider manufactures (i.e. NACE codes 15-37 in Revision 2, see Table 1 in Appendix).[13] Finally, we define the economy-wide measure as the weighted average of all industries (we use the share of an industry's total trade in the total bilateral trade flow as the weight).

These calculations showed that about 29 %(10 %) of all non-zero trade flows (6,339 out of 9,152 bilateral flows had non-zero observations) had a Grubel-Llyod index larger than zero (10 %), which underlines the fact that the North-South IIT flows are fairly important even at very low aggregation levels. And, as discussed in Nilsson (1999), there is a large variation within as well as between industries. We also found that most of the IIT flows were defined as vertically differentiated, independently of the value of α. Around 69 % of all IIT flows had a ratio between the share of vertical IIT and the share of total IIT that exceeded 0.9. The final observation is that North's export, on average, is of a higher quality when using unit values per tonne as an approximation for the quality level.

Explanatory Variables[14]

We have used GDP at current market price and the total population of 1992 from World Bank's World Development Indicators 1998 (WDI) to calculate the absolute difference of GDP per capita (DGDPC) between an EU member and a South country, which is used as a proxy for the first hypothesis. A larger difference in GDP per capita (or capital-to-labour ratios) implies that the two trading partners specialise in different quality varieties as long as these are produced with different factor intensities. That is, we expect the coefficient of DGDPC to be positive. However, differences in GDP per capita also have a demand dimension, which will be discussed below.

The hypothesis on the effects of income distribution patterns is tested with three different proxies. The first proxy is the difference between South's and North's Gini coefficients (DGIN = $Gini^s$ - $Gini^n$), which originate from the UNDP's World Income Inequality Database version Beta 3.8 November 1999 (WIID).[15] The second proxy (RGIN) is a dummy, and it comes alive when the sum of the shares of total income of the two lowest income deciles in North and the two highest deciles in South is larger than the average of the whole sample. That is, this dummy indicates which of the bilateral partners have, on average, a relatively high demand for each others varieties. The third proxy is also a dummy variable (SGIN), and it takes the value of one when the ratio between trading partners' Gini coefficients is inside the range of 0.9 and 1.1 and zero otherwise.[16] One may expect the signs of the two first proxies to be positive since a more unequal (equal) distribution in South (North) implies that its import of the high (low)-quality variety increases, and hence the share of vertical IIT increases.[17] The third proxy is used since we want to compare our results, *inter alia*, with Tharakan and Kerstens (1995), who assumed a positive sign if IIT flows were vertical in nature. The sign on this last proxy, however, can be negative as well as positive since a dissimilar income distribution does not indicate whether South (North) demands more of the high (low)-quality variety or not.[18]

Moreover, in the theoretical part we argued for that a more unequal distribution in South and a more equal distribution in North will not necessarily increase the share of vertical IIT since this is dependent on an overlap in demand. In other words, a similar capital-to-labour ratio ensures a demand for high (low)-quality varieties in South (North), so that a positive effect could emerge from the changes of the income distributions (as long as South exports low-quality varieties and North high-quality varieties). We therefore interact the different proxies for income distributions with the differences in per capita income, and note that a larger DGDPC always implies a lower GDP per capita in South (see Table A3 in Appendix). Differences in per capita income will, however, also have a direct effect on the demand pattern. We saw in the theoretical part that we may assume that the Linder-type hypothesis is valid when the direct income effect on IIT flows, after a change in capital-to-labour ratios, is large, and that this is more likely if South's income distribution is more unequal than North's. That is, we expect a negative interaction term since it captures the requirement of a similar capital-to-labour ratio in order to expect a positive effect from a change in the income distribution pattern within countries and the increased probability of a Linder-type hypothesis when per capita income changes.

Finally, the average sizes of two bilateral trade partners (AVGDP) will affect the trade volumes between them, as both vertical IIT and total trade volumes will increase the larger they are. But the expected sign of the coefficient of AVGDP as an explanatory variable of the share of vertical IIT is ambiguous as suggested by our theoretical model.

Econometric Analysis

The Regression Model

The data material of this paper has three dimensions, 8 reference countries (EU members), 52 partner countries (low income countries), and 22 different industries; which adds up to 9,152 bilateral trade flows. The industries and countries included in this study are found in Table A1 and A2 in the Appendix.

The different dimensions of the data material require some presumptions about unobservable characteristics that may effect the error terms. In this paper we will group the country effects into four different subgroups reflecting the different preference agreements faced by South when it trades with the EU. The reasons for using these four broad subgroups based on trade partners are the common external trade policy of the EU, and the fact that the variations of the independent variables within the EU are rather low compared to their partners (see Table A3 in Appendix). The four country groups are (see Table A2) ACP (the African Caribbean and Pacific countries), NAME (North Africa and Middle East countries), CEE (Central and Eastern European countries), and finally OTHER (other countries). The different industries (see Table A1) are grouped into 14 sectors that reflect the industry effects in the data material.

Moreover, we will use a non-linear least square (NLLS) estimation with a logistic probability function since the dependent variable is a proportion and we found a large number of zero observations in the sample.[19] That is, the regression model is:

$$VB_{jb} = \frac{1}{1+\exp(-X_b\beta - Z_{gp}\lambda)} + \varepsilon_{jb},$$

where b indicates bilateral partners, j is the NACE-industry (at a 2-digit level), X_b is a vector with a constant and bilateral partner-specific variables, Z_{gp} is a vector with dummy variables that pick up the effects of various preferential trade agreements and sectors, and finally ε_{jb} is the error term. The regression model for the economy-wide analysis is identical except that we drop the industry and the sector indices *j* and *g*. Finally, the estimation of the industry effects will be consistent since we have 416 bilateral flows while the industries number 14.

Results of the Economy-Wide Analysis

The results of the economy-wide analysis, using weighted averages of all industry measures, are found in Table 1. The overall fit is not overwhelming for highly aggregated data, the adjusted R^2 is between 0.08 and 0.10, but the Pseudo-F tests indicate that we can reject the hypothesis that all coefficients of the independent variables equal zero. A Wald-test as well as an F-test indicate that partner group effects are important, and they show that the ACP countries have much lower levels of vertical IIT as a share of total trade. The shares of vertical IIT in CEE countries are, on average, higher than the other countries in the sample, and the same is valid for NAME countries if we accept the 11 % significant level in regression (ii). The reasons behind the significant partner group effects could be numerous since they pick up all unobservable characteristics. But we suspect that they represent differences in the design of preferential trade agreements, i.e. differences in trade opportunities, and differences in distance from the EU since both NAME and CEE are countries that are closer to the EU than the other trade partners.

Table 1 about here.

If we first consider the demand side aspects of this model, we can see that the average market size is important. That is, the larger the average economic size the higher the share of vertical IIT, which is indicated by the highly significant positive coefficient of AVGDP in all regressions. The theoretical model could not, however, predict whether a larger average market size would have a positive effect or not. Many empirical studies assume, however, a positive relation between average market size and share of vertical IIT for various reasons. Greenaway et al (p. 8, 1999), referring to demand side factors in Falvey and Kierzkowski (1987), argue that we may "*expect the amount of vertical IIT to be positively related to the average market size*", and Fontagné et al (p. 105, 1997) underscore the positive relationship between "[*t*]*he size of countries, a variable which is often associated with the potential for economies of scale … and for greater variety of differing qualities for the same product, has a positive effect on IIT in vertically differentiated products*".[20] In other words, we find similar results as in other studies regarding the average market size, but the explanation for this finding is ambiguous. An important fact, however, is that we use bilateral trade flows, and hence the average size may catch, as Fontagné *et al* argues, the possibility of producing a greater number of varieties/qualities.

An interesting finding is that the results in regression (ii) underline the fact that a more unequal distribution in South than in North increases the share of vertical IIT in total trade, as we expected, when the two partners have a relatively similar per capita income level. That is, there must be some overlap in demand at the national level (we must find some consumers in each country that demand a variety produced by its partner) between countries before any redistribution schemes within countries bring about trade flows. This is indicated by the marginal effect in Table 1, which is the partial differentiation of the regression equation with respect to the proxy for dissimilarity in income distribution. The significance of such an interaction term is supported by the Wald test in regression (ii). Moreover, the proxy RGIN in regression (iii), which reveals high income shares in South's (North's) high (low)-income stratum, is significant at a 16 % level while the proxy SGIN in regression (i) is only significant at a 28 % level. That is, it seems important to distinguish the partner that has a more unequal income distribution, as we argued for in the theoretical part, since there is a rather distinct specialisation pattern in production.

However, we do not find any results that support the fact that per capita income differences *per se*, either as a supply or demand-side determinant, have any explanatory power with regard to variations in the share of vertical IIT. But the general results provide us with some support for the theoretical foundation, and with several important insights. One is that average market size matters, but its theoretical explanation is rather fuzzy. Another is that a more unequal income distribution in South than in North matters, with a positive effect on the share of vertical IIT as long as the per capita income is fairly similar. The results could, however, be affected by technological differences between North and South in all or some industries. If these industry effects are aggregated into bilateral trade flows and not picked up by the partner group dummies, the results of the economy wide analysis will be biased. We shall therefore make use of a multi-industry analysis.

Results of the Multi-Industry Regression

Table 2 presents the results of the multi-industry approach. The overall fit for the multi-industry regression is fairly good (compared to, e.g., Ballance *et al*) and the value of the adjusted R^2 is around 0.06, and, as in the economy-wide analysis, the pseudo-F test indicates that we can reject the hypothesis that all coefficients of the independent variables equal zero. Moreover, all industry dummies are highly significant with values ranging from 0.9 to 2.4

when sector A is integrated in the intercept. That is, the industry effects are important and an aggregation to an economy wide measure, especially if many partners specialise their production in different industries, may lead to inconsistent estimators. The partner group dummies are all significant and they indicate that ACP countries have a much lower share of vertical IIT, while CEE as well as NAME countries have a higher share than the other countries on average.

Table 2 reveals, as in the economy wide approach, that the average market size is important, and a greater average market implies a larger share of vertical IIT in total trade. Moreover, we find strong support for the hypothesis that a more unequal distribution in South than in North leads to a larger share of vertical IIT as long as the per capita incomes are fairly similar. Support is found in regressions (ii) and (iii), which reveal that the direct effect as well as the interaction term matters. Furthermore, both these regressions show that the marginal effect with respect to a change in the income distribution moves from a positive value to a negative value when per capita income differences increase.

However, when we use a more "common" proxy for dissimilarities in income distribution (SGIN) in regression (i), we see that both the direct effect and the interaction term become insignificant. We believe that this is due to the fact that this proxy does not indicate whether it is the income distribution in South or in North that is more equal than the other; it only indicates whether the Gini coefficient is fairly similar or not. But if there is a distinct production pattern regarding the quality level so that South (North) produces a lower (higher) quality, the positive effect on the share of vertical IIT from a more dissimilar income distribution only emerges when South's (North's) income distribution becomes more (less) unequal.

A result that emerges from this approach is that differences in per capita income matter. But, as we discussed in the theoretical part, this could be either a supply or a demand-side effect. The supply-side effect is expected to be positive since a more dissimilar capital-to-labour ratio, or per capita income, implies a higher degree of specialisation on different quality levels. The results in Table 2 indicate that the direct effect is positive. However, the specialisation pattern could stem from, for example, technological differences, while per capita income differences affect the share of vertical IIT through the demand side. We believe more in the latter explanation since per capita income differences are only significant if we use a proxy that indicates when income distribution in South becomes more unequal than in North (i.e. regressions (ii) and (iii)). We can see that the Linder-type hypothesis becomes valid when South's income distribution becomes more unequal than North's since the interaction term is negative. In other words, a less similar per capita income reduces the share of vertical IIT as long as the income distribution within South (North) leads to a higher income concentration in the high (low)-income stratum, so that the demand for high (low)-quality varieties is relatively high.

Table 2 about here.

How robust are our results after changes of the threshold value α (i.e. the α used in equation (4))? Table A4 in the Appendix indicates that the results discussed above are very robust. All coefficients have the same sign and almost exactly the same value even if we use a broader definition of vertical IIT, and in Table A4 we contrast our findings with an α that equals 0.15 and zero (regressions (a) and (b) respectively, where the target value in (b) is similar to the Grubel-Lloyd index).[21] This is in line with the findings that most IIT flows, between the EU and low-income countries included in this study, are defined as vertical independently of the alpha value, and hence we expected similar results.

In regressions (d) and (e) of Table A4 we have included other "relevant" country-specific variables that have been used, *inter alia*, in Fontagné, Freudenberg and Péridy (1997).[22] However, the important relationship between the income distribution within and between countries seems to be valid even after the inclusion of these new variables. We can see that if we drop the interaction term (regression (c) and (e)), the explanatory value decreases and variables that capture income distribution differences become insignificant. That is, the relationship of the income distribution within and between countries is important in order to capture the effects of different demand patterns in models of vertical IIT.

To sum up, the results of a multi-industry approach provide rather strong support for our hypotheses on the interaction between income distribution and per capita income differences. The multi-industry approach assumes, however, that the slope for each variable is the same for all industries. This can be very restrictive, even though we allow for industry effects, since different technologies, demand elasticities, and trade policies may affect the relationship between the share of vertical IIT in total trade and the independent variables differently. We will, therefore, divide the sample into different sectors and run regression (iii) in Table 2 on each sector without any industry dummies.

Results of a Sector-Level Analysis

The results after splitting up the sample into sectors are found in Table 3, and the fit of the regression model varies from zero to a rather good fit. The regression of manufactures of food products, beverages and tobacco (sector A) has a zero fit, while the regression of manufactures of wood and cork products (sector D) has an adjusted R^2 value of 0.35. Moreover, the pseudo-F test of the regression of sector A could not reject the hypothesis that all coefficients equal zero. One explanation for this bad fit could be that this sector is rather regulated, which is also true for manufactures of textiles and textile products, and leather and leather products (sector B and C). All three of these regressions accepted the restriction that the sum of the interacted coefficients equals zero (see note c in Table 3).

There are, however, four more regressions that accepted this restriction, and these are the regressions of manufactures of paper products, plastic products, electrical and optical equipment, and motor vehicles (i.e. sector E, H, L and M). An interesting finding is that the ratio between the number of products defined as high-quality EU export and the number defined as low-quality EU export is very low in many of these sectors (except for sector H). Figure A1 in the Appendix shows that this ratio is very low in sectors A, B, C, and L; which sum up to about 42 % of the total trade flow (see Figure A2). One explanation for this pattern, besides the fact that South may produce a high-quality variety in many products, could be outsourcing. That is, firms in the EU export unfinished products to South, where they are processed and then re-exported to the EU for consumption or for adding more value to the product before consumption.[23] In other words, this type of trade is the same as a relocation of parts of the production process (e.g. labour-intensive assembling), and it can explain the weaker support for demand patterns as a driving force behind vertical IIT in these sectors. That is, the demand side effects become weaker since we do not have the assumed unique localisation pattern, and hence other variables, not considered in this study, may become more important to explain the variation of the share in vertical IIT. We still find some support for our demand-side factors such as the average market size and direct effect of a more unequal income distribution in South than in North. The support of the latter effect is, however, rather weak. If we do not use heteroskedasticity-consistent covariance matrices in sectors that did not rejected the test of homoskedasticity (sector A, B, C, E, and H), the coefficient of RGIN and the interaction term became insignificant in sector A and B as well.

On the other hand, there are several sectors that are more in line with the presumption of a distinct specialisation pattern. These are manufactures of products of wood, coke and refined petroleum, non-metalic mineral products, metal products, machinery, and manufacturing n.e.c. (i.e. sectors D, F, I, J, K, and N); which sum up to around 34 % of the total trade flow. Moreover, all of these sectors support the interaction term between per capita income and the proxy for dissimilar income distributions. A more unequal (equal) income distribution in South (North) leads to a higher share of vertical trade (the regression of sector F only provides a coefficient of RGIN that is significant at a 11 % level) as long as the per capita income between the trading partners is rather similar.

The results in Table 3 also indicate that the impact of differences in per capita income is more significant in the latter sectors than the former, and we can see that the coefficients of DGDPC alter between positive and negative. But the interaction term is still always negative, so that the Linder-type hypothesis is supported in at least four regressions: as long as the income distribution tends to specialise the demand pattern within countries, so that there is a demand for importing high (low)-quality varieties in South (North). These results suggest clearly that per capita income differences are more a demand side than a supply side determinant of vertical IIT. Finally, the results in Table 3 show that average market size still matters in ten out of fourteen sectors.

To sum up, we find that demand patterns matter and explain a large part of the variation in the share of vertical IIT in a subset of industries. The relationship between income distribution and per capita income seems to be important in industries with a similar specialisation pattern as presumed in the theoretical part. We are, on the other hand, uncertain about the supply side effects. Our proxy for capital-to-labour ratio (differences in per capita income) does not pick up any supply side effects, and we suspect that we need more industry-specific factors and/or technological differences to capture the supply side effects.

Table 3 about here.

Summary and Conclusions

Demand side conditions have played an important role in the literature on vertical IIT, and in the theoretical part we argued that we must consider income distribution within as well as between countries in order to make any precepts. To our knowledge, earlier empirical studies have ignored this aspect. We therefore confronted our hypotheses with an empirical analysis that focused on bilateral IIT flows between 8 EU members and 52 low-income countries. Our focus on North-South IIT was in line with the theoretical presumptions of a distinct localisation pattern of production of different qualities, since we found, on average, that the

EU exported higher-quality varieties than South, and since a majority of all IIT flows were defined as vertical IIT.

The results stemmed from three different empirical approaches (economy wide, multi-industry, and sector level), which all gave some support to the hypotheses and underscored the interaction between income distribution within and between countries. We found that a more unequal (equal) income distribution in South (North) increased the share of vertical IIT since foreign demand for North's (South's) high (low)-quality varieties increased. This effect was, however, dependent on the income distribution between countries. That is, the positive impact on the share of vertical IIT of a change in the income distribution pattern ceased if demand for the varieties produced by the partner was non-existent due to large differences in average per capita income.

A startling, yet expected, result appeared after a decomposition of the sample into different sectors, since the sector approach revealed the same pattern as above in sectors with a distinct specialisation pattern in qualities. Although we found some weak support for the importance of income distribution *per se* within sectors with a less distinct specialisation pattern, we found no support for the interaction between the income distribution within and between countries. We concluded that one reason behind these findings was the importance of outsourcing.

That is, on the one hand we found support for the importance of the income distribution within and between countries, as underscored by models of vertical IIT, as long as the trade pattern followed the presumption of a distinct specialisation pattern in production of high and low-quality varieties. On the other hand, we found no satisfactory explanations for the distinct specialisation pattern in production. These patterns could be driven by technological and/or endowments differences at a national and/or industry level.

Tables

Table 1: Regression results of the economy-wide measure: [a]

Dependent: $VB_p(\alpha = 0.25)$ [b]	*Non-linear LS with a logistic probability function.*		
Independents	(i)	(ii)	(iii)
AVGDP	**1.19** (*0.00*)	**1.15** (*0.00*)	**1.16** (*0.00*)
DGDPC	-0.002 (*0.93*)	0.01 (*0.69*)	0.01 (*0.63*)
ACP	**-0.65** (*0.04*)	**-0.61** (*0.05*)	**-0.68** (*0.03*)
NAME	0.31 (*0.28*)	0.45 (*0.11*)	0.32 (*0.25*)
CEE	**0.39** (*0.10*)	**0.76** (*0.00*)	**0.61** (*0.02*)
SGIN	1.15 (*0.28*)		
DGIN		**0.10** (*0.00*)	
RGIN			1.13 (*0.16*)
DGDPC_GIN	-0.04 (*0.58*)	**-0.004** (*0.04*)	-0.04 (*0.28*)
Pseudo-F (p-value) [c]	*0.00*	*0.00*	*0.00*
Wald test (p-value) [d]	*0.54*	*0.04*	*0.51*
Marg eff. (mean, max, min) [e]	*0.005, 0.025, -0.001*	*0.001, 0.002, -0.000*	*0.005, 0.021, -0.001*
R^2 adjusted	*0.08*	*0.10*	*0.08*
D. f. [f]	*408*	*408*	*408*

Notes:
[a] The table presents the coefficients of the NLLS, values within parentheses are p-values from a two-tail *t*-test, and bold figures indicate that a coefficient is significant at least at a 10 % level. All p-values are based on a heteroskedasticity-consistent covariance matrix (see Davidson and MacKinnon, 1993).
[b] Similar results were found when $\alpha = 0.15$.
[c] Testing the restriction: $\boldsymbol{\beta} = 0$.
[d] Testing the restriction: $\{\beta_{DGDPC} + \beta_{DGDPC\_GIN}, \beta_{SGIN/DGIN/RGIN} + \beta_{DGDPC\_GIN}\} = 0$.
[e] The partial differentiation of VB_b with respect to SGIN/DGIN/RGIN.
[f] The sample consists of 416 different bilateral trade flows at an economy wide level.

Table 2: Regression results of a multi-industry approach: [a]

Dependent: $VB_p(\alpha = 0.25)$ [b]	*Non-linear LS with a logistic probability function.*		
Independents	(i)	(ii)	(iii)
AVGDP	**1.17** (*0.00*)	**1.07** (*0.00*)	**1.20** (*0.00*)
DGDPC	0.02 (*0.29*)	**0.06** (*0.00*)	**0.04** (*0.01*)
ACP	**-0.93** (*0.01*)	**-0.79** (*0.00*)	**-0.95** (*0.00*)
NAME	**0.40** (*0.03*)	**0.45** (*0.00*)	**0.34** (*0.01*)
CEE	**0.66** (*0.00*)	**0.78** (*0.00*)	**0.78** (*0.00*)
SGIN	0.22 (*0.72*)		
DGIN		**0.14** (*0.00*)	
RGIN			**1.71** (*0.00*)
GDPC_GIN	0.01 (*0.83*)	**-0.01** (*0.00*)	**-0.08** (*0.00*)
Industry dummies	Yes (all significant)	Yes (all significant)	Yes (all significant)
Pseudo-F (p-value) [c]	*0.00*	*0.00*	*0.00*
Wald test (p-value) [d]	*0.02*	*0.00*	*0.00*
Marg eff. (mean, max, min) [e]	*0.006, 0.048, 0.000*	*-0.000, 0.003, -0.004*	*0.001, 0.040, -0.033*
R^2 adjusted	*0.05*	*0.06*	*0.06*
D. f. [f]	*9,131*	*9,131*	*9,131*

Notes:
[a, b, c, d, and e] See Table 1.
[f] The sample consists of 9,152 bilateral trade flows.

Table 3: Results after a sectorial deconstruction. [a]

Independent: VB_{jp} ($\alpha = 0.25$)

Non-linear LS with a logistic probability function.

Sector	AVGDP	DGDPC	RGIN	GDPC_GIN	*Max/Min Marginal effect* [b]	*P-val.* [c] *Dum.* [d]	*R^2 adj D. f.*
A	**1.46**	-0.006	**2.53**	-0.06	*0.025*	*0.59*	*0.00*
	(*0.00*)	(*0.92*)	(*0.04*)	(*0.24*)	*0.000*	*Yes*	*824*
B	**0.93**	0.04	**2.21**	**-0.12**	*0.028*	*0.33*	*0.05*
	(*0.00*)	(*0.25*)	(*0.03*)	(*0.02*)	*-0.040*	*Yes*	*824*
C	**2.06**	0.01	**2.63**	**-0.13**	*0.070*	*0.17*	*0.06*
	(*0.00*)	(*0.83*)	(*0.04*)	(*0.02*)	*-0.040*	*Yes*	*408*
D	**11.64**	0.01	**18.37**	**-0.82**	*0.737*	***0.00***	*0.35*
	(*0.00*)	(*0.96*)	(*0.00*)	(*0.00*)	*-0.095*	*Yes*	*408*
E	0.63	0.02	0.89	-0.06	*0.009*	*0.86*	*0.03*
	(*0.21*)	(*0.65*)	(*0.51*)	(*0.37*)	*-0.026*	*Yes*	*824*
F	1.55	**0.28**	7.08	**-0.32**	*0.104*	***0.00***	*0.10*
	(*0.15*)	(*0.06*)	(*0.11*)	(*0.09*)	*-0.259*	*Yes*	*408*
G	0.61	0.05	**2.56**	**-0.14**	*0.021*	***0.10***	*0.09*
	(*0.33*)	(*0.49*)	(*0.09*)	(*0.07*)	*-0.033*	*Yes*	*408*
H	**1.62**	0.04	0.68	-0.01	*0.041*	*0.56*	*0.11*
	(*0.00*)	(*0.46*)	(*0.66*)	(*0.83*)	*-0.000*	*Yes*	*408*
I	**3.64**	**-0.10**	**3.35**	**-0.17**	*0.084*	***0.02***	*0.04*
	(*0.00*)	(*0.10*)	(*0.00*)	(*0.01*)	*-0.044*	*Yes*	*408*
J	**3.02**	-0.01	**3.21**	**-0.15**	*0.042*	***0.08***	*0.14*
	(*0.00*)	(*0.97*)	(*0.07*)	(*0.06*)	*-0.044*	*Yes*	*824*
K	**6.38**	**-0.25**	**2.97**	**-0.14**	*0.066*	***0.01***	*0.04*
	(*0.00*)	(*0.00*)	(*0.06*)	(*0.05*)	*-0.041*	*Yes*	*408*
L	**0.79**	0.02	0.49	-0.02	*0.002*	*0.72*	*0.03*
	(*0.00*)	(*0.24*)	(*0.47*)	(*0.47*)	*-0.001*	*Yes*	*1656*
M	0.55	-0.01	-1.27	0.06	*0.003*	*0.68*	*0.02*
	(*0.25*)	(*0.88*)	(*0.43*)	(*0.49*)	*-0.001*	*Yes*	*824*
N	0.50	**0.07**	**2.99**	**-0.13**	*0.091*	***0.05***	*0.06*
	(*0.23*)	(*0.09*)	(*0.02*)	(*0.02*)	*-0.060*	*Yes*	*408*

Notes:

[a] See Table 1. Furthermore, all regressions, except for sector A, rejected the fact that all coefficients equal zero, and we only show the results of the regression with RGIN (the results are similar when we substitute DGIN for RGIN).

[b] Same note as note e in Table 1.

[c] Testing the restriction: $\{\beta_{DGDPC} + \beta_{DGDPC\_GIN}, \beta_{RGIN} + \beta_{DGDPC\_GIN}\} = 0$.

[d] Partner dummies.

Appendix

Equation A1: Partial differentiation of a consumer's income with respect to the redistribution scheme (ι) and capital-to-labour ratio (k).

$$\frac{\partial i^{hj}}{\partial \iota} = -(w + rk\rho^{-1}) \;\; ; \;\; \frac{\partial i^{lj}}{\partial \iota} = (w\rho + rk)(1-\rho)^{-1} \;\; ;$$

$$\frac{\partial i^{hj}}{\partial k} = \frac{r\rho - rk\rho_k}{\rho^2}(1 - \iota) \;\; ; \;\; \frac{\partial i^{lj}}{\partial k} = \frac{(1-\rho)(w\rho_k + r) + (w\rho + rk)\rho_k}{(1-\rho)^2}(\iota)$$

Table A1: NACE industries.

Code	*Sectors*	*Industry*
15	A	*Manufacture of food products and beverages.*
16	A	*" tobacco products.*
17	B	*" textiles.*
18	B	*" wearing apparel.*
19	C	*" luggage, handbags, saddlery, harness and footwear.*
20	D	*" wood and products of wood and cork (except furniture).*
21	E	*" pulp, paper and paper products.*
22	E	*Publishing, printing and reproduction of recorded media.*
23	F	*" coke and refined petroleum.*
24	G	*" chemicals, chemical products and man-made fibres.*
25	H	*" rubber and plastic products.*
26	I	*" non-metallic mineral products.*
27	J	*" basic metals.*
28	J	*" fabricated metal products (except machinery and equipment).*
29	K	*" machinery and equipment n.e.c.*
30	L	*" electrical and optical equipment.*
31	L	*" electrical machinery and apparatus n.e.c.*
32	L	*" radio, television and communication equipment and apparatus.*
33	L	*" medical, precision and optical instruments, watches and clocks.*
34	M	*" motor vehicles, trailers and semi-trailers.*
35	M	*" other transport equipment.*
36	N	*" furniture, manufacturing n.e.c.*

Table A2: Reference and partner countries.

	Region	Country
Reference countries:	EU	Belgium, Denmark, France, Germany, Ireland, Italy, Netherlands, Spain.
Partner countries:	ACP	Burkina Faso, Dominican Rep., Ghana, Guinea, Gambia, Guinea-Bissau, Guyana, Jamaica, Kenya, Lesotho, Madagascar, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Uganda, South Africa, Zambia, Zimbabwe
	NAME	Egypt, Jordan, Morocco, Tunisia
	CEE	Bulgaria, Estonia, Hungary, Lithuania, Latvia, Moldova, Poland, Romania, Slovenia
	OTHER	Bangladesh, Bolivia, Chile, Ecuador, Guatemala, Indonesia, India, Lao, Sri Lanka, Mexico, Malaysia, Pakistan, Panama, Peru, Philippines, Russian Federation, Thailand, Venezuela

Notes:
Abbreviations: ACP (African, Caribbean, and Pacific countries), NAME (North African and Middle East countries), CEE (Central- and Eastern European countries), OTHER (other countries).

Table A3: Descriptive statistics.

	POP [a]	***GDP*** [b]	***Gini*** [c]	***INCSH20*** [d]	***INCSH100*** [e]	***GDP/POP***
All countries						
Mean	42.00	1.33E+5	40.74	0.06	0.47	3982
VC [f]	2.78	2.64	0.26	0.39	0.18	1.77
Max	882.00	1.97E+6	62.90	0.09	0.65	27431
Min	0.80	2.22E+2	24.70	0.01	0.34	164
EU member						
Mean	33.00	7.28E+5	30.95	0.08	0.38	21151
VC	0.87	0.95	0.16	0.13	0.07	0.21
Max	81.00	1.97E+6	38.50	0.09	0.43	27431
Min	3.50	5.23E+4	24.70	0.07	0.34	14734
South partner						
Mean	43.00	4.18E+4	42.24	0.06	0.49	1340
VC	2.88	2.05	0.25	0.41	0.17	0.98
Max	882.00	4.45E+5	62.90	0.09	0.65	6272
Min	0.80	2.22E+2	25.50	0.01	0.35	164

Notes:
[a] Total population in millions 1992 from WDI (World Bank's World Development Indicators 1998).
[b] GDP at current US$ market prices 1992 from WDI.
[c] Gini coefficients from WIID (UNDP's World Income Inequality Database version Beta 3.8).
[d] Income share accruing to the two lowest deciles from WIID.
[e] Income share accruing to the two highest deciles from WIID.
[f] Variation coefficient (the ratio between the standard deviation and the mean).

Figure A1:

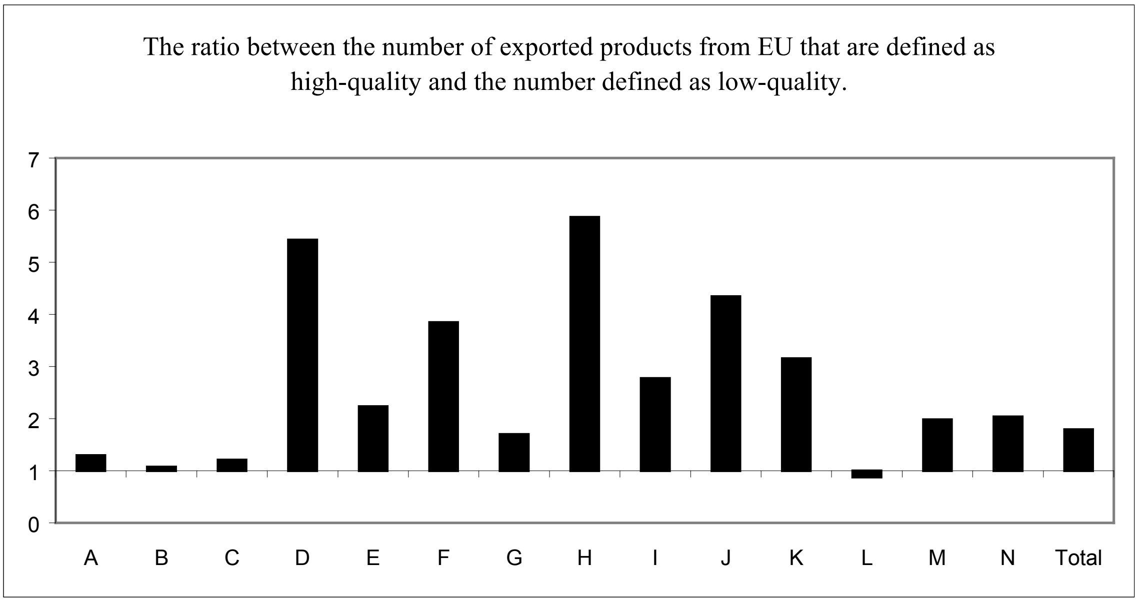

Figure A2:

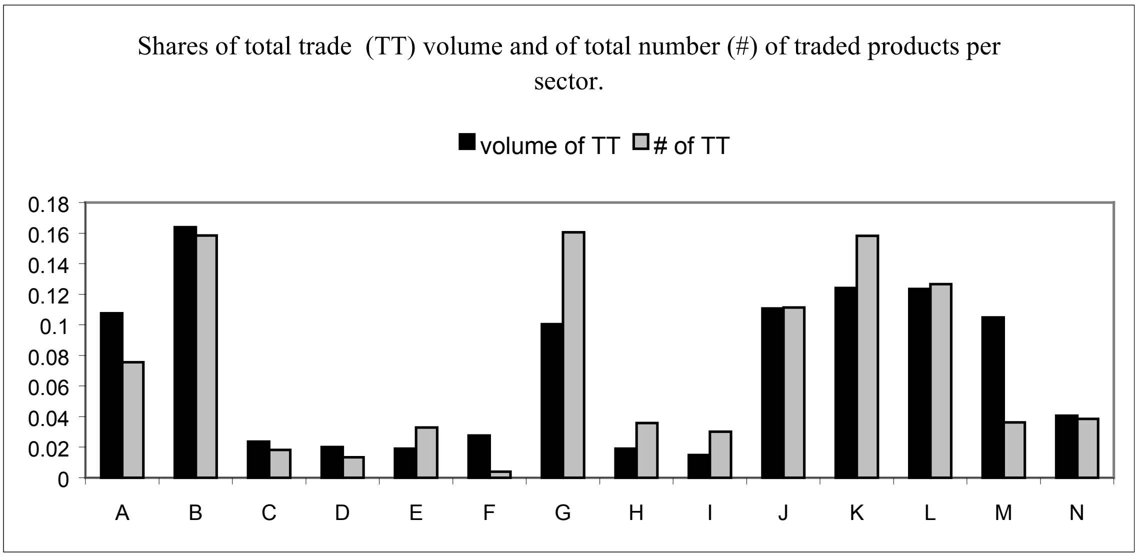

Table A4: Robustness tests: [a]

	Non-linear LS with a logistic probability function.				
Independents/Dependent	VB_{jb}(α=.15) (a)	G-L (b)	VB_{jb}(α=.25) (c)	VB_{jb}(α=.25) (d)	VB_{jb}(α=.25) (e)
AVGDP	**0.97** (*0.00*)	**0.97** (*0.00*)	**1.17** (*0.00*)	**3.72** (*0.00*)	**3.80** (*0.00*)
DGDPC	**0.06** (*0.00*)	**0.05** (*0.00*)	**0.03** (*0.05*)	**0.05** (*0.08*)	0.01 (*0.72*)
ACP	**-0.79** (*0.00*)	**-0.79** (*0.00*)	**-1.05** (*0.00*)	-0.21 (*0.32*)	**-0.66** (*0.06*)
NAME	**0.56** (*0.00*)	**0.67** (*0.00*)	**0.32** (*0.02*)	**0.59** (*0.05*)	0.35 (*0.28*)
CEEC	**0.80** (*0.00*)	**0.79** (*0.00*)	**0.70** (*0.00*)	**0.67** (*0.06*)	0.62 (*0.11*)
DGIN	**0.14** (*0.00*)	**0.13** (*0.00*)	0.005 (*0.46*)	**0.20** (*0.00*)	-0.002 (*0.78*)
GDPC_GIN	**-0.01** (*0.00*)	**-0.01** (*0.00*)		**-0.01** (*0.00*)	
Absolute difference in GDP				**-1.52** (*0.00*)	**-1.51** (*0.00*)
Distance				-0.06 (*0.16*)	-0.06 (*0.18*)
Average per capita income				**0.19** (*0.00*)	**0.15** (*0.00*)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Pseudo-F (p-value) [b]	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Wald test (p-value) [c]	*0.00*	*0.00*		*0.00*	
R^2 adjusted	*0.06*	*0.07*	*0.05*	*0.08*	*0.07*
D. f. [d]	*9,131*	*9,131*	*9,132*	*9,128*	*9,129*

Notes:
[a] The table presents the coefficients from the NLLS, values within parentheses are p-values from a two-tail *t*-test, and bold figures indicate that a coefficient is significant at least at a 10 % level. All p-values are based on heteroskedasticity-consistent covariance matrix (see Davidson and MacKinnon, 1993), and the results were similar if we substituted RGIN for DGIN.
[b] Test the restriction that all coefficients are set to zero.
[c] Testing the restriction: $\{\beta_{DGDPC} + \beta_{DGDPC\_GIN}, \beta_{DGIN/} + \beta_{DGDPC\_GIN}\} = 0$.
[d] The sample consists of 416 different bilateral trade flows at an economy wide level.

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End-Notes

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[1] See e.g. Falvey and Kierzkowski (1987), Greenaway and Milner (1986), (1987), and Greenaway and Torstensson (1997).

[2] North and South are only used to simplify the denomination for high and low-income countries, respectively.

[3] See also Flam and Helpman (1987), who discuss trade between unequal partners in a similar framework to Falvey and Kierzkowski, except for the focus on Ricardian supply effects. See also Greenaway and Milner (1986).

[4] That is, $r^n < r^s - [w^s(\alpha^s - \alpha^n)]/(\alpha^n\beta_h)$ and $r^n > r^s - [w^s(\alpha^s - \alpha^n)]/(\alpha^n\beta_l)$, which says that the unit cost of producing a high(low)-quality variety is lower(higher) in North than in South.

[5] The specialisation pattern may also arise due to differences in relative endowments.

[6] The direct income effect is found in Equation A1 in Appendix.

[7] This discussion can be compared with Flam and Helpman (p. 817, 1987), who argued that "[*W*]*hen the rates of population growth are the same in both countries, there is no change in the patterns of consumption, production, and trade*".

[8] For a discussion regarding measurement of product differentiation, see e.g. Gray and Martin (1980), Greenaway (1984) and Greenaway, Hine and Milner (1994).

[9] The different quality levels were measured by Consuming Reports ranking, and products with highly subjective and/or several quality-related scales were omitted.

[10] Note that we have removed very small trade volumes (less than 20,000 US$) and trade flows without any information on quantity. Furthermore, Belgium's trade flow incorporates the trade flows of Luxembourg.

[11] See e.g. Greenaway et al (1994 and 1999), and Fontagné et al (1997).

[12] For a discussion about the categorical aggregation problem and trade imbalances, see e.g. Greenaway and Milner (1983), Milner (1988), Kol and Mennes (1989), Vona (1991), Nilsson (1997b), and Fontagné and Freudenberg (1997).

[13] The conversion table from HS to NACE was obtained from Statistics Sweden.

[14] Descriptive data are found in Table A3 in Appendix.

[15] Note that the quality of the measures differs from country to country, and the years of observation range from 1987 to 1994. About 37 % of the income distribution observations is defined as less reliable by WDI, all EU members and 14 South partners are found in this category, which are all based on income data. The findings of Deininger and Squire (1996) suggest that these observations may, on average, have a 5 point higher Gini coefficient. The other observations are defined as reliable and are based on expenditure data of the whole population. The results of the econometric analysis are, however, not affected by a general reduction of the Gini coefficients based on income data.

[16] Tharakan and Kerstens (1995) and Hu and Ma (1999) used a similar range.

[17] We expect a positive sign if South (EU) specialises its production towards low (high)-quality varieties, which is true, on average, if we accept unit values as a good approximation for the quality level.

[18] There are, for example, 19 partners from South that have a smaller Gini coefficient than the highest value in North.

[19] Similar regression model has been used by, inter alia, Balassa and Bauwens (1987), Greenaway, Milner and Elliott (1999), and Aturupane, Djankov and Hoekman (1999). We use the NLLS estimators since we are not prepared to specify the distribution of the error terms (see e.g. Davidson and MacKinnon, 1993).

[20] Ballance et al (p. 333, 1992) assume "*that larger countries would have a higher share of IIT…* [that can be]*…attributed to the possibility that with increasing returns to scale, large countries will be able to produce a wider variety of differentiated products*".

[21] We use DGIN in Table A4, and the results are similar to RGIN.

[22] The ”relevant” variables are; the absolute difference in GDP, the distance from partners' geographical centres (same calculation as in Nilsson, 1997a), and the average GDP per capita. The inclusion of these variables may lead to collinearity problems since the correlation between AVGDP (DGDPC) and absolute difference in GDP (average GDP per capita) is rather high.

[23] See e.g. Feenstra (1998).