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Do Endowments Matter for Vertical Intra-Industry Trade with Emergent Countries? Empirical Evidence for Spain.*

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Abstract

In this paper, we study the nature of Spanish intra-industry trade and find that intra-industry trade with CEEC, Asian and Mediterranean countries has increased considerably since the middle of the Nineties. The second aim of the paper is to study if the comparative advantage argument also explains the vertical intra-industry trade between countries with different income levels. To this end we build physical, technological and human capital stocks for a large sample of countries. Results obtained with the panel techniques support the idea of a neo Ricardian explanation of VIIT rather than the neo-Hecksher-Ohlin explanation for intra-industry trade with emergent countries. Furthermore, our results suggest that the variables considered, mostly country-specific better explain vertical intra-industry trade than horizontal intra-industry trade. Results obtained with the Heckman method support the idea that IIT is more likely to occur with emergent countries with higher income per capita and with OECD countries that have a more similar level of income to that of Spain. Differences in endowments play an important role to determine the volume of IIT rather than the probability of IIT to occur. An aditional contribution of this paper is to demonstrate that panel approach allows for more robust conclusions than OLS estimations when explaining intra-industry trade. The Heckman procedure to account for the zero flows also represents a major improvement respect to the standard approach.

JEL Classification Numbers: F11, F12, F14, C23, C24.

Keywords: Intra-industry trade; Comparative Advantage, Spain, Vertical Differentiation, Panel data, Truncated models.

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1. INTRODUCTION

In the eighties, theoretical literature of international trade proposed justifications for intra-industry trade which could be easily tested by empirical analysis. Production under increasing returns to scale, together with the hypothesis of consumers' preferences for variety, justify that similar products could be both exported and imported (Krugman, 1979, 1980; Lancaster 1980; Helpman, 1981). These arguments also explain why intra-industry trade generally takes place among similar and rich countries.

The model proposed by Helpman and Krugman (1985) also considers differences in endowments providing an explanation for intra-industry trade between unequal partners. Differentiated products are supposed to be more capital-intensive, a key hypothesis that is well established empirically. Predictions driven from these models, point that the volume of intra-industry trade will be larger, the larger the intensity in capital relative to labour of the trading partners is. Furthermore, as a larger market allows for economies of scale to occur, similar and large markets will also lead to more intra-industry trade. Finally, the more different their capital-labour ratios, the lower intra-industry trade will be.

In the last decades, empirical and theoretical literature on international trade has provided new insights concerning intra-industry trade. Products can be differentiated either horizontally, where products differ not intrinsically in their design, color or other attributes; or vertically, where products are differentiated by their quality. According to Falvey (1981) and Falvey and Kierzkowski (1987), vertically differentiated products are the result of different production functions, that is, low quality products might be labour-intensive, while high quality products might be capital-intensive. Consequently, differences in factor endowments are expected to enhance vertical IIT as shown in the Heckscher-Ohlin model. Alternatively, vertical differentiated products can be produced by more or less qualified employees, see Gabszewicz et al. 1981. Based on Ricardian models, countries can also have a comparative advantage in a quality segment due to differences in technology, see Flam and Helpman (1987) or due to differences in research and development expenditures as in Shaked and Sutton (1984).

According to this literature, countries specialize in a quality segment depending on their comparative advantage. Consequently, differences in factor endowments enhance vertical intra-industry trade, just like inter-industry trade. Few studies have improved the understanding of intra-industry trade by disentangling it into vertical and horizontal intra-industry trade. They have also verified that the comparative advantage explanation holds for vertical intra-industry trade among developed countries[1]. However, only few studies have analyzed the determinants of intra-industry trade between high-income and emergent countries, mainly because these flows were negligible until the second half of the nineties. Aturupane et al (1999), Crespo and Fontoura (2004) and Nilsson (1999) are examples of such studies. Though, due to difficulty to gather data for these countries, these studies suffer from several limitations such as an old

[1] Some references could be Blanes and Martin (2000), Díaz-Mora (2002), Fontagné and Freudenberg (1997), Greenaway et al. (1994), (1995), Martin and Orts (2001), (2002).

period of study, conditioned by the availability of data[2] and/or the fact that they do not consider the different nature of IIT and/or the use of a very limited number of explanatory variables.

This paper is an attempt to contribute to this literature in two ways. First, we examine Spanish intra-industry trade during a period of increasing openness for Spain (1988-2000). Second, we study whether or not the comparative advantage explanation allows for a good understanding of the vertical intra-industry trade between unequal partners. To this end, first, we use a large sample of countries that includes OECD and emergent countries, and secondly we estimate a more general model either with panel data techniques or Heckman procedure. It is important to note that our model accounts for physical, technological capital and human capital stocks, that we have calculated.

This paper is organized as follows. The next section briefly describes the way we measure intra-industry trade and comments the level of intra-industry trade for Spain. Section 3 presents the empirical model and section 4 contains the econometric results. In Section 5 we conclude. Figures and tables are confined to an Appendix.

2. MEASUREMENT OF THE INTRA-INDUSTRY TRADE

We calculate levels of intra-industry trade, IIT from now on, between Spain and a group of 188 countries for the period 1988-2000 at the 8-digit level of disaggregation of the EU's Combined Nomenclature (CN). Data were obtained from COMEXT, Eurostat's database. Then, product categories are adapted to the 15 industries of the NACE Clio R 25 classification.

Following Greenaway and Milner (1983), we use the Adjusted Grubel-Lloyd Index (1975). We will call it AGL for the rest of the paper. We define the volume of intra-industry trade between Spain and country j for each 8-digit product p as the overlap between Spanish exports X and imports M. For each industry k, the IIT is obtained as

$$IIT_k^j = \sum_{p \in k} IIT_p^j = \sum_{p \in k} 2 \min \left(X_p^j, M_p^j \right)$$

The AGL Index is therefore the share of the IIT in the total volume of trade

$$AGL_k^j = \frac{IIT_k^j}{X_k^j + M_k^j} \times 100 = \frac{\sum_{p \in k} 2 \min \left(X_p^j, M_p^j \right)}{\sum_{p \in k} \left(X_p^j + M_p^j \right)} \times 100$$

This measure allows for both geographic and industry aggregation, where k can either be the total or any level of classification[3].

Abd-el-Rahman (1986) assumes that differences in unit value calculated per tonne reflect differences in quality. Greenaway et al. (1994) and Fontagné et al. (1997) use this methodology to differentiate between vertical and horizontal intra-industry trade.

[2]For instance, the most obvious source for data on capital stocks is the Penn World Tables that covers the period 1988-1992.

[3]Even if estimations are performed at the country level, we calculate the intensity of IIT by regions in order to summarize the most stylized facts in graphs.

Therefore, if the export and import unit values differ less than a certain percentage, products are considered similar or horizontally differentiated; otherwise this flow is considered as trade of vertically differentiated products. Unit values of exports and imports, $UV(X)$ and $UV(M)$ respectively, are calculated at the most disaggregated level p and for each overlap bilateral flow. Then, IIT of vertical differentiated products, from now on $VIIT$, and IIT of horizontal differentiated products, called $HIIT$, are obtained as follows

$$IIT_p^j = \begin{cases} HIIT_k^j & \text{if} \quad \frac{UV\left(X_p^j\right)}{UV\left(M_p^j\right)} \in [1-\alpha, 1+\alpha] \\ VIIT_k^j & \text{if} \quad \frac{UV\left(X_p^j\right)}{UV\left(M_p^j\right)} \notin [1-\alpha, 1+\alpha] \end{cases}$$

where the parameter α is an arbitrarily fixed threshold[4]. In the case of developing countries, the level of IIT could be concentrated in relatively few groups of products, while the total trade might be insignificant. Nillson (1999) suggests to use the average level of intra-industry trade per product traded as an alternative measure for suitable comparisons of the extent of IIT between small and large countries. The reason is that AGL is in nature unscaled and it does not reflect the absolute level of IIT and can lead to biased estimations.

The correlation coefficient between all measures is reported in Table 1. The volume of IIT is highly correlated, of about 96%, with IIT volume per product traded while the correlation with each of these variables with the AGL index is much lower, 78% and 82% respectively. As a consequence, using IIT volume or IIT volume per product traded as the explained variable in the estimations should lead to the same results, while explaining the AGL index could introduce some differences in the results. Turning to the value of the parameter α that should be used, when a difference in unit values of more or less 15% is used, vertical intra-industry trade volume is correlated at 99% with the measure of vertical IIT when a margin of 25% is used. Similar results are obtained for the horizontal intra-industry trade, indicating that the choice of one of these two values for α, though arbitrary, should not have any substantial effects on the estimations' results. Hence, we will use the IIT volume and a margin of 25%.

The importance of each type of trade between Spain and the different regions is summarized in Figure 1. The regions we consider are the European Union (EU), the OECD countries, the African-Caribbean Pacific Countries (ACP), Latin American countries, Developing Asian Countries, Asian New Industrialized Countries (NIC), Central and Eastern European Countries (CEEC), New Independent States, former USSR (NIS), Mediterranean and Northern African Countries (MNA) and Middle Eastern Countries (MEC).

Intra-industry trade takes up a great proportion of the Spanish trade with the EU but also represents more and more of its trade with OECD, CEEC, NIC of Asia and MNA countries. In 2000, IIT represented 33% of the total volume of trade with the EU, 13,4% with the other countries of the OECD, 13% with CEEC, 6,2 % with NIC of Asia and 4,9

[4] It usually takes values such as 0.15 or 0.25.

% with MNA. For all the regions, IIT consists mainly in vertical differentiated products except with CEEC and EU members for which each type of trade represents the same proportion. This fact implies that quality is the main concern for competitiveness. Manufactured products are more differentiated in nature, but the industry with the highest level of IIT differs from one region to another. All these facts are supported by data presented in Table 2.a and 2.b for the year 2000.

Figure 2 displays the level of IIT between Spain and 188 countries and their GDP per capita for two years: 1996 and 2000. It is obvious that low-income countries have a relatively low level of IIT with Spain. But the relation between these two variables is not so straightforward if countries with an intermediate or high income per capita are considered.

3. EMPIRICAL MODEL

There exists a well established empirical model that should be derived from theoretical counterpart as detailed in Fontagné et al. (1998). Following the proposal of these authors, we estimate a model that accounts for a broad range of country specific effects and some industry specific variables. We consider as dependent variable the volume of vertical and horizontal intra-industry trade in order to identify differences in their determinants. The model is tested in its logarithmic form. In this section we first describe into detail the benchmark model, Model 1 from now on, we will estimate, and then we start introducing several changes into this model generating some other alternative specifications.

First, to explain the volume of either VIIT or HIIT, the benchmark model proposed is the following.

$$\begin{aligned} IIT_{jkt} &= \beta_0 + \beta_1 DifGDP_{jt} + \beta_2 AvGDP_{jt} + \beta_3 DifGDPpc_{jt} + \beta_4 AvGDPpc_{jt} \\ &+ \beta_5 Dist_j + \beta_6 Cont + \beta_7 Comlang + \beta_6 Nbflows_{jkt} + \beta_7 EU + \beta_k S_k + \epsilon_{jkt} \end{aligned}$$

where j represents the Spanish trade partner and k the industry[5]; IIT_{jkt} denotes the volume of either VIIT or HIIT; $DifGDP_{jt}$ is the difference in absolute terms of real GDP between Spain and its respective trading partner, $AvGDP_j$ is the average real GDP of Spain and its trading partner j., $DifGDPpc_j$ is the difference in absolute terms of per capita income between Spain and its trading partners and $AvGDPpc_j$ average per capita GDP of Spain and its respective trading partner, $Dist_j$ is the geographical distance in kilometers between the Spanish capital and the capital of country j introduced as a proxy for transportation costs. We also will consider a dummy (EU) that takes the value 1 if the trading partner belongs to the European Union. Following Aturupane et al. (1999), we introduce the number of flows ($Nbflows_{jkt}$) built as the number of products traded at the 8-digit level in each industry k between Spain and country j. Finally, we include a dummy ($Cont$) that takes the value 1 if the trade partner shares a frontier with Spain, a dummy for Common Language ($Comlang$) for

[5] It is according to the NACE CLIOR25 nomenclature

countries who uses Spanish as official language, and a group of dummies for sectors, S_k. Sources for all the variables are detailed in Table 3.

In this benchmark model, we have to distinguish among explanatory variables that will affect the nature of the intra-industry trade and variables that affect in the same way both types of intra-industry trade. In the first group, we include $DifGDPpc_j$ as an indicator of differences in factor endowments[6]. Since we assume that $VIIT$ should be explained by the comparative advantage, we expect a positive influence of this variable on $VIIT$ while the effect should be negative on $HIIT$. Since horizontal differentiation results in more varieties of goods, we expect $Nbflows_{jkt}$ to reflect the degree of horizontal differentiation of the industry and therefore to display a positive sign for when explaining $HIIT$ while a negative impact on $VIIT$.

Concerning the group of variables that affect in the same way both types of IIT, we consider the following variables. A big difference in economic size, measured by $DifGDP_j$, reflects both differences in demand and in supply sizes and it is supposed to reduce any kind of IIT. Since the demand for variety, the intensity in capital in relation to labour and production of differentiated goods increases with income, we expect a positive effect of the variable $AvGDPpc_j$.

Following the *gravity model* approach of international trade, we include a list of variables in order to predict adequately the level of trade. In order to measure the market size we introduce the variable $AvGDP$. Based on the Linder hypothesis, external markets can be considered as an extension of the internal market and local demand stimulates the innovation of products. In the context of the Chamberlin model, the preference for varieties of consumers is high and a large market indicates a more diverse demand for differentiated goods. Economic size also reflects the supply potential and, therefore, the export potential in general, but more likely differentiated goods since the production of these goods is under increasing returns to scale. The average economic size is, thus, expected to increase the volume of trade. Besides, to capture possible specificity of transaction costs between trade partners, we include the distance ($Dist_j$) that is supposed to reduce any kind of trade; and $Comlang$ and $Cont$ that are expected to enhance the volume of trade in general and they could have a specific impact on intra-industry trade. We expect that trading partners who maintain lower tariffs and non-tariff barriers, as EU members, should face higher levels of any kind of trade[7].

At this point, we could think that determinants of the volume of IIT do not differ very much from the determinants of the overall volume of trade. To check if this is the case, we propose another specification, Model 2, that includes all determinants of Model 1 and the lag value of total volume of trade ($Lagvol$). By this way, we ought to

[6] This variable is used in the same way in Greenaway et al. (1994) or Durkin and Kryger (2000) for instance.

[7] Since the EU (and thus Spain) grants a preferential access to developing countries depending on their development level and their region of origin, we seek to capture the effect of tariffs and non-tariff barriers by the means of dummies for the 11 main regions considered by the common trade policy. Thus, due to multicollinearity problems (these groups present similar GDP already taken into account or belong to the same geographical region as reflected by distance), we renounce to introduce them in the estimations.

control for determinants of the total volume of trade, and it allows us to check for the sensibility of our results to the specification chosen. It turns out that if this variable is positive and significant, it means that determinants of total volume of trade would explain partially the volume of IIT.

As pointed out in the introduction, some of the contribution of this paper is to include variables that better measure the factor endowments. To this end, we build a measure of physical, human and technological capitals. The reason for doing so, is that income per capita used in models 1-2 does not only reflect the size of the different factors of production, but also reflects the influence of the demand size. In order to clarify the effect of the supply factors, we construct direct measures of production factors. Then, we propose Model 3-4 as the counterpart of Model 1-2 but replacing GDP per-capita by the measure of physical capital per capita, a more direct measure of the capital intensity. Finally, we propose Model 5-6, as the counterpart of Model 1-2 but replacing not only GDP per-capita by physical capital but also by human and technological capitals[8]. We proceed to explain briefly how we constructed these variables. We use a measure of physical capital, calculated using the perpetual inventory theory method

$$K_t = (1 - \delta) K_{t-1} + INV_t$$

where K_t is the physical capital for the year t, δ is the depreciation rate[9], and INV_t is the investment expenditure. The initial physical capital stock K_0 is calculated as follows

$$K_0 = \frac{1 + g_{GDP}}{\delta + g_{GDP}} INV_0$$

where g_{GDP} is the variation rate of GDP by year (base 1995) and INV_0 is expenditures on investment for the initial year[10]. The technological capital has been constructed in a similar way, using $R\&D$ expenditures. To obtain a measure of human capital endowment we consider the average years of schooling calculated from the following formula, for details, see Barro and Lee (1993).

$$AYS = \sum_j (YR_j \times HS_j)$$

where j is the schooling level, YR_j is the number of years of schooling represented by level j and HS_j is the fraction of the population for which the jth level is the highest value attained.

Following the comparative advantage explanation as for the benchmark model, differences in factor endowment are supposed to enhance VIIT. Therefore, the variables measuring differences on physical, human and technological capital stock between Spain and its respective trading partner, $DifKpc$, $DifKTpc$ and $DifKHpc$, that have substituted $DifGDPpc$, are expected to have a positive effect on VIIT. The effect of physical

[8] The reason to do the substitution of the GDP by variables representing factors of production in a sequential way, is that the number of countries for which we can construct physical capital are larger than for the two other variables.

[9] We use a depreciation rate of 4 per cent following Benhabib and Spiegel (1994).

[10] The initial year considered is the older year available for any country.

capital stock is less clear on horizontally differentiated products while differences in technological and human capital should reduce HIIT. We also replace $AVGDPpc_j$ by the average levels of physical, technological and human capital stocks per capita, $AVKpc$, $AVKTpc$, $AVKHpc$, respectively. Following the same reasoning as for $AVGDPpc_j$ we expect a positive sign.

4. ECONOMETRIC RESULTS

We first present the results of the panel estimation for the period 1996-2000 for all the countries and by type of countries and compare them to a cross-section analysis for the year 1999 estimated by the ordinary least squares method. We then turn to the analysis of the results of the Heckman procedure[11].

4.1. Panel estimation

We will present, first of all, the results for the estimation of benchmark model, Model 1, in detail, since most of the explanations will apply for the rest of the models. Then we comment the additional results that appear in any of the alternative models. As pointed out before, we have estimated each of the models for VIIT and for HIIT. Results for all countries are reported in Table 4 and 5 respectively. Note that we also have estimated the models for an specific group of countries, OECD and non-OECD, see Table 6.

The outstanding feature of the panel estimations is the robustness of the results, with most of them significant at the 1 percent level. For panel regression, we use the random-effects approach which is the more accurate due to our sample of countries, although we introduce fixed effects by sectors.

In general, variables that do affect equally both types of IIT display the expected sign and they are statistically significant. That is the case of variables representing the market size, namely, $DifGDP$ and $AvGDP$. Turning to the traditional variables of the gravity equation, the impact of distance is always negative and very significant. *Contiguity* has a positive and significant sign in all models explaining HIIT but not always when explaining VIIT. Countries who use Spanish as an official language may have a bigger volume of trade with Spain. Though, this does not seem to have a specific influence on VIIT and the evidence is weak for HIIT. Spanish intra-industry trade with the EU members is higher than predicted by other variables. This phenomenon is more accentuated for HIIT. Finally, a higher $AvGDPpc$ is associated with more IIT in general but the higher levels of GDP per capita have a bigger influence on VIIT than for HIIT.

Considering the variables that may affect the nature of IIT, $DifGDPpc_j$ affects negatively the volume of VIIT. This is a non-expected finding according to the theoretical predictions explained in the previous section, but it is in harmony with some other empirical studies. The same type of results is found in Nillson (1999), but he considers

[11] Panel data estimations and OLS for the AGL index have also been carried out. We omit the estimation of the AGL for two reasons. First, the estimation of volume of IIT is more consistent with the gravity specification. Secondly, given the heterogeneity of countries we consider, the AGL index could be the same whether the total volume of trade is significant or not.

total volume of IIT. In Blanes and Martin (2000) differences in GDP per capita also have a negative influence on any kind of intra-industry trade, whether OECD trading partners are considered or a larger sample of both developed and developing countries are considered. Crespo and Fontoura (2004) observed that the traditional determinants of trade ought to explain the Portuguese volume of vertical intra-industry trade when considering a sample of 46 countries. The authors also include the interaction between the Gini variable and per capita income differences. We are sceptical about this multiplicative variable since its expected influence is not clear and we are unable to determine whether the negative sign is in favour of comparative advantage theory or not.

The lagged of total volume of trade, Model 2, has a significant and positive effect on any kind of IIT flows, indicating that the volume of IIT is partially explained by the same determinant of the overall volume of trade. Note that our results emphasizes a specific influence of variables that are usually included as determinants of total volume of trade, on the volume of IIT. This is confirmed by the fact that the signs and significance of the estimated coefficients corresponding to the others variables, do not change in general, if something they decrease.

We expected that imports and exports of similar products differentiated by their quality are expected to increase with differences in factor endowments, while the effect should be the opposite for horizontal differentiated products. Therefore, using GDP per capita as a proxy for endowment as in Model 1-2, do not offer support for the comparative advantage explanation of VIIT.

Concerning the alternative models, Model 3-6, the additional findings are the following. Recall that we use stocks of physical, technological and human capital stock per capita instead of GDP per capita to establish more accurately the effect of supply factors. First, concerning market size, the significance of the parameter affecting $DifGDP$ could not be set in Model 5-6. Since we take into account the size of the main factors of production and therefore the determinants of the supply we interpret the coefficient of the $DifGDP$ and $AvGDP$ as a proxy for the demand size in these cases. Then, results are suitable with theoretical predictions since the size of demand is not a specific motor of IIT but influences more definitively total volume of trade. A confirmation for that is that the coefficients of these variables are always lower when taking into account the lag value of the volume of trade. Though, we expected bigger market to be a good proxy for the number of varieties demanded but this effect is not well captured by this variable. Secondly, as expected $AvKpc$, and $AvKTpc$ have a positive and significant influence on VIIT but the results are not significant for HIIT. $AvKHpc$ does not display the expected sign since it has a negative effect which is an unexpected result. Thirdly, $difKpc$ is not always significant, differences in human capital have a negative effect on VIIT and is not significant for HIIT[12]. DifKTpc has a robust negative impact on IIT, regardless to its nature These estimations confirm that differences in endowment can not directly associated with more IIT since differences in technological and human capital stocks reduce any kind of IIT. Our results differ from the studies of Mora (2002) for intra-EU trade and of Blanes and Martin (2000) for

[12] Díaz-Mora C. (2000) also finds a similar results for the Transport sector.

the Spanish trade with the OECD, where differences in human capital or technological capital have a more obvious positive effect on VIIT than physical capital differences.

Additional results in favour of Model 6, the overall R-squared ranges from 0.65 to 0.85 depending on the specification and the explicated variable. In general, R-squared for models explaining Vertical IIT are a little bit higher than for HIIT. In general, models that include lagged volume of trade display a higher overall R-squared.

In order to find more evidence either for or against the comparative advantage hypothesis to explain VIIT, we estimate Model 6 for the most developed countries on one hand, and for a group of less developed countries, such as Asia, Latin America, MNA and CEEC, on the other hand When considering the group of similar countries, for example the OECD countries, we expect that the determinants of VIIT slightly differ from the ones of VIIT among partners more heterogeneous as far as tastes and levels of development are concerned. Effectively, we find significant differences in the explanations for VIIT among developed or emergent partners. A high level of technological capital stocks is an important determinant for the volume of vertically differentiated goods with the OECD while the differences in technological capital is a barrier for VIIT with emergent countries. Human capital is not an important determinant for developed countries while the strange negative impact of human capital level on VIIT still holds for less developed countries. On the other hand, the factors explaining VIIT between Spain and the most developed countries differ slightly from those explaining HIIT while our model fails to explain HIIT with non OECD countries. In this case, the differences in physical capital stock per capita enhances VIIT while there are not significant for HIIT Finally, concerning HIIT, the number of significant variables is more limited. Aturupane et al. (1999) evidenced that HIIT is mainly a matter of industry-specific factors such as labor intensity of production or FDI, variables that we were not able to include in this study. Results indicate that trade of varieties with Spain is higher for EU countries and with partners who represents a higher weight in Spanish trade or trade a great number of products. This means that differences in endowment may influence this context but does not have a specific influence on the volume of HIIT.

4.2. Cross-section estimation: OLS versus Heckman technique

We estimate the models by OLS techniques for year 1999 and compare them to the panel estimation. One problem of this estimation is that it is driven only on flows that present a non-zero value, since we use the logarithmic transformation of the IIT volume. We argue that we should take into account the determinants of overall IIT when considering the difference between determinants of vertical versus horizontal IIT. That is, explaining variables (both country and industry-specific effects) may explain the fact that countries engage in IIT but could influence in a different way the fact that these two-way flows concern horizontal or vertical differentiated products. Since these shares are very low in some cases, and we think that the determinants of IIT could differ strongly if countries share specific characteristics, we decided to use also the Heckman estimation method that allows taking into account this selection effect.

The most important results of the panel estimations are robust to OLS specifications, that is: (i) differences in income per capita have a negative impact on VIIT but not significantly matter for HIIT; (ii) differences in physical capital stock reduce VIIT in general but enhances VIIT with the most developed partners; (iii) differences in technological capital stocks are an important barrier for VIIT and for HIIT with most developed countries. OLS estimations also display a high level adjusted R-squared (ranging from 0.66 to 0.89) and results concerning the significance and signs of coefficients are very similar to panel data estimations although less robust. All these findings are reported in Table 7-9.

Heckman estimation method consists of estimating simultaneously a probit equation, the selection mechanism, and an OLS equation, the regression equation. A binary variable D_{kj} is defined according to the following scheme

$$D_{kj} = \begin{cases} 1 & \text{if} \quad IIT_k^j \neq 0 \\ 0 & \text{if} \quad IIT_k^j = 0 \end{cases}$$

This variable takes the value 1 if total intra-industry trade exists and 0 in the opposite case. Using D_{ij} as the dependent variable, we consider the probit equation

$$\Pr\{D_k^j = 1 \mid \omega_k^j\} = F\left(\beta' \omega_k^j\right)$$

where ω_k^j represents a set of explanatory variables for the industry k and country j, we alternatively use variables of model 6 or model 1. The statistically significant variables will contribute to explain exclusively the probability of appearance of intra-industry trade flows. When analyzing the determinants of $VIIT$ and $HIIT$, provided that IIT_{ij} is different from zero, we should take into account the bias introduced due to the elimination of the zero observations from the sample when specifying the model, that is

$$E[VIIT_k^j \mid IIT_k^j \neq 0] = \delta' z_k^j + E[u_k^j \mid IIT_k^j \neq 0]$$

where z_k^j represents the set of explanatory variables of model 6 as defined in the previous section for the industry k and country j and the second term of the right-hand side of the equation is proportional to the inverse of the Mills ratio. The estimation of this inverse is obtained from the probit model estimated in the first stage of the analysis.

Estimations have been carried out for three different sets of countries: first, all countries, and then non EU and non-OECD countries[13]. We have considered two alternative set of explanatory variables into the selection equation, one with the same variables included in Model 6 and the other one with variables of Model 1. In both cases the regression equation considers variables of Model 6. We estimate these equations for the case of VIIT and HIIT. The results are presented in Table 10a-11b respectively.

The regression equation results are very similar that those obtained in the previous section. Differences and level of market sizes do not have a significant impact on the volume of IIT, regardless its nature. Differences in factor endowments, in particular physical and technological capital stock, have a negative effect in determining the level of VIIT. But the evidence is somewhat weak for non-OECD countries. Furthermore,

[13]It consists on MNA, CEEC, Asia, ACP countries.

distance and EU membership present the expected signs, and the past total volume of trade is of great relevance. When European countries are excluded from the estimation, market sizes, $DifKTpc$ and $AvKHpc$ better explain the volume of VIIT, while endowments do not have a specific effect on VIIT with non-OECD countries. Very few variables are significant when explaining the volume of HIIT. Dummies for sectors are all significant and positive for the majority of sectors, indicating that trade of differentiated products is also driven by industries characteristics as market structure and characteristics of products.

Turning to the selection equation, when model 6 is used, very few variables are significant indicating that the variables used explain more accurately the level of IIT volume than the reason why some bilateral flows consist in inter or intra-industry trade For VIIT and HIIT, only the number of flows, and the past volume of trade seem to have a determinant and positive influence on the probability for intra-industry trade to occur. The distance is only significant when VIIT is at stake but doesn't display the expected sign when trade with non-OECD is considered The way IIT occurs or not is not a matter of industry characteristics since dummies for sectors are not significant whatever the selection equation is used.

When model 1 is used as for the selection equation, the probability of IIT to occur appears higher, the higher the market sizes are. The indicator of differences in GDP per capita has a significant negative sign only when OECD countries are included. The average income per capita,presents a significant and positive coefficient only for emergent countries which implies that some degree of similarity in endowments is a condition for IIT to occur. Similar conclusions are reached by Martin and Orts (2002) studying the appearance of vertical trade flows for OECD countries using the same method. Concerning HIIT, Martin and Orts (2001) for Spanish trade with the OECD find that sectorial characteristics are the more relevant indicators to explain the existence of HIIT. Since our explanatory variables mainly have a national dimension, the lower fit of our model for HIIT is in harmony with the findings of these authors.

5. CONCLUSIONS

An important feature of international trade is the rapid growth of the intra-industry trade and especially the trade of vertical differentiated products. This paper provides evidence concerning the nature of Spanish intra-industry trade and found that intra-industry trade with CEEC, Asian and Mediterranean countries has increased considerably since the middle of the Nineties and focus thereafter on this period.

The second aim of the paper was to determine to what extend comparative advantage can explain VIIT using physical, technological and human capital stocks for a large sample of countries. Our results are not so conclusive as other studies. Our results support the idea of a neo-Ricardian explanation of VIIT rather than the neo-Hecksher-Ohlin explanation since differences in technological capital stocks appear systematically as a limitation for VIIT. The positive impact of physical capital stocks on VIIT appears clearer when explaining VIIT with OECD countries while physical capital differences lead to its decrease when all countries are considered. Results obtained with the Heckman method support the idea that IIT is more likely to occur with emergent countries with higher income per capita and with OECD countries that have a more similar level of income as Spain. Furthermore, our results suggest that the variables considered, mostly country-specific better explain vertical intra-industry trade with emergent countries. Differences in endowments play an important role to determine the volume of IIT rather than the probability of IIT to occur between Spain and emergent countries.

An additional contribution of this paper is to demonstrate that panel approach allows for more robust conclusion than OLS estimations when explaining intra-industry trade. The use of this technique should be recommend to find more evidence concerning determinants of intra-industry trade. Another originality of this study is the use of an Heckman procedure to account for the zero flows which represents a major improvement respect to the standard approach. As far as methodology is concerned, this paper also underlines that not all the traditional determinants of inter-industry trade have a specific effect on intra-industry trade but variables usually introduced as proxies for transaction costs have an effect. An important feature is that the empirical model generally better fit for VIIT than for HIIT determinants.A natural extension of this work is to integrate variables at the industry level to improve the understanding of HIIT.

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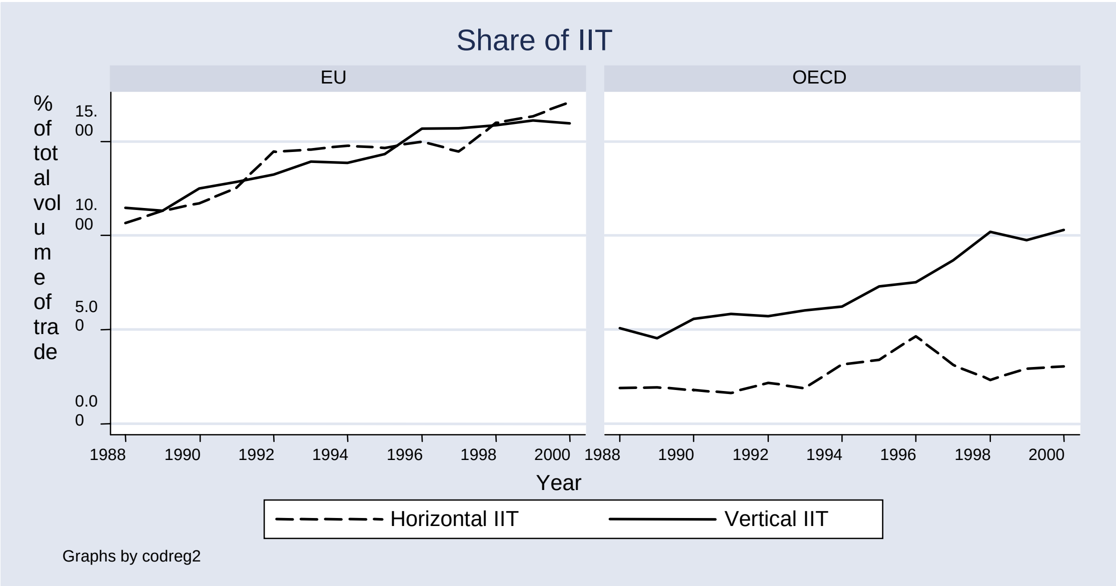
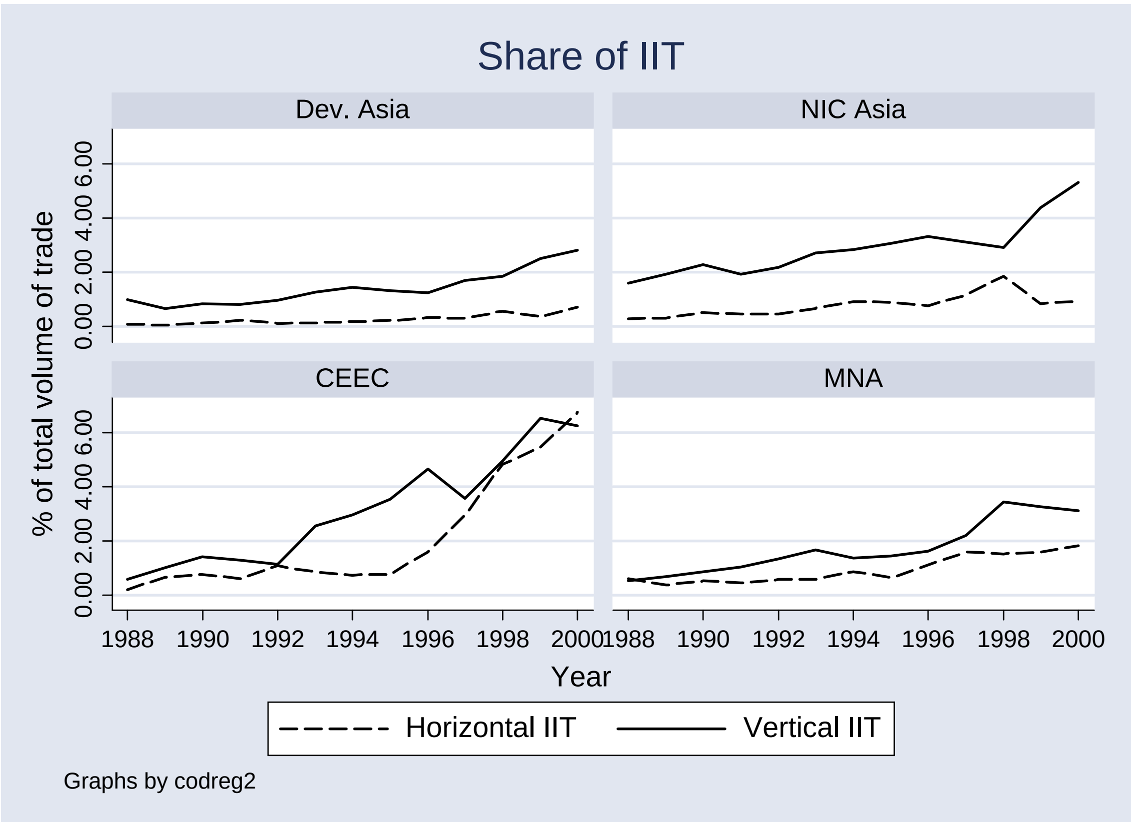
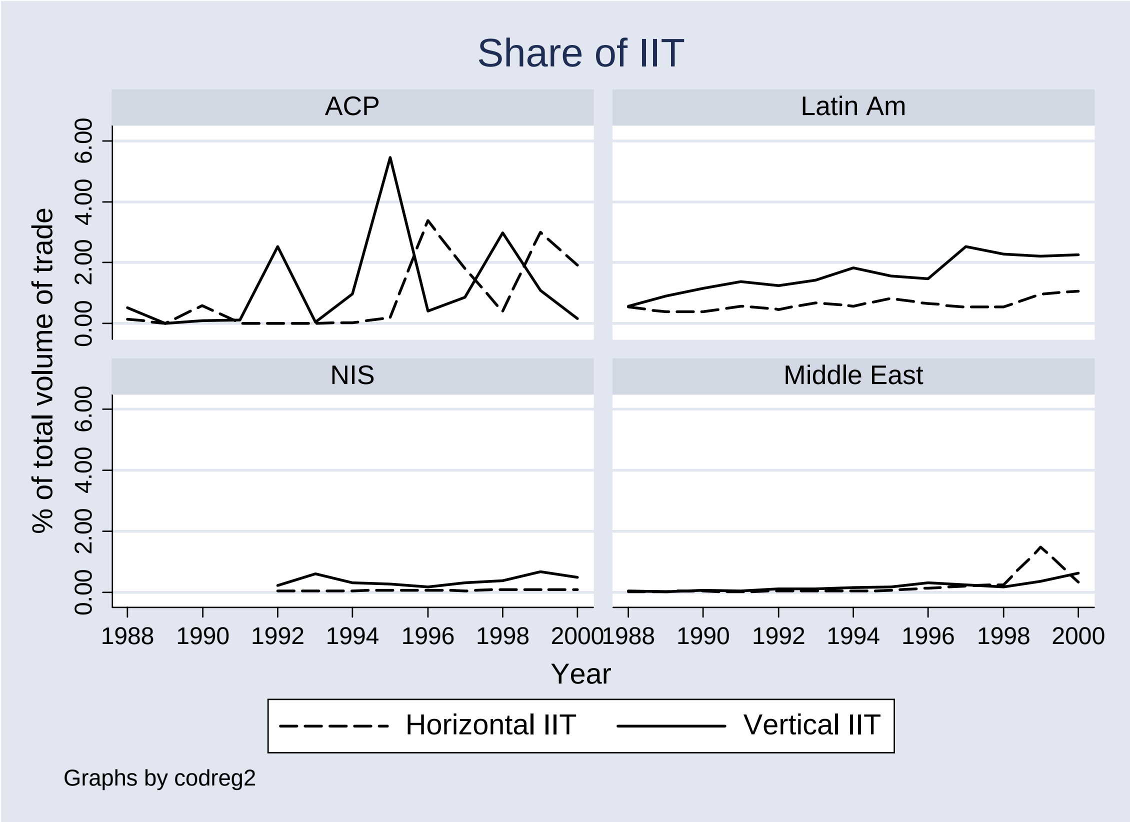
Figure 1: Adjusted Grubel-Lloyd Index by regions (Vertical and Horizontal Intra-industry trade, 1988-2000).

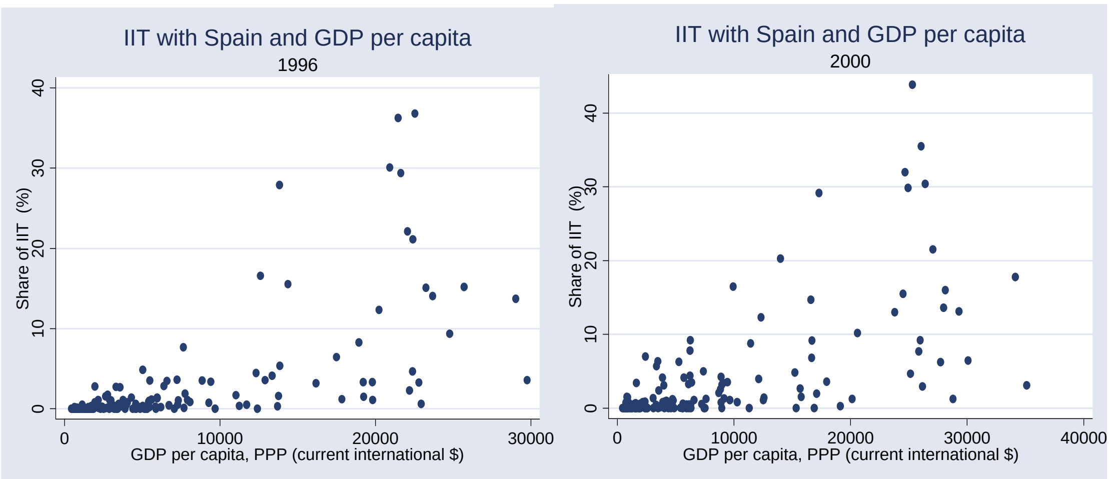






Source: See Table I

Figure 2: Spanish Intra-industry trade with 188 countries and GDP per capita of the trading partner (1996 and 2000).



Source: See Table I

Table 1. Correlations between alternative measures of trade types (Spanish trade, 1996, # obs: 188).

All pr.	IIT	VIIT$^{(a)}$	HIIT$^{(a)}$	VIIT$^{(b)}$	HIIT$^{(b)}$	$\frac{IIT}{nprod}$	$\frac{IIT}{Vol}$	$\frac{VIIT}{Vol}^{(a)}$	$\frac{HIIT}{Vol}^{(a)}$	$\frac{VIIT}{Vol}^{(b)}$
IIT	1,000									
VIIT$^{(a)}$	0,982	1,000								
HIIT$^{(a)}$	0,981	0,929	1,000							
VIIT$^{(b)}$	0,982	0,999	0,927	1,000						
HIIT$^{(b)}$	0,935	0,852	0,983	0,847	1,000					
$\frac{IIT}{nprod}$	0,959	0,945	0,938	0,945	0,887	1,000				
$\frac{IIT}{Vol}$	0,776	0,782	0,743	0,790	0,674	0,828	1,000			
$\frac{VIIT}{Vol}^{(a)}$	0,718	0,753	0,657	0,758	0,574	0,725	0,910	1,000		
$\frac{HIIT}{Vol}^{(a)}$	0,696	0,670	0,696	0,681	0,653	0,782	0,911	0,658	1,000	
$\frac{VIIT}{Vol}^{(b)}$	0,737	0,770	0,678	0,779	0,588	0,745	0,929	0,990	0,701	1,000
$\frac{HIIT}{Vol}^{(b)}$	0,582	0,540	0,603	0,545	0,591	0,688	0,785	0,474	0,956	0,500

Note: IIT: vol of intra-industrial trade; VIIT: IIT of vert. diff. products; HIIT:. IIT of horiz. diff products. $^{(a)}a = 0.25$, $^{(b)}\ a = 0.15$

Table 2.a. Adjusted Grubel-Lloyd Index by industry (2000, % of Spanish Total Vol. Trade)

	ACP			Dev. ASIA			Latin. A.M.			MNA		
Industry	IIT	HIIT	DIIT	IIT	HIIT	DIIT	IIT	HIIT	DIIT	IIT	HIIT	DIIT
01	0,1	0,0	0,1	2,8	1,4	1,4	1,6	0,1	1,5	0,9	0,5	0,3
06	0,0	0,0	0,0	0,1	0,0	0,1	0,3	0,2	0,2	0,1	0,0	0,1
13	0,3	0,0	0,3	4,1	1,9	2,2	0,7	0,1	0,6	1,3	0,3	1,1
15	0,1	0,0	0,1	3,7	0,5	3,2	3,9	1,1	2,8	3,1	1,0	2,2
17	1,2	1,1	0,1	5,2	2,5	2,7	6,7	3,3	3,3	5,0	2,0	3,0
19	0,4	0,0	0,4	5,8	2,4	3,4	3,2	0,1	3,1	4,1	0,2	3,9
21	0,6	0,1	0,5	6,1	1,3	4,7	5,3	0,6	4,6	3,4	0,6	2,8
23	1,3	0,3	1,0	15,2	8,9	6,3	4,7	0,5	4,3	6,5	1,2	5,3
25	0,2	0,1	0,2	11,7	8,2	3,5	9,6	1,1	8,5	6,5	1,1	5,4
28	21,1	20,4	0,7	3,6	1,2	2,4	17,4	2,5	14,9	7,4	5,1	2,4
36	0,3	0,1	0,2	0,8	0,2	0,6	2,9	1,2	1,7	1,3	0,4	0,9
42	1,1	0,0	1,0	13,8	4,1	9,7	0,9	0,1	0,8	4,4	0,9	3,4
47	0,1	0,0	0,1	1,5	0,4	1,0	3,0	0,3	2,7	5,1	0,8	4,3
48	0,4	0,1	0,3	12,8	2,0	10,7	4,3	0,5	3,8	9,5	1,2	8,3
49	0,4	0,0	0,4	22,0	10,1	12,0	3,8	2,5	1,4	7,8	2,3	5,5
Total	2,1	1,9	0,2	4,9	1,8	3,1	3,5	0,7	2,8	3,3	1,1	2,3

Note: Nace clio R25. 01 Agric., forestry and fishery prod.; 06 Fuel and power prod.; 13 Ferrous and non-ferrous metals; 15 Non-metallic minerals; 17 Chemical prod; 19 Metal prod.; 21 Agric. and indust. machinery; 23 Office and data processing machines, precision and optical inst; 25 Elect. goods; 28 Transp. equip; 36 Food, beverages, tobacco; 42 Textiles and clothing, leather and footwear; 47 Paper, printing prod; 48 Other manufactured prod; 49 Rubber and plastic product

Table 2.b. Adjusted Grubel-Lloyd Index by industry (2000, % of Spanish Total Vol. Trade)

	EU			OECD			CEEC			NIC ASIA		
Industry	IIT	HIIT	DIIT	IIT	HIIT	DIIT	IIT	HIIT	DIIT	IIT	HIIT	DIIT
01	9,5	3,9	5,6	0,9	0,1	0,8	0,5	0,2	0,3	0,3	0,1	0,2
06	19,6	12,3	7,3	0,5	0,3	0,2	0,1	0,0	0,0	0,3	0,0	0,3
13	27,1	19,4	7,7	3,2	1,6	1,6	0,7	0,5	0,3	2,9	2,0	0,9
15	21,8	5,6	16,2	3,4	1,0	2,3	6,2	0,7	5,6	2,1	0,2	1,9
17	36,0	14,9	21,1	17,9	2,2	15,6	6,8	1,1	5,8	6,6	3,2	3,4
19	37,5	13,6	24,0	17,5	2,6	14,8	12,0	4,3	7,7	6,5	0,9	5,6
21	26,5	10,1	16,4	17,8	3,5	14,3	13,6	2,5	11,2	6,8	0,9	5,9
23	21,2	4,7	16,5	12,3	2,0	10,3	12,7	6,3	6,3	7,4	0,4	7,0
25	36,8	11,6	25,2	21,0	3,4	17,6	8,7	3,1	5,6	9,5	2,1	7,4
28	45,6	31,5	14,1	20,2	6,7	13,4	23,8	16,6	7,2	4,6	0,2	4,5
36	15,9	7,0	8,9	2,7	0,8	1,9	1,2	0,3	0,9	3,1	0,1	3,0
42	32,4	7,9	24,6	9,1	2,2	6,9	8,0	3,0	5,0	6,3	0,4	5,9
47	29,1	9,2	19,9	15,0	3,7	11,3	9,8	4,0	5,8	6,4	0,9	5,5
48	40,4	12,2	28,2	23,9	2,4	21,5	16,1	3,3	12,8	11,3	1,6	9,8
49	48,4	31,0	17,4	21,3	12,6	8,7	24,1	14,0	10,0	22,0	10,1	12,0
Total	33,0	17,1	16,0	13,4	3,1	10,3	13,0	6,7	6,3	4,9	1,8	3,1

Note: Nace clio R25. 01 Agric., forestry and fishery prod.; 06 Fuel and power prod.; 13 Ferrous and non-ferrous metals; 15 Non-metallic minerals; 17 Chemical prod; 19 Metal prod.; 21 Agric. and indust. machinery; 23 Office and data processing machines, precision and optical inst; 25 Elect. goods; 28 Transp. equip; 36 Food, beverages, tobacco; 42 Textiles and clothing, leather and footwear; 47 Paper, printing prod; 48 Other manufactured prod; 49 Rubber and plastic product

Table3. List of Variables.

Variable	Definition	Source
X	Exports	Comext, Eurostat
M	Imports	Comext, Eurostat
CGDP	Constant Gross Domestic Product (1995 prices)	WDI database
CGDPpc	Constant Gross Domestic Product per-capita (1995 prices)	WDI database
Distance	Distance in kms between capitals	CEPII
Nb flows	Number of eight digit products traded	Comext, Eurostat
Contiguity	One if partners share the same border	CEPII
Com. lang.	One if partners' official language is Spanish	CEPII
Inv	Expenditures on investment	WDI database
R&D	Expenditures on R&D	WDI database
AYR	Average years of schooling	WDI database
Pop	Population	WDI database

Table 4. Panel Estimation of Vertical Intra-Industrial Trade (1996-2000)

	PANEL (All countries)					
Log VIIT	(1)	(2)	(3)	(4)	(5)	(6)
intcpt	-77.95***	-52.57***	-82.55***	-56.11***	-59.36***	-35.29***
	(5.33)	(4.93)	(5.34)	(4.87)	(5.84)	(3.66)
DifCGDP	-0.573***	-0.350***	-0.551***	-0.349***	-0.228***	-0.116**
	(0.094)	(0.086)	(0.095)	(0.086)	(0.071)	(0.045)
AvCGDP	3.516***	2.025***	3.411***	1.963***	1.327***	0.518***
	(0.241)	(0.225)	(0.239)	(0.219)	(0.240)	(0.150)
DifCGDPpc	-0.374***	-0.287**				
	(0.138)	(0.126)				
AvCGDPpc	1.818***	1.260***				
	(0.295)	(0.269)				
Distance	-0.595***	-0.431***	-0.325**	-0.257*	-1.004***	-0.656***
	(0.158)	(0.144)	(0.163)	(0.145)	(0.126)	(0.072)
Nb flows	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Contiguity	1.934***	1.246**	2.388***	1.553**	0.752	0.333
	(0.681)	(0.618)	(0.681)	(0.603)	(0.490)	(0.263)
Com. lang.	1.021***	0.263	0.974***	0.274	0.908***	0.117
	(0.245)	(0.224)	(0.252)	(0.225)	(0.236)	(0.142)
EU	2.145***	1.319***	2.381***	1.480***	1.316***	0.639***
	(0.374)	(0.341)	(0.368)	(0.328)	(0.246)	(0.142)
Lag Vol.		0.556***		0.563***		0.699***
		(0.020)		(0.021)		(0.029)
DifKpc			-0.243**	-0.168*	0.128	0.080
			(0.097)	(0.087)	(0.111)	(0.067)
AvKpc			1.956***	1.364***	2.855***	1.220***
			(0.30)	(0.267)	(0.537)	(0.322)
DifKTpc					-0.786***	-0.422***
					(0.148)	(0.085)
AvKTpc					0.545*	0.485***
					(0.307)	(0.179)
DifKHpc					-0.168**	-0.089*
					(0.083)	(0.051)
AvKHpc					-1.141***	-0.672***
					(0.191)	(0.123)
N	4585	4571	4423	4409	2278	2278
R^2	0.656	0.768	0.651	0.764	0.797	0.852
# countries	126	126	111	111	49	49

Note: Standard errors in parentheses: ***, ** and * stand for statistical significance at the 1%, 5% and 10% levels respectively.

Table 5. Panel Estimation of Horizontal Intra-Industrial Trade (1996-2000)

	PANEL (All countries)					
Log HIIT	(1)	(2)	(3)	(4)	(5)	(6)
intcpt	-47.32***	-26.71***	-49.94***	-28.34***	-39.16***	-23.68***
	(4.429)	(4.709)	(4.758)	(4.875)	(4.677)	(4.076)
DifCGDP	-0.333***	-0.064	-0.373***	-0.126	-0.063	-0.005
	(0.083)	(0.086)	(0.090)	(0.089)	(0.060)	(0.051)
AvCGDP	2.635***	1.185***	2.605***	1.185***	1.188***	0.501***
	(0.191)	(0.212)	(0.203)	(0.216)	(0.201)	(0.177)
DifCGDPpc	-0.254**	-0.170				
	(0.128)	(0.131)				
AvCGDPpc	0.406*	-0.025				
	(0.244)	(0.256)				
Distance	-0.706***	-0.564***	-0.592***	-0.532***	-1.149***	-0.879***
	(0.130)	(0.136)	(0.140)	(0.140)	(0.092)	(0.079)
Nb flows	0.002***	0.001***	0.002***	0.001***	0.002***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Contiguity	2.068***	1.360**	2.335***	1.50***	1.178***	0.772***
	(0.504)	(0.535)	(0.541)	(0.548)	(0.309)	(0.255)
Com. lang.	0.378*	-0.275	0.274	-0.283	0.617***	0.140
	(0.210)	(0.219)	(0.229)	(0.230)	(0.189)	(0.164)
EU	2.294***	1.464***	2.516***	1.594***	1.624***	0.786***
	(0.290)	(0.308)	(0.304)	(0.310)	(0.173)	(0.151)
Lag Vol.		0.615***		0.618***		0.845***
		(0.029)		(0.030)		(0.047)
DifKpc			0.093	0.131	0.069	-0.029
			(0.092)	(0.092)	(0.088)	(0.075)
AvKpc			0.379	-0.028	1.092***	0.238
			(0.260)	(0.262)	(0.414)	(0.353)
DifKTpc					-0.467***	-0.179*
					(0.109)	(0.094)
AvKTpc					0.543**	0.253
					(0.236)	(0.201)
DifKHpc					-0.082	0.027
					(0.067)	(0.057)
AvKHpc					-1.037***	-0.488***
					(0.172)	(0.153)
N	3413	3400	3324	3311	1933	1933
R^2	0.658	0.732	0.658	0.732	0.724	0.767
RMSE	117	117	104	104	47	47

Note: Standard errors in parentheses: ***, ** and * stand for statistical significance at the 1%, 5% and 10% levels respectively.

Table 6. Panel Estimation for OECD and NO-OECD countries (1996-2000)

	Log VIIT		Log HIIT	
	OECD	NO OECD	OECD	NO OECD
intcpt	-14.96*	-33.44	-13.836*	2.642
	(8.317)	(28.896)	(7.246)	(50.040)
DifCGDP	-0.074	-0.892*	0.059	-0.882
	(0.072)	(0.506)	(0.061)	(0.846)
AvCGDP	0.766***	-1.552	0.273	-2.954
	(0.227)	(1.827)	(0.217)	(3.325)
Distance	-0.960***	-0.461**	-0.785***	-0.508
	(0.126)	(0.227)	(0.097)	(0.517)
Nb flows	0.001**	0.002**	0.001*	0.002**
	(0.000)	(0.001)	(0.000)	(0.001)
Contiguity	0.064		0.452*	
	(0.377)		(0.240)	
Com. lang.		-0.025		-0.111
		(0.297)		(0.695)
EU	0.640***		0.623***	
	(0.234)		(0.152)	
DifKpc	0.387*	1.627*	0.163	1.835
	(0.209)	(0.862)	(0.180)	(1.504)
AvKpc	-1.343	7.252***	-0.791	7.309
	(0.950)	(2.548)	(0.816)	(4.572)
DifKTpc	-0.718*	-0.638***	-0.335	-0.314
	(0.414)	(0.221)	(0.356)	(0.473)
AvKTpc	1.599**	-0.544	0.682	-0.222
	(0.702)	(0.559)	(0.554)	(1.217)
DifKHpc	-0.363	-0.043	-0.245	-0.058
	(0.240)	(0.090)	(0.203)	(0.178)
AvKHpc	-0.249	-0.938***	-0.101	-0.649
	(0.345)	(0.261)	(0.354)	(0.526)
Lag Vol.	0.483***	0.672***	0.960***	0.594***
	(0.044)	(0.041)	(0.069)	(0.080)
N	1189	1089	1117	816
R^2(overall)	0.878	0.704	0.797	0.413
# countries	19	30	19	28

Note: Standard errors in parentheses: ***, ** and * stand for statistical significance at the 1%, 5% and 10% levels respectively.

Table7. Ols Estimation of Vertical Intra-Industrial Trade (1999)

	OLS (All countries)					
Log VIIT	(1)	(2)	(3)	(4)	(5)	(6)
Intcpt	-38.28***	-25.34***	-40.29***	-26.87***	-34.20***	-25.25***
	(4.027)	(3.130)	(4.043)	(3.134)	(5.809)	(4.909)
DifCGDP	-0.374***	-0.138***	-0.392***	-0.169***	-0.063	-0.010
	(0.059)	(0.046)	(0.062)	(0.048)	(0.062)	(0.052)
AvCGDP	2.207***	0.686***	2.152***	0.672***	0.438*	0.062
	(0.168)	(0.142)	(0.167)	(0.140)	(0.246)	(0.208)
DifCGDPpc	-0.312***	-0.223**				
	(0.116)	(0.093)				
AvCGDPpc	0.665***	0.572***				
	(0.204)	(0.163)				
Distance	-0.430***	-0.362***	-0.348***	-0.319***	-0.935***	-0.638***
	(0.108)	(0.083)	(0.108)	(0.082)	(0.118)	(0.101)
Nb flows	0.006***	0.002***	0.006***	0.002***	0.002***	0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Contiguity	1.009**	0.260	1.234***	0.371	0.619	0.255
	(0.392)	(0.301)	(0.388)	(0.298)	(0.384)	(0.323)
Com. lang.	0.076	-0.340**	0.018	-0.365***	0.485**	-0.166
	(0.177)	(0.136)	(0.179)	(0.137)	(0.224)	(0.193)
EU	1.471***	0.473**	1.569***	0.602***	1.242***	0.482**
	(0.239)	(0.190)	(0.231)	(0.185)	(0.224)	(0.195)
Lag Vol.		0.958***		0.974***		0.815***
		(0.038)		(0.039)		(0.058)
DifKpc			-0.065	0.002	0.027	-0.059
			(0.075)	(0.058)	(0.120)	(0.101)
AvKpc			0.684***	0.501***	1.697***	0.987**
			(0.201)	(0.156)	(0.516)	(0.435)
DifKTpc					-0.667***	-0.402***
					(0.139)	(0.118)
AvKTpc					0.809***	0.448*
					(0.290)	(0.245)
DifKHpc					-0.028	0.010
					(0.069)	(0.058)
AvKHpc					-1.608***	-0.840***
					(0.212)	(0.186)
N	933	919	901	887	484	484
R^2	0.699	0.826	0.699	0.828	0.823	0.876
RMSE	1.823	1.393	1.822	1.388	1.323	1.108

Note: Standard errors in parentheses: ***, ** and * stand for statistical significance at the 1%, 5% and 10% levels respectively.

Table 8. Ols Estimation of Horizontal Intra-Industrial Trade (1999

	OLS (All countries)					
Log HIIT	(1)	(2)	(3)	(4)	(5)	(6)
Intcpt	-24.15***	-16.88***	-25.96***	-18.58***	-19.71***	-14.239**
	(4.225)	(3.779)	(4.279)	(3.763)	(7.517)	(7.126)
DifCGDP	-0.145**	0.012	-0.217***	-0.069	-0.020	0.006
	(0.066)	(0.059)	(0.068)	(0.060)	(0.084)	(0.079)
AvCGDP	1.891***	0.744***	1.904***	0.745***	0.957***	0.605*
	(0.178)	(0.177)	(0.179)	(0.176)	(0.340)	(0.324)
DifCGDPpc	-0.311**	-0.211*				
	(0.130)	(0.119)				
AvCGDPpc	-0.128	-0.032				
	(0.227)	(0.206)				
Distance	-0.924***	-0.875***	-0.877***	-0.853***	-1.329***	-1.031***
	(0.122)	(0.107)	(0.122)	(0.106)	(0.154)	(0.151)
Nb flows	0.004***	0.002***	0.004***	0.001***	0.002***	0.001*
	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)
Contiguity	1.196***	0.619*	1.375***	0.673*	0.982**	0.684
	(0.396)	(0.351)	(0.394)	(0.345)	(0.468)	(0.443)
Com. lang.	0.168	-0.197	0.055	-0.259	0.498*	-0.004
	(0.221)	(0.197)	(0.225)	(0.197)	(0.301)	(0.293)
EU	1.394***	0.625***	1.557***	0.817***	1.583***	0.928***
	(0.257)	(0.238)	(0.248)	(0.229)	(0.287)	(0.286)
Lag Vol.		0.767***		0.820***		0.728***
		(0.057)		(0.060)		(0.104)
DifKpc			0.149*	0.213***	0.106	0.041
			(0.083)	(0.073)	(0.160)	(0.151)
AvKpc			-0.254	-0.193	-0.308	-0.658
			(0.227)	(0.20)	(0.682)	(0.645)
DifKTpc					-0.399**	-0.193
					(0.197)	(0.188)
AvKTpc					0.798**	0.435
					(0.397)	(0.378)
DifKHpc					-0.040	-0.009
					(0.088)	(0.083)
AvKHpc					-1.058***	-0.40
					(0.295)	(0.294)
N	696	683	676	663	410	410
R^2	0.669	0.747	0.669	0.755	0.747	0.776
RMSE	1.818	1.598	1.824	1.58	1.605	1.512

Note: Standard errors in parentheses: ***, ** and * stand for statistical significance at the 1%, 5% and 10% levels respectively.

Table 9. Ols Estimation for OECD and NO-OECD countries (1999)

OLS	Log VIIT		Log HIIT	
	OECD	NO OECD	OECD	NO OECD
intcpt	5.563	-305.89***	-27.213	-203.78
	(11.2)	(115.6)	(18.24)	(190.6)
DifCGDP	-0.040	2.250**	0.002	2.144
	(0.070)	(1.104)	(0.112)	(1.771)
AvCGDP	1.057**	7.354**	0.037	8.345
	(0.454)	(3.411)	(0.714)	(5.571)
Distance	-0.973***	-0.406*	-1.013***	-1.223***
	(0.137)	(0.227)	(0.230)	(0.346)
Nb flows	0.001*	0.001	0.000	0.004*
	(0.000)	(0.001)	(0.001)	(0.002)
Contiguity	-0.155		1.109*	
	(0.388)		(0.608)	
Com. lang.		-0.547		-0.188
		(0.341)		(0.533)
EU	0.390*		1.071***	
	(0.221)		(0.350)	
DifKpc	0.712**	0.444	-0.072	-0.905
	(0.297)	(1.999)	(0.489)	(3.566)
AvKpc	-3.676***	3.251	0.20	-6.467
	(1.363)	(4.858)	(2.192)	(8.698)
DifKTpc	-1.129	-0.468*	-2.236**	0.262
	(0.704)	(0.266)	(1.096)	(0.448)
AvKTpc	2.237**	0.233	3.488**	1.273
	(1.064)	(0.669)	(1.669)	(1.111)
DifKHpc	-0.591	0.077	0.489	0.006
	(0.444)	(0.077)	(0.699)	(0.114)
AvKHpc	0.691	-0.762***	-1.646	0.239
	(0.906)	(0.260)	(1.420)	(0.447)
Lag Vol.	0.573***	0.758***	0.759***	0.647***
	(0.093)	(0.091)	(0.168)	(0.174)
N	249	235	234	176
R^2	0.900	0.750	0.808	0.483
RMSE	0.928	1.218	1.417	1.652

Note: Standard errors in parentheses: ***, ** and * stand for statistical significance at the 1%, 5% and 10% levels respectively.

Table 10.a. Heckman Estimation for Vertical Intra-Industrial Trade (1999)

VIIT	All countries		no UE		no oecd	
	Est. Eq.	Selec Eq.	Est. Eq.	SelecEq.	Est. Eq.	Selec Eq.
DifCGDP	0.033	0.476	0.049	0.128	2.231	-3.597
	(0.044)	(0.840)	(0.061)	(1.069)	(1.505)	(69.304)
AvCGDP	-0.146	4.141	-0.014	1.592	7.243	9.811
	(0.185)	(4.703)	(0.232)	(4.216)	(4.645)	(86.379)
Distance	-0.656***	-0.839*	-0.799***	-0.478	-0.451	2.470*
	(0.095)	(0.432)	(0.128)	(0.459)	(0.309)	(1.413)
Nb flows	0.001	0.038***	0.001	0.046***	-0.001	0.041**
	(0.000)	(0.011)	(0.001)	(0.014)	(0.002)	(0.019)
Contiguity	0.209	-7.304				
	(0.324)	(0.000)				
Com. lang.	-0.047	0.996	0.005	0.625	-0.317	-0.429
	(0.191)	(0.681)	(0.213)	(0.697)	(0.470)	(1.042)
EU	0.379**	-0.444				
	(0.172)	(1.274)				
DifKpc	-0.182***	-0.554	-0.273**	-0.221	3.237	-19.73
	(0.065)	(0.461)	(0.138)	(0.508)	(2.824)	(12.69)
AvKpc	1.000**	-0.210	2.562***	0.345	9.418	-49.012
	(0.428)	(1.688)	(0.653)	(1.880)	(6.847)	(32.73)
DifKTpc	-0.414***	-0.673	-0.655***	-0.787*	-0.314	23.72**
	(0.110)	(0.423)	(0.138)	(0.449)	(0.363)	(12.065)
AvKTpc	0.655***	0.609	-0.123	0.577	1.059	88.48**
	(0.239)	(0.905)	(0.337)	(0.875)	(0.934)	(43.490)
DifKHpc	0.015	-0.576	0.059	-0.720	0.073	-1.684
	(0.055)	(0.666)	(0.062)	(0.626)	(0.106)	(1.643)
AvKHpc	-0.961***	0.201	-1.190***	0.439	-0.892**	3.249
	(0.181)	(1.124)	(0.214)	(1.080)	(0.355)	(3.285)
Lag Vol.	0.838***	0.348**	0.867***	0.258*	0.861***	0.162
	(0.059)	(0.156)	(0.075)	(0.148)	(0.128)	(0.211)
Constant	-23.33***	-122.62	-37.92***	-53.47	-407.0***	-223.3
	(4.216)	(132.0)	(6.957)	(124.5)	(160.0)	(123.2)
N						

Note: Standard errors in parentheses: ***, ** and * stand for statistical significance at the 1%, 5% and 10% levels respectively.
$^{(a)} for number of censored observations$

Table 10.b. Heckman Estimation for Vertical Intra-Industrial Trade (1999)

VIIT	All countries		no UE		no oecd	
	Est. Eq.	Selec Eq.	Est. Eq.	SelecEq.	Est. Eq.	Selec Eq.
DifCGDP	0.029	0.535*	0.044	0.549*	2.163**	4.012**
	(0.044)	(0.295)	(0.060)	(0.311)	(1.039)	(1.868)
AvCGDP	-0.078	8.444***	0.012	7.594***	7.207**	17.401***
	(0.187)	(1.860)	(0.231)	(1.959)	(3.207)	(5.331)
Distance	-0.650***	-1.160***	-0.800***	-1.202***	-0.528**	-1.267***
	(0.096)	(0.192)	(0.127)	(0.215)	(0.221)	(0.232)
Nb flows	0.001*	0.028***	0.001*	0.031***	0.000	0.028***
	(0.000)	(0.004)	(0.001)	(0.005)	(0.001)	(0.005)
Contiguity	0.246	-8.562				
	(0.324)	(0.000)				
Com.lang.	-0.065	1.721***	0.013	1.631***	-0.311	1.769***
	(0.193)	(0.274)	(0.214)	(0.289)	(0.338)	(0.317)
EU	0.407**	-1.046				
	(0.173)	(0.782)				
DifKpc	-0.179***		-0.276**		1.947	
	(0.065)		(0.137)		(1.950)	
AvKpc	0.978**		2.625***		6.594	
	(0.428)		(0.650)		(4.728)	
DifKTpc	-0.390***		-0.673***		-0.401	
	(0.113)		(0.140)		(0.249)	
AvKTpc	0.599**		-0.151		0.721	
	(0.244)		(0.338)		(0.655)	
DifKHpc	0.014		0.061		0.075	
	(0.055)		(0.061)		(0.073)	
AvKHpc	-0.910***		-1.165***		-0.806***	
	(0.183)		(0.212)		(0.242)	
Lag Vol.	0.801***	0.166***	0.842***	0.204***	0.854***	0.151*
	(0.061)	(0.064)	(0.077)	(0.074)	(0.097)	(0.078)
DifCGDPpc		-0.543***		-0.532**		0.680
		(0.208)		(0.222)		(0.605)
AvCGDPpc		0.849		1.718**		5.319***
		(0.679)		(0.710)		(1.390)
Constant	-22.99***	-238.4***	-37.73***	-224.6***	-356.1***	-622.5***
	(4.213)	(53.45)	(6.936)	(57.11)	(110.9)	(187.6)
N						

Note: Standard errors in parentheses: ***, ** and * stand for statistical significance at the 1%, 5% and 10% levels respectively. [(a)] $fornumberofcensoredobservations$

Table 11.a. Heckman Estimation for Horizontal Intra-Industrial Trade (1999)

HIIT	All countries		no UE		no oecd	
	Est. Eq.	Selec Eq.	Est. Eq.	SelecEq.	Est. Eq.	Selec Eq.
DifCGDP	0.053	0.237	0.042	0.157	2.081	-0.642
	(0.066)	(0.468)	(0.093)	(0.357)	(1.632)	(5.696)
Av. CGDP	0.247	0.737	0.359	0.425	8.057	9.969
	(0.283)	(2.840)	(0.361)	(1.787)	(5.141)	(8.090)
Distance	-0.928***	-0.530	-0.902***	-0.328	-1.208***	0.126
	(0.141)	(0.380)	(0.194)	(0.397)	(0.319)	(1.019)
Nb flows	0.000	0.025***	0.003**	0.027***	0.003	0.019
	(0.001)	(0.009)	(0.001)	(0.010)	(0.002)	(0.013)
Contiguity	0.616	-1.013				
	(0.440)	(0.000)				
Com. lang.	0.281	0.338	-0.034	0.205	-0.125	0.390
	(0.284)	(0.661)	(0.317)	(0.654)	(0.498)	(1.076)
EU	0.859***	-0.931				
	(0.246)	(1.268)				
DifKpc	-0.092	-0.266	-0.006	-0.062	0.045	-0.421
	(0.093)	(0.423)	(0.212)	(0.464)	(3.500)	(5.951)
AvKpc	-0.330	0.307	-1.256	0.860	-4.322	0.262
	(0.624)	(1.743)	(1.037)	(1.915)	(8.470)	(15.314)
DifKTpc	-0.375**	-0.062	-0.134	-0.178	0.272	3.325
	(0.173)	(0.392)	(0.222)	(0.423)	(0.412)	(5.716)
AvKTpc	0.842**	0.005	0.816	-0.258	1.513	12.167
	(0.363)	(0.853)	(0.529)	(0.898)	(1.065)	(20.737)
DifKHpc	-0.033	-0.165	-0.016	-0.189	0.002	0.403
	(0.078)	(0.625)	(0.088)	(0.579)	(0.105)	(0.506)
AvKHpc	-0.540*	-0.159	-0.431	-0.041	0.176	-0.655
	(0.283)	(1.139)	(0.351)	(1.079)	(0.419)	(0.889)
Lag Vol.	0.883***	0.504**	0.626***	0.447**	0.699***	0.497**
	(0.102)	(0.196)	(0.140)	(0.197)	(0.173)	(0.240)
Constant	-16.77***	-38.26	-4.144	-32.1	-230.92	-368.5
	(5.980)	(73.16)	(10.46)	(43.62)	(178.7)	(0.00)
N						

Note: Standard errors in parentheses: ***, ** and * stand for statistical significance at the 1%, 5% and 10% levels respectively.
$^{(a)} fornumberofcensoredobservations$

Table 11.b. Heckman Estimation for Horizontal Intra-Industrial Trade (1999)

HIIT	All countries		no UE		no oecd	
	Est. Eq.	Selec Eq.	Est. Eq.	SelecEq.	Est. Eq.	Selec Eq.
DifCGDP	0.044	0.397	0.040	0.385	2.050	2.430
	(0.065)	(0.320)	(0.093)	(0.343)	(1.627)	(2.003)
AvCGDP	0.266	5.352***	0.365	4.290**	8.007	10.532*
	(0.283)	(1.932)	(0.364)	(1.975)	(5.114)	(5.658)
Distance	-0.938***	-0.904***	-0.908***	-0.923***	-1.304***	-0.937***
	(0.141)	(0.215)	(0.195)	(0.239)	(0.320)	(0.255)
Nb flows	0.001	0.030***	0.003**	0.032***	0.003	0.028***
	(0.001)	(0.004)	(0.001)	(0.005)	(0.002)	(0.006)
Contiguity	0.588	-4.545				
	(0.439)	(0.000)				
Com. lang.	0.325	1.249***	-0.024	1.121***	0.042	1.157***
	(0.285)	(0.318)	(0.322)	(0.334)	(0.509)	(0.360)
EU	0.852***	-1.017				
	(0.245)	(0.829)				
DifKpc	-0.088		-0.011		0.757	
	(0.092)		(0.212)		(3.365)	
AvKpc	-0.329		-1.235		-2.948	
	(0.622)		(1.037)		(8.172)	
DifKTpc	-0.402**		-0.156		0.242	
	(0.175)		(0.230)		(0.407)	
AvKTpc	0.896**		0.832		1.863*	
	(0.369)		(0.539)		(1.059)	
DifKHpc	-0.037		-0.016		-0.003	
	(0.077)		(0.088)		(0.106)	
AvKHpc	-0.523*		-0.427		0.120	
	(0.281)		(0.354)		(0.412)	
Lag Vol.	0.876***	0.186**	0.610***	0.215**	0.795***	0.189*
	(0.102)	(0.084)	(0.142)	(0.094)	(0.183)	(0.103)
DifCGDPpc		-0.343		-0.455*		0.853
		(0.229)		(0.246)		(0.791)
AvCGDPpc		0.843		1.190		4.983***
		(0.713)		(0.726)		(1.646)
Constant	-16.8***	-156.5***	-3.876	-130.4**	-255.3	-398.5**
	(5.96)	(54.7)	(10.4)	(56.8)	(176.1)	(198.6)
N						

Note: Standard errors in parentheses: ***, ** and * stand for statistical significance at the 1%, 5% and 10% levels respectively.
[(a)] $for number of censored observations$