

UNITED STATES' INTRA-INDUSTRY TRADE

ABSTRACT

The main objective of this manuscript is to explain the horizontal and vertical intra-industry trade of United States with trade partner of NAFTA, European Union and ASEAN. Identify the determinants of intra-industry trade, horizontal and vertical. Using a panel data approach, the results show a negative correlation between endowments and intra-industry trade. These results indicate that intra-industry trade occurs more frequently among countries that are similar in terms of factor endowments. The findings support the theory that, in general, there is no positive statistical association between HIIT and HO variables. Our results also confirm the hypothesis that trade increases if the transportation costs decrease.

Keywords: *Horizontal Intra-industry trade, Vertical, United States, Comparative Advantages.*

INTRODUCTION

The intra-industry trade (IIT) or two-way trade is defined as simultaneous exports and imports of a product within country or a particular industry. Nowadays in the developed world, most trade is of the IIT. Intra-industry trade is more intensive within countries and industries with similar income levels. IIT is explained by increasing return-to-scale, monopolistic competition and product differentiation. The traditional IIT models (Krugman, 1979, Lancaster, 1980) predict a negative correlation between comparative advantage and IIT. The literature of IIT emerged with Verdoorn (1960) and Balassa (1966). This phenomenon occurred in the years following the formation of the European Economic Community (EEC). However, it only started to receive increasing attention after Grubel and Lloyd (1975) had introduced an index to measure IIT.

In the 1990s new developments which occurred with a special emphasis to the European Union and central and eastern European countries (Aturupane, Djankov, and Hoekman, 1999, Kandogan, 2003). Clark (2007), Clark and Stanley (2003) Hart and McDonald (1992), and Ekanayake et al (2009) are same examples of studies on the U.S. IIT. The new trade theories (Krugman 1979, Lancaster 1980, Helpman 1981, Eaton and Kierzkowski 1984 and Helpman and Krugman 1985) explained the IIT in imperfect competition and introduce economies of scale and product differentiation.

Greenaway, Hilner and Milner (1994) and Abd-El-Rahaman (1991) introduced new types of differentiation (horizontal and vertical intra-industry). The relative unit values of exports and imports are use for separating HIIT and VIIT. This has been criticized in the literature (Zhang and Clark, 2009). This article uses the methodology of Kandogan (2003) by the fact that solving the problems associated with the dispersion of the unit value.

Horizontal intra-industry trade (HIIT) occurs within similar products. In other words, the products are differentiated by attributes (see Krugman, 1979, Lancaster, 1980, Eaton and Kierzkowski 1984, and Helpman and Krugman 1985).

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VIIT intra-industry trade (VIIT) is explained by different quality products (see Falvey, 1981, Falvey and Kierzkowski 1987, and Shaked and Sutton, 1984). This type of trade (VIIT) is also explained by the fragmentation or outsourcing (Lloyd 2004).

This manuscript analyses the determinants of intra-industry trade (IIT) and its components (HIIT and VIIT) between United States and NAFTA, European Union, and ASEAN countries in the period 1995-2008. This study uses country-specific characteristics (per capita income, market size, and geographical distance and factor endowments). The manuscript uses a panel data approach. Section 3 we present the measurement of IIT. Section 4 shows the econometric model. The final section provides conclusions.

Literature Review and Empirical Studies

The models of Krugman (1979) and Lancaster (1980) consider a monopolistic competition with increasing returns to scale. A few years later, Helpman and Krugman (1985) synthesized these type models called Chamberlin – Heckscher -Ohlin. This theoretical construction combines monopolistic competition and the theory of Heckscher - Ohlin, relating differences in factor endowments and horizontal product differentiation. In vertical intra-industry trade we can refer the contributions of Falvey and Kierzkowski (1987) and Shaked and Sutton (1984). It was concluded that the capital-abundant countries have a comparative advantage in goods of high quality and abundant in labour countries exporting low-quality goods. The vertical product differentiation means that different varieties have different types of quality. The demand is made up of consumers with different types of choice, that is, a relationship that emerges from the quality- price. On the supply side is assumed that the products (varieties) are low or high quality. The lower qualities products are labour intensive and higher quality are capital intensive. Falvey and Kierzkowski (1987) followed Linder (1961) theory. The authors consider that vertical differentiation could be explained by differences between per capita incomes. Falvey and Kierzkowski (1987) concluded that countries are capital abundant have higher productivity and higher wages. Symmetrically, the labour abundant country (low-wage country) will have comparative advantages in low-quality varieties that are labour-intensive. Flam and Helpman (1987) contains the differences in technology (labour productivity) that explain VIIT. The country with most productivity has higher wages and exports the higher quality products. In the Shaked and Sutton's article (1984), trade is studied in the context of a natural oligopoly, vertical product differentiation. The IIT is explained by different varieties of quality products (differences in income distribution: lower income country specializing in lower quality products, higher income specializing of quality products).

The study of Ekanayake (2001) examines the determinants of Mexican intra-industry trade. This study concludes that IIT is positively correlated with economic dimension (average of GDP per capita), trade intensity (openness trade), and border. Ekanayake (2001) also shows that IIT is negatively correlated with relative factor endowments and geographical distance.

Mardas and Nikas (2008) analyses the free trade areas (FTA) between the Balkan countries and Greece. The authors conclude that trade liberalization influences the increase of IIT. Recent studies found vertical IIT dominates HIIT in bilateral trade. Yoshida et al. (2009) consider the vertical intra-industry trade (VIIT) between Japan and various European countries. The authors conclude that IIT between European countries and Japan increases with their corresponding Japanese FDI (foreign direct investment), especially for new EU member countries. Ekanayake et al. (2009) analyse the vertical and horizontal IIT between the United States and NAFTA: The authors use the methodology of Greenaway et al.² (1994) to calculate the components of IIT, i.e HIIT (horizontal intra-industry trade) and VIIT (vertical intra-industry trade). Ekanayake et al. (2009) find that VIIT predominate in the US-NAFTA.

² The unit prices of exports and imports.

Chang (2009) examines the main factors of HIIT and VIIT including investment approaches of a firm in the industry of information technology for Asian, European and U.S. markets. The study uses time series data over the period of 1996-2005. Chang (2009) demonstrates that vertical intra-industry trade is significant between Asia and EU countries. According to Chang (2009) the regional agreements between EU and Association of South East Asian Nations (ASEAN) conduces the vertical specialization.

Kimura et al. (2007) analyzed parts and components trade between East Asia and Europe. This study also shows that VIIT is higher than HIIT.

Wakasugi (2007) constructed an index of vertical intra-industry trade to measure the fragmentation of production. The author used a gravity model and analyzed the impact of VIIT in East Asia, NAFTA, and European Union. Wakasugi (2007) concluded that fragmentation increased with intra-industry trade.

MEASUREMENT OF INTRA - INDUSTRY TRADE

It is usual the empirical studies using the unit prices of exports and imports to determine the horizontal intra-industry trade (HIIT) and vertical intra-industry trade (VIIT). This technique has been criticized by several authors. Most studies show that vertical intra-industry trade is inflated, when using the criterion of Greenaway Hine, and Milner (1994) or Abd-el-Rahman (1991). The present study uses the methodology of Kandogan (2003) for separating IIT into its components (HIIT) and (VIIT) intra-industry trade. Grubel and Lloyd (1975) shows that the products are similar in HIIT and products with different types of quality are VIIT. A large part of total trade (TT) in industry is inter-industry trade (INT). Kandogan's methodology is summarized below:

$$TT_i = X_i + M_i \quad (1)$$

$$IIT_i = TT_i - |X_i - M_i| \quad (2)$$

$$INT_i = TT_i - IIT_i \quad (3)$$

$$HIIT_i = \sum (X_{ik} + M_{ik} - |X_{ik} - M_{ik}|) \quad (4)$$

$$VIIT_i = IIT_i - HIIT_i \quad (5)$$

ECONOMETRICAL MODEL

Following the literature our study applies a gravity equation with panel data. The dependent variable used is U.S. intra - industry trade (IIT_{it}), horizontal IIT ($HIIT_{it}$) and vertical IIT ($VIIT_{it}$). The data for the dependent variable is sourced from OECD at the five-digit level of the Standard International Trade classification (SITC) in US dollars. The explanatory variables are taken from World Development Indicators, the World Bank.

EXPLANATORY VARIABLES

Hypothesis 1: IIT and HIIT predominate between countries that are similar in terms of factor endowments.

Hypothesis 1(a): VIIT predominate between countries that are different in terms of factor endowments.

Economic differences between countries (DGDP): this is difference in GDP (PPP, incurent international dollars) between U.S. and the partner country:

$$|GDP^{U.S.} - GDP^{partner}|$$

Following Helpman (1987), and Greenaway Hine, and Milner (1994) we used this proxy to evaluate relative factor endowments. Loertscher and Wolter (1980) and Balassa and Bauwens (1987) suggest a negative sign for the IIT model. Linder (1961) considers that countries with similar demands will trade similar products. Hummels and Levinshon (1995) and Greenaway et al. (1994) found a negative sign. Greenaway Hine, and Milner (1994) also

found a negative relationship between IIT, HIIT, and the difference in income per capita. It is generally agreed that the expected sign for the variable difference of income per capita is negative in the models of IIT and HIIT (Hummels and Levinshon (1995) and positive model VIIT (Greenaway, Hine and Milner1994). It should be noted that the recent study by Zhan and Clark (2009) found a negative relationship to the model VIIT for the case study of North American.

Hypothesis 2: There is a positive relationship between lowest value of GDP per capita and IIT (HIIT, and VIIT).

-MinGDP: this is the lowest value of GDP per capita (PPP, in current international dollars) between U.S. and the partner country:

$$\text{Min}(GDP^{U.S.}, GDP^{partner})$$

This variable is included to control for relative size effects. According to Helpman (1987) and Hummels and Levinshon (1995), a positive sign is expected, which is consistent with the hypothesis of a positive correlation between the share of IIT(HIIT, VIIT) and dissimilarity in per-capita GDP.

Hypothesis 3: There is a negative relationship between highest value of GDP per capita and IIT (HIIT, and VIIT).

MaxGDP: this is the higher/highest value of GDP per capita (PPP, in current international dollars) between U.S. and the partner country.

$$\text{Max}(GDP^{U.S.}, GDP^{partner})$$

This variable is also included to control for relative size effects. A negative sign is expected (Helpman 1987, Hummels and Levinshon 1995, and Greenaway Hine, and Milner (1994). A negative sign is consistent with the hypothesis that the more similar countries are in economic dimension, the greater the IIT between them.

Hypothesis 4: There is a positive relationship between comparative advantages and VIIT.

INT: this is inter-industry trade. Following the literature (Grubel and Lloyd, 1975, and Kandogan, 2003) we expected a negative sign to IIT and HIIT models, and positive to VIIT model.

Hypothesis 5: Trade increases when partners are geographically close.

DISTxDGDP: this is geographical distance multiplied by the DGDP between the U.S. and the partner country. Balassa and Bauwens (1987) argue that IIT (HIIT) will be greater when trading partners are geographically close. A longer distance will increase the transaction and transportation costs. Thus, there is a negative relationship between the share of IIT in the industry and geographical distance. Hummels and Levinshon (1995) found a negative sign.

Hypothesis 6: The foreign direct investment influences the volume of trade.

FDI (Foreign Direct Investment inflows): the relationship between IIT and the level of FDI in a particular industry is somewhat ambiguous since FDI may be a substitute for the trade. Gray (1988) considers an ambiguous relationship between FDI and IIT. Greenaway Hine, and Milner (1994) estimated a positive sign for the coefficient of this variable. Markusen (1984) considers that IIT, HIIT and VIIT shares will be positively associated with a trading partner's FDI inflows.

MODEL SPECIFICATION

$$y_{it} = \beta_0 + \beta_1 X_{it} + \delta t + \eta_i + \varepsilon_{it} \quad (6)$$

Where y_{it} is the intra-industry trade (IIT_{it}) horizontal IIT (HIIT_{it}) and vertical IIT (VIIT_{it}), X is a set of explanatory variables. All variables are in the logarithm form; η_i is the unobserved time-invariant specific effects; δt captures a common deterministic trend; ε_{it} is a random disturbance assumed to be normal, and identical distributed (IID) with $E(\varepsilon_{it})=0$; $\text{Var}(\varepsilon_{it})=\sigma^2 > 0$.

EMPIRICAL RESULTS

Fixed effects estimates are reported in table 1. The general performance of the three equations is satisfactory.

Table 1: Fixed Effects Estimates

	IIT	HIIT	VIIT
Variables	Coefficient	Coefficient	Coefficient
LogDGDP	-2.515 (-8.925)***	-2.668 (-3.533)***	0.4978 (1.882)*
LogMinGDP	-0.128 (-1.211)	-1.185 (-3.232)***	0.425 (0.988)
LogMaxGDP	0.087 (1.785)*	0.823 (1.726)*	0.107 (4.235)***
LogFDI	0.746 (3.339)***	0.191 (2.675)***	0.654 (0.224)
LINT	-0.074 (-3.198)***	-0.485 (-5.995)***	0.9180 (26.612)***
LogDISTxDGDP	-0.286 (-4.692)***	-0.227 (-1.751)*	0.041 (0.693)
Adj. R ²	0.95	0.86	0.90
Observations	252	252	252

T-statistics (heteroskedasticity corrected) are in round brackets.

***/** - Statistically significant, respectively at the 1%, 5%, and 10% levels.

Our analysis pretends to evaluate the signs of the coefficients and their significances. For the first equation (IIT) all the explanatory variables are significant, which the exception of LogMinGDP.

The estimates obtained for the second model (HIIT) show that all explanatory variables are significant. The results are very similar to the previous model estimated. The third equation (VIIT) presents three significant variables (LogDGDP, LogMaxGDP, and LogINT).

Factor endowment differences (LogDGDP) are consistent with theoretical predictions, i.e, a negative impact on IIT and HIIT, and a positive influence on VIIT. Helpman and Krugman (1985) found a negative sign. Zhang and Clark (2009) also found a negative sign for IIT and HIIT to the North American case. Greenaway, Hine, and Milner (1994) expect a positive relationship between the VIIT and differences in relative factor endowments. Falvey and Kierzkowski (1987) suggest that this relationship will be positive for the VIIT model.

Following Helpman and Krugman (1985) and Hummels and Levinsohn (1995), the study also includes two variables to control for relative size effects. Our results are not according to the theoretical models.

The foreign direct investment (LogFDI) is an important determinant. As in Greenaway, Hine and Milner (1994) we find a positive correlation between FDI and IIT, and HIIT.

The index of inter-industry trade (INT) has a significant effect on IIT and HIIT. This result is according to the literature (Grubel and Lloyd 1975, and Kandogan 2003). Lloyd (2004) refers that vertical IIT is explained by comparative advantages; i.e there is a positive relationship between INT and vertical IIT. This is in accordance with the neo-Heckscher-Ohlin trade theory, which also explains VIIT by comparative advantages.

The geographical distance multiplied by the difference between per-capita incomes (LogDISTxDGDP), has been used a typical gravity model variable. A negative effect of distance on bilateral IIT, HIIT and VIIT was expected and the results confirm this to IIT and HIIT models, underling the importance of neighbour partnerships. Zhang and Clark (2009) also found the same results to U.S. experience. The regression results suggest the influence of U.S. free trade agreements (NAFTA). The predominance of HIIT shows that United States has trade relations with more intensity with Canada and Mexico, which is geographically closer.

CONCLUSIONS

The objective of this manuscript was to analyze the country-specific determinants of intra-industry trade for U.S. The hypotheses put forward in regard to common country characteristics are generally confirmed by the empirical results. Our results are robust with static and dynamic panel data.

The variable (LogDGDP) used to evaluate the relative factor endowments presents a negative impact on IIT, and HIIT, when we used fixed. These results are according to the literature (Loertscher and Wolter, 1980). The study of Zhang and Clark (2009) also found a negative sign to U.S. experience. IIT occurs more frequently among countries that are similar in terms of factor endowment.

We find a positive correlation between LogDGDP and vertical IIT. Our results show that the higher the difference in GDP per capita between U.S. and trade partner, the higher will be VIIT.

The variable foreign direct investment (FDI) is according to the literature, i.e, there is a positive relationship between FDI and IIT. Markusen (1984), Heplaman and Krugman (1995), Greenaway et al. (1994) found a positive sign. The results show that FDI and trade are complementary.

The variable (LogINT) used to analyses the inter-industry (Grubel and Lloyd 1975, and Kandogan 2003) is according to the literature; the inter-industry trade presents a negative correlation with IIT and HIIT.

Vertical IIT is explained by comparative advantages; i.e there is a positive relationship between INT and vertical IIT (Lloyd 2004). This is in accordance with the neo-Heckscher-Ohlin trade theory, which also explains VIIT by comparative advantages.

According to the literature we expected a negative sign to geographical distance. It is usual that the literature attributes a negative sign to geographical distance, i.e. trade increases if the partners are geographically close. The findings support this hypothesis.

In the further, we need to improve research on vertical integration (fragmentation), because this phenomenon is associated to two-trade of different endowments quality products.

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INTRAINDUSTRIJSKA TRGOVINA SJEDINJENIH AMERIČKIH DRŽAVA

SAŽETAK

Cilj ovog rada je objasniti horizontalnu i vertikalnu intraindustrijsku trgovinu SAD-a s trgovinskim partnerima NAFTA-e, Europske Unije i ASEAN-a, te utvrditi determinante intraindustrijske trgovine, horizontalne i vertikalne. Koristeći pristup panelnih podataka, rezultati pokazuju negativnu korelaciju između zaklada i intraindustrijske trgovine. Ti rezultati ukazuju na to da se intraindustrijska trgovina češće odvija među zemljama koje imaju sličnosti po pitanju zaklada. Nalazi potvrđuju teoriju da, generalno gledano, nema pozitivne statističke veze između HIIT i HO varijabli. Naši rezultati također potvrđuju hipotezu da trgovine raste ako se smanjuju troškovi prijevoza.

Ključne riječi: Horizontalna intraindustrijska trgovina, Vertikalna, SAD, Komparativne prednosti