

DETERMINANTS OF VIETNAMESE INTRA-INDUSTRY TRADE

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Abstract

This study investigates the determinants of Vietnam's intra-industry trade with the rest of the world. The study is based on a panel data covering Vietnam's intra-industry trade with 64 countries from 2006 to 2016. A system-GMM model is used to account for the dynamic nature of Vietnam's IIT and endogeneity problem. The study found that market size, difference in market size, difference in GDP per capita, geographical distance, trade imbalance, trade orientation, institutional difference, technological difference, and cultural difference are important determinants of Vietnam's intra-industry trade with the rest of the world. Specifically, average GDP and trade orientation are the factors which have positive impact on Vietnam's IIT, HIIT, and VIIT. In contrast, differences in per capita income and GDP, trade imbalance, and geographical distance between Vietnam and its trading partners are those factors that hinder Vietnam's IIT, HIIT, and VIIT with the rest of the world. Although technological and cultural distance between Vietnam and its trading partners have negative impact on Vietnam's IIT and HIIT, they have positive impact on Vietnam's VIIT with the rest of the world.

Keywords: Intra-industry trade, vertical intra-industry trade, horizontal intra-industry trade, Vietnam

INTRODUCTION

International trade has been greatly important to the global economy. Trade flow between countries is traditionally based on their endowments of factors of production. Capital-abundant countries tend to specialize in the production of capital-intensive products and export these products in exchange for labor-intensive products. Conversely, labor-abundant countries are likely to specialize in the production of labor-intensive products and export these products in exchange for capital-intensive products. However, since the 1960s, an increasing amount of trade among developed countries has taken place in commodities that are in the same industry. Such phenomenon is called intra-industry trade (IIT), which is the simultaneous import and export of goods within the same industry as opposed to inter-industry trade (IT), which is import and export of goods between different industries.

Since then, IIT has become more significant not only in the North-North trade but also in the North-South trade. For example, Murshed (2001) documented that the share of intra-industry trade as a proportion of total manufactured trade in Asian economies has increased since 1980. According to Kimura, Takahashi, and Hayakawa (2007), component trade in East Asia is driven by international fragmentation of the production process, intra-industry trade is a new feature of Latin American trade and is increasing its share of total trade (Baumann, 1994). In the Pacific Basin, the overall level of intra-industry trade for newly industrialized countries is growing closer to that of developed countries (Greenaway & Milner, 1986). With an increasing proportion of world trade, intra-industry trade plays an important role in the world economy.

Like other countries in the world, the trade flow of Vietnam consists of inter-industry trade and intra-industry trade. Although overall trade volume has been expanded significantly, there have emerged potential problems with intra-industry trade. In terms of the magnitude, IIT has always made up less than 50 percent of Vietnam's overall trade volume. In terms of trend, between 1997 and 2016, the share of intra-industry trade in Vietnam's total trade has been decreasing. For example, in 1997 the share of intra-industry trade accounted for 16 percent of Vietnam's total trade, leaving 84 percent of Vietnam's trade being inter-industry trade. Although this figure increased to 20 percent in 2007 and 28 percent in 2016, the share of IIT in Vietnam's total trade is relatively small. It is therefore imperative to study the solutions to improve the share of IIT in Vietnam's total trade in the coming time.

The main objective of this study is to assess the determinants of Vietnam's intra-industry trade with the rest of the world. For this, the study has following specific research questions.

1. To estimate the extent of Vietnam's IIT and to disentangle Vietnam's IIT into horizontal IIT (HIIT) and vertical IIT (VIIT).

2. To analyze the determinants of Vietnam's IIT, HIIT, and VIIT.
3. To propose the solutions for improving Vietnam's IIT based on the empirical results.

LITERATURE REVIEW

Definition and measurement of intra-industry trade

The concept of IIT was first introduced in the 1960s and attracted academic interest after studies undertaken by (Verdoorn, 1960) and (Balassa, 1966). IIT is defined as the exchange of similar kinds of products within the same industry. There are a plenty of theoretical explanations for the phenomenon of IIT. However, the most accepted explanation was proposed by (Krugman & Obstfeld, 1991) who argued that economies engaging in international trade can specialize to take advantage of increasing returns to scale. Trade allows countries to specialize in a limited variety of products and take advantage of increasing returns to scale (i.e., economies of scale) in production, but without reducing the variety of goods available for consumption.

Since the introduction of IIT in the 1970s, a number of approaches for calculating the degree of IIT have been proposed in the literature (Balassa, 1966; Kojima, 1964; Michaely, 1967). Among them, Grubel and Lloyd index (G-L index) has been most the most popular index and widely used to measure the degree of IIT (Grubel & Lloyd, 1971a, 1975). It is considered to be the most appropriate measure for calculating an industry's pattern of trade in a single period of time. The index measures the share of IIT for industry k between country i and country j . The formula for IIT index is given below:

$$IIT_{ijk} = 1 - \frac{|X_{ijk} - M_{ijk}|}{(X_{ijk} + M_{ijk})} \quad (1)$$

Where X_{ijk} is country i 's exports of product k to country j , and M_{ijk} is country i 's imports of product k from country j . IIT_{ijk} index presented in equation (1) measures the proportion of intra-industry trade in industry k between country i and country j .

If all trade in industry k are intra-industry trade ($X_{ijk}=M_{ijk}$) then $IIT_{ijk}=1$. Conversely, if all trade in industry k are inter-industry trade (either $X_{ijk}=0$ or $M_{ijk}=0$), then $IIT_{ijk}=0$. Therefore, the index ranges between zero (a complete inter-industry trade) and one (a complete intra-industry trade). In order to measure the average IIT between country i and country j in all products, the IIT index in equation (1) can be modified using trade weighted measure of IIT as follows:

$$IIT_{ijk} = \sum_{k=1}^n W_{ijk} \left[1 - \frac{|X_{ijk} - M_{ijk}|}{(X_{ijk} + M_{ijk})} \right]$$

Where

$$W_{ijk} = \left[\frac{(X_{ijk} + M_{ijk})}{\sum_{i=1}^n (X_{ijk} + M_{ijk})} \right]$$

Where n is the number of industries at a chosen level of aggregation. The index measures the average IIT directly as a percentage of the export and import trade.

Disentangling intra-industry trade into horizontal and vertical intra-industry trade

Studies on IIT increasingly stressed the importance of differentiating between HIIT and VIIT. HIIT can be understood as the exchange of commodities differentiated by different attributes including quality, whereas VIIT is the exchange of commodities characterized by different qualities. HIIT is considered to be of greater relevance to trade among developed countries, which have high and similar per capita incomes. In contrast, VIIT is thought to be particularly relevant to trade among unequal partners with different income levels.

There are three main approaches to disentangle IIT into HIIT and VIIT. The first approach is proposed by Greenaway, Hine, and Milner (1995) who further decompose the G-L index into HIIT and VIIT using unit values of exports and imports. This approach is known as the G-H-M methodology. The second approach was developed by Fontagné and Freudenberg (1997). The third approach was put forward by Kandogan (2003b), who proposed a new definition of HIIT and VIIT based on the stage of production. Accordingly, horizontal IIT refers to similar products that are simultaneously exported and imported at the same stage of production, and is mainly due to product differentiation. In contrast, vertical IIT refers to the simultaneous exports and imports of goods in the same industry, but at different stages of production, and is mainly due to varying factor intensities within an industry.

Kandogan (2003a) proposed a new method of decomposing total intra-industry trade into vertical and horizontal IIT that is based on using values of exports and imports at two different levels of aggregation. The higher level of aggregation defines industries and the lower level of aggregation defines different products in each industry. Using trade data at higher level of aggregation, the total amount of IIT in each industry is computed by finding the amount of exports matched by imports. Then, the amount of matched trade in each product of an industry is computed using data at lower level aggregation. This gives the trade of similar products, i.e. horizontal IIT. The rest of the IIT in this industry is the trade of different products or products at different stages of production within that industry, i.e. vertical IIT. Unmatched part of the total trade (TT) in the industry is inter-industry trade (IT):

$$\begin{aligned}
TT_k &= X_k + M_k \\
IIT_k &= TT_k - |X_k - M_k| \\
IT_k &= TT_k - IIT_k \\
HIIT_i &= \sum_p X_{kp} + M_{kp} - |X_{kp} - M_{kp}| \\
VIIT_k &= IIT_k - HIIT_k
\end{aligned}$$

Where k is industry, which is at 2-digit level of SITC; p is product, which is at 4-digit level of SITC.

Determinants of intra-industry trade

The determinants of intra-industry trade come from many sources and a large volume of literature has been devoted to studying IIT. Generally, literature can be categorized as theoretical studies and empirical studies. Theoretical studies seek explanations for the existence and development of IIT. Empirical studies mainly focus on determinants of IIT, with a relatively small amount of literature on aggregation and measurement issues of IIT. Because of the love of variety, consumers demand horizontally differentiated products of similar quality from both domestic producers and foreign producers. Similarly, consumers benefit from having the option to choose different qualities of products, as shown in Flam and Helpman (1987). An extensive literature review has led to the following determinants of IIT, HIIT, and VIIT.

- Market size: According to Helpman and Krugman (1985), the share of IIT in manufactured goods trade tends to increase as the average market size of the two countries increases due to the presence of economies of scale. Large the international market provides greater opportunities for production of differentiated goods. In addition, larger markets are also likely to have greater demand for foreign differentiated goods and the potential for IIT becomes high. It means that countries with smaller market size would have limited opportunities to take advantage of economies of scale in the production of differentiated goods and thus the potential for IIT is low. As a result, we predict that the shares of IIT, HIIT, and VIIT between any two countries are expected to be positively related the average market size of partner countries. A proxy, which is often used to measure the effect of market size on IIT is the average market size. Since the IIT, HIIT, and VIIT are measured on a bilateral basis, it is necessary to use average GDP of the home country and its partner country.

- Difference in per capita income: According to Linder (1961)'s argument, the similarities in income levels are associated with the similarities in demand structures between trading

partners, providing basis for IIT. Therefore, countries with similar demand structures would develop similar sets of products, first for home consumption and later for export. This argument means that as the per capita incomes of two nations become more identical, the demand structures of these two countries tend to become more similar. If it is further assumed that there is a preference for variety within product categories, IIT and HIIT take place. However, the VIIT model suggests the reverse relationship between income similarity and the extent of VIIT where dissimilarity in demand structures gives rise to more VIIT. Therefore, difference in per capita income between countries is expected to have negative impact on IIT and HIIT and have positive impact on VIIT.

- Difference in market size: According to Helpman and Krugman (1985), differences in market size indicate differences in their ability to manufacture differentiated products. As countries become more similar in terms of their market size and factor endowments, the potential for overlapping demand for differentiated products is enhanced. Thus, difference in market sizes between countries is expected to be negative for IIT and HIIT as the potential for gains in trade of different varieties is reduced. In contrast, the share of vertical IIT is to be positively correlated with the differences in market sizes, serving as proxy for differences in factor endowments. The reason is that vertically differentiated goods differ in terms of factor intensities and unit production costs. Therefore, the difference in market sizes between countries is expected to have positive impact on VIIT.

- Geographical distance: It has been found that the share of intra-industry trade is negatively correlated with geographical distance. The finding is justified on the ground that distance between countries reflects the costs of cross-border transaction of goods and services. These costs include transport and insurance costs and the cost of information necessary for trading differentiated products (Balassa & Bauwens, 1987). In addition, distance between countries also means the costs of communication, cultural familiarity, and institutional factors (Blum & Goldfarb, 2006). Furthermore, countries which are distant from each other are less familiar with each other's business practices and laws. All these costs contribute to higher transaction costs. Therefore, geographical distance between countries is expected to have a negative impact on IIT, HIIT, and VIIT.

- Trade imbalance: According to Grubel and Lloyd (1971b), IIT is affected by the trade imbalance of a country. This effect will be greater the larger the share of net trade and the smaller the share of IIT in total trade. The index should be negatively correlated with the trade imbalance so estimated coefficients in the regression equation will be biased if the trade imbalance is correlated with the explanatory variables. Following Stone and Lee (1995), a

number of studies include a measure of the trade imbalance to control for this possible bias (Li, Moshirian, & Sim, 2003). IIT is expected to be negatively correlated with the trade imbalance.

- Trade orientation: Empirical research has showed that trade orientation of a developing country will also influence IIT. According to Falvey (1981) countries with lower trade barriers will have higher levels of IIT. Following Stone and Lee (1995), Balassa and Bauwens (1987), and Balassa (1986), trade orientation is proxied by the residuals from a regression of per capita trade (exports plus imports) on per capita income and population. The share of IIT will be positively correlated with the developing country's trade orientation. This findings are also supported by Ekanayake, Veeramacheni, and Moslares (2009).

- Institutional difference: An important issue when it comes to international trade is dissimilarities in countries' institutions and governance. A high quality within legal systems accompanied by a low degree of corruption, and a stable political environment definitely improves countries' accountability. This reduces transaction costs by enhancing the security of assets as well as increasing the level of trust in economic transactions (Groot, Linders, Rietveld, & Subramanian, 2004). Difference in institutions between countries lead to higher transaction costs (Blum & Goldfarb, 2006; Huang, 2007). The reason is that, when undertaking export and import activities, firms both countries with different institutional frameworks are not familiar with each other's institutions. Therefore, institutional difference between countries is theorized to have negative impact on IIT, HIIT, and VIIT.

- Technological difference: Theoretically, industries with a high rate of technical innovation are anticipated to have a higher degree of IIT than industries with simple technologies. IIT caused by a technological gap trade can usually be explained by the differences of quality. Technological gap has been measured differently in the empirical studies. This variable is significant with the expected sign in several studies. Industries with a high rate of technical innovation are expected to have a higher degree of IIT than industries with simple and non-changing technologies. IIT caused by a technological gap trade can usually be explained by "the Functional Hypotheses" due to the differences of quality and technology. Therefore, technological gap is expected to have negative impact on IIT and HIIT, but have negative impact on VIIT.

- Cultural difference: It is generally accepted that the costs associated with international trade increases with cultural difference because larger cultural difference makes it too difficult to understand and predict behavior of others (Elsass & Veiga, 1994), making transactional interaction complicated (Parkhe, 1991). Therefore, cultural difference impedes the implementation of business deals. The most difficult issues associated with cross-cultural interaction include those associated with understanding and perception of the same situation.

Different perceptions complicate interaction and hinder the development rapport and trust, which generally stimulate interactions. Therefore, cultural difference is expected to reduce IIT and HIIT. However, cultural difference also means diverse demand for vertically differentiated products. Hence, cultural difference is expected to increase VIIT.

RESEARCH METHODOLOGY

Econometric model

In order to analyze factors affecting Vietnam's IIT, a panel data model is used with the dependent variable being Vietnam's intra-industry trade with each of its trading partner. The gravity model of international trade for panel data in this study is based on Kien and Thao (2016) augmented with other important independent variables.

- *IIT equation (determinants of IIT)*

$$IIT_{ijt} = \alpha + \beta_1 AGDP_{ijt} + \beta_2 DPIN_{ijt} + \beta_3 DGDP_{ijt} + \beta_4 DIST_{ij} + \beta_5 TO_{ijt} + \beta_6 TIMB_{ijt} + \beta_7 ID_{ijt} + \beta_8 TD_{ijt} + \beta_9 CD_{ij} + e_{ijt} \quad (1)$$

- *HIIT equation (determinants of HIIT)*

$$HIIT_{ijt} = \alpha + \beta_1 AGDP_{ijt} + \beta_2 DPIN_{ijt} + \beta_3 DGDP_{ijt} + \beta_4 DIST_{ij} + \beta_5 TO_{ijt} + \beta_6 TIMB_{ijt} + \beta_7 ID_{ijt} + \beta_8 TD_{ijt} + \beta_9 CD_{ij} + e_{ijt} \quad (2)$$

- *VIIT equation (determinants of VIIT)*

$$VIIT_{ijt} = \alpha + \beta_1 AGDP_{ijt} + \beta_2 DPIN_{ijt} + \beta_3 DGDP_{ijt} + \beta_4 DIST_{ij} + \beta_5 TO_{ijt} + \beta_6 TIMB_{ijt} + \beta_7 ID_{ijt} + \beta_8 TD_{ijt} + \beta_9 CD_{ij} + e_{ijt} \quad (3)$$

Dependent variables

In this study, equations 1, 2, and 3 represent the determinants of IIT, HIIT, and VIIT respectively. The calculation of IIT, HIIT, and VIIT are explained in 2.1 and 2.2.

- *Average GDP (AGDP_{ijt}):* AGDP_{ijt} is the average GDP of Vietnam (country *i*) and its partners (country *j*). It is used as a proxy for the market size of both economies and calculated as follows:

$$AGDP_{ijt} = \frac{1}{2}(GDP_{it} + GDP_{jt})$$

Where: GDP_{it} is the GDP of Vietnam in year *t*, GDP_{jt} is the GDP of Vietnam's trading partner in year *t*.

- *Difference in per capita income (DPIN_{ijt}):* Difference in per capita income between Vietnam and its trading partner is computed as follows:

$$DPIN_{ijt} = \left| \frac{GDP_{it}}{POP_{it}} - \frac{GDP_{jt}}{POP_{jt}} \right|$$

Where: GDP_{it} is the Gross Domestic Product of Vietnam in a year t , GDP_{jt} is the Gross Domestic Product of Vietnam's trading partner in a year t , POP_{it} is the population of Vietnam in a year t , POP_{jt} is the population of Vietnam's trading partner in year t .

- *The difference in economic size (DGDP_{ijt})*: Following Balassa and Bauwens (1988), the difference in economic size (DGDP) between Vietnam and a given country is derived to reflect the standardized difference in size:

$$DGDP_{ijt} = 1 + \frac{[w \ln(w) + (1-w) \ln(1-w)]}{\ln 2}$$

Where

$$w = \frac{GDP_{it}}{GDP_{it} + GDP_{jt}}$$

- *Distance (DIST_{ij})*: DIST_{ij} is the geographical distance between the capital city of country i and the capital city of country j , measured in km.

- *Trade orientation (TO_{jt})*: Trade orientation is defined as the residual from a regression of per capita trade (PCT) on per capita income (PCI) and population).

$$\ln PCT = \alpha + \beta_1 \ln PCI + \beta_2 \ln PCT + \varepsilon$$

Where

$$PCT = (Exports + Imports) / Population$$

- *Trade imbalance (TIMB_{ijt})*: This variable represents net trade as a share of trade and takes a value of zero at the lower extreme if there is no trade imbalance and a value of one if there are neither exports nor imports. Following Lee (1993) this dissertation considers the trade imbalance as a control variable, which is measured by:

$$TIMB_{ijt} = \frac{|X_{ijt} - M_{ijt}|}{(X_{ijt} + M_{ijt})}$$

Where: X_{ijt} is Vietnam's exports to country j at the time t , M_{ijt} is Vietnam's imports from country j at the time t .

- *Institutional distance (ID_{ijt})*: ID_{ijt} is the institutional distance between Vietnam and its trading partner at time t . This study measures the difference in institutional quality by the Kaufmann index, which includes six indicators with each of these indicators capturing different aspects of governance. They include voice and accountability, political stability, government effectiveness, regulatory quality, and rule of law. The institutional distance is calculated as follows: $ID_{ijt} = |I_{it} - I_{jt}|$. I_{it} is the index of country i 's institutional quality, while I_{jt} is the index of

country j 's institutional quality. This paper used dummy variable that are based on comparison between ID_{ijt} and the population standard deviation of the institutional quality index. ID_{ijt} equals 1 if it is greater than the population standard deviation, and 0 otherwise.

- *Cultural distance (CD_{ij})*: CD_{ij} is the cultural distance between Vietnam and its trading partner at year t . It is measured based on the quantitative cultural scores obtained by the Dutch social psychologist Geert Hofstede. A wide-spread way of using the individual Hofstede scores in order to arrive at an aggregate measure of cultural distance is constructed as a Euclidean Distance between two countries based on Hofstede's cultural dimensions, namely: Power Distance, Individualism, Masculinity, and Uncertainty Avoidance. Each of these scores can take values between 0 and 112, with a higher value indicating that power distance, individualism, masculinity etc. are more firmly entrenched in a nation's culture. Mathematically, CD can be represented by the following:

$$CD_{ij} = \sqrt{\sum_{i=1}^4 (I_i - J_i)^2}$$

Where I_i is the index for the i^{th} cultural dimension for Vietnam, J_i is the index for the i^{th} cultural dimension for Vietnam's trading partner.

- *Technological distance (TD_{ijt})*: TD_{ijt} is the technological distance between Vietnam (*country_i*) and the rest of the World (*country_j*). It is calculated as follows: $TD_{ijt} = |T_{it} - T_{jt}|$. T_{it} is the index of country i 's technological capability, while T_{jt} is the index of country j 's technological capability. TD_{ijt} equals 1 if it is greater than its population standard deviation, and 0 otherwise.

The models presented in equations 1-3 are static. However, in the real world situation, trading partners that trade with each other at the previous year (at the time $t-1$) have the tendency to maintain their trading relations at the present year (at the time t). The reason is that the exporting and importing countries have to make initial investment in setting up the network in their trading partners. Therefore, the static specification in equation 1 can be enhanced by adding lagged dependent variable, which allows feedback from past shocks to current values of the dependent variable. The equation 1, 2, and 3 can be expressed in the following dynamic form as follows:

- *IIT equation (determinants of IIT)*

$$IIT_{ijt} = \alpha + \gamma IIT_{ij,t-1} + \beta_1 AGDP_{ijt} + \beta_2 DPIN_{ijt} + \beta_3 DGDP_{ijt} + \beta_4 DIST_{ij} + \beta_5 TO_{ijt} + \beta_6 TIMB_{ijt} + \beta_7 ID_{ijt} + \beta_8 TD_{ijt} + \beta_9 CD_{ij} + e_{ijt} \quad (4)$$

- *HIIT equation (determinants of HIIT)*

$$HIIT_{ijt} = \alpha + \gamma IIT_{ij,t-1} + \beta_1 AGDP_{ijt} + \beta_2 DPIN_{ijt} + \beta_3 DGDP_{ijt} + \beta_4 DIST_{ij} + \beta_5 TO_{ijt} + \beta_6 TIMB_{ijt} + \beta_7 ID_{ijt} + \beta_8 TD_{ijt} + \beta_9 CD_{ij} + e_{ijt} \quad (5)$$

- HIIT equation (determinants of VIIT)

$$VIIT_{ijt} = \alpha + \gamma IIT_{ij,t-1} + \beta_1 AGDP_{ijt} + \beta_2 DPIN_{ijt} + \beta_3 DGDP_{ijt} + \beta_4 DIST_{ij} + \beta_5 TO_{ijt} + \beta_6 TIMB_{ijt} + \beta_7 ID_{ijt} + \beta_8 TD_{ijt} + \beta_9 CD_{ij} + e_{ijt} \quad (6)$$

Therefore, in this study the authors ran equations 4, 5, and 6.

Note: All variables, except TO_{jt} and CD_{ij} , are in the log form.

The Data

In this study, secondary data for all trading partners of Vietnam was collected. There were 64 countries in the sample (Appendix 1). For the rest of the countries, data either on bilateral trade or other independent variables were not available. Vietnam's IIT, HIIT, and VIIT indices with 48 major trading countries of Vietnam were computed for the period 2006-2016 which were available in WEO database. Then, country-specific factors are analyzed.

Data on Vietnam's exports to and imports from each of its trading partners are collected from the United Nations International Trade Statistics Database. Data on GDP and per capita GDP are collected from the World Economic Outlook (WEO) database. Distance data is collected from Indo.com, which is one of the reliable sources. Institutional and technological data are collected from the Global Competitiveness Index published by the World Economic Forum. Cultural data on 4 dimensions of national culture developed by Geert Hofstede Geert Jan Hofstede, Michael Minkov and their research teams are adopted from Hofstede Insights.

ANALYSIS AND RESULTS

Overview of Vietnam's IIT with the rest of the world

Vietnam's international trade flows can be decomposed into inter-industry trade and intra-industry trade. An overview of Vietnam's overall trade patterns with the rest of the world is presented in Table 1.

Table 1: Vietnam's overall trade patterns with the Rest of the World (in percent)

Product group	2006	2011	2016
Total trade	100.0	100.0	100.0
Intra-industry trade	20.0	26.0	29.4
Inter-industry trade	80.0	74.0	70.6

Source: The author's calculation using data from UN Comtrade.

According to Table 1, trade flows between Vietnam and the rest of the World are dominated by IT trade. During the period 2006-2016, the share of IIT in total trade only accounts for less than 30 percent. However, the extent of Vietnam's IIT tends to increase gradually over the same period. In term of Vietnam's trade with major blocs, this study attaches special importance to four main blocs as illustrated in table 2.

Table 2: Vietnam's IIT with major trade blocs and grouping

Trade blocs and grouping	2006			2011			2016		
	IIT	HIIT	VIIT	IIT	HIIT	VIIT	IIT	HIIT	VIIT
Total	0.140	0.077	0.063	0.148	0.111	0.037	0.169	0.111	0.058
ASEAN	0.149	0.110	0.039	0.172	0.109	0.062	0.173	0.114	0.059
EU	0.077	0.037	0.039	0.090	0.035	0.055	0.069	0.044	0.024
NAFTA	0.330	0.168	0.162	0.188	0.188	0.000	0.196	0.180	0.016
East Asia	0.079	0.060	0.020	0.150	0.071	0.079	0.224	0.122	0.102
MERCOSUR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Source: The author's calculation based on data from UN Comtrade

As can be seen from Table 2, the major part of trade between Vietnam and blocs is inter-industry trade, while the share of Vietnam's intra-industry trade only makes up a small part, especially with EU, NAFTA, and MERCOSUR bloc. East Asia countries are those which have largest share of intra-industry trade with Vietnam. ASEAN is market that has the second largest share of IIT with Vietnam. During period from 2006 to 2016, the volume of intra-industry trade increased in size. Vietnam's IIT with NAFTA tended to increase steadily in during three periods. However, NAFTA is still market that Vietnam's trade is primarily based on inter-industry trade.

Basically, the patterns of Vietnam's IIT with the major trade blocs and grouping are dominated by HIIT. In most periods, the share of VIIT is relatively small. For example, East Asian countries are those which have the largest share of VIIT with Vietnam. However, the share of Vietnam's VIIT with these countries only accounts for 10.2 percent. ASEAN is the trade bloc which has the second largest share of VIIT with Vietnam. MERCOSUR is the trade bloc which has the lowest share of VIIT with Vietnam, which is almost zero.

Determinants of Vietnam's IIT with the rest of the world

Our model includes Vietnam's IIT with 64 trading partners for the period of 2006-2016, leading to 704 observations. The summary statistics of basic gravity and other commonly used variables are presented in appendix 2. To analyze the determinants of Vietnam's IIT, HIIT, and VIIT with the rest of the world, this study uses a GMM model in order to account for the dynamic effect

and overcome the problem of endogeneity. Before running the GMM model, we conducted the Hadri Lagrange multiplier test for panel unit root (Hadri, 2000).

Table 3: Hadri Lagrange Multiplier Unit-root Test

Variables	z-value	Probability
IIT _{ijt}	8.777	0.000
HIIT _{ijt}	9.870	0.000
VIIIT _{ijt}	8.537	0.000
AGDP _{ijt}	10.517	0.000
DPIN _{ijt}	9.780	0.000
DGDP _{ijt}	10.680	0.000
TIMB _{ijt}	8.806	0.000
TO _{jt}	9.600	0.000
ID _{ijt}	7.632	0.000
TD _{ijt}	8.626	0.000

According to the Harid test, the null hypothesis is that all the panels are stationary. As results of unit root test, the null hypothesis of unit root is rejected at the 0.01 level. That means all variables used in this model including do not have unit roots. In addition to Harid test, this study used the Sargan test of overidentifying restriction (Sargan, 1958) and the Arellano-Bond test for AR(2) in first differences. The Sargan test of over identifying restriction is used to make sure that instruments used in this model are valid. The test has the null hypothesis that the instruments are valid. The Arellano-Bond test for AR (2) in first differences has the null hypothesis of no autocorrelation (Arellano, 1991).

Table 4: Specification tests for IIT model

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Sargan test of over identifying restriction						
Statistic	2.09	1.60	1.58	2.22	0.37	3.33
Probability	0.148	0.206	0.209	0.136	0.543	0.343
Arellano-Bond test for AR(2) in first differences						
z-test	-0.22	0.24	0.22	0.18	0.16	0.53
Probability	0.825	0.807	0.823	0.860	0.871	0.596

The results of the tests in Table 4 show that the instruments are valid and there is no autocorrelation. Besides, this study also conducts sensitivity tests by adding new variables in each time. The first model includes basic variables: geographical distance ($Distance_{ijt}$); Average GDP_{ijt}, DGDP_{ijt} and DPIN_{ijt}. In the second model, the variable TB_{ijt} is added. The third model

includes an additional variable, which is TO_{jt} . In the fourth model, ID_{ijt} is added. The fifth model includes TD_{ijt} , and the last model includes CD_{ij} . The analysis and interpretation in this study is based on model 6.

Table 5: Determinants of Vietnam's IIT

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
IIT_{ijt-1}	0.694** (0.059)	0.608** (0.068)	0.608** (0.068)	0.600** (0.071)	0.583** (0.074)	0.475** (0.097)
$AGDP_{ijt}$	0.015** (0.004)	0.020** (0.004)	0.020** (0.004)	0.020** (0.004)	0.057** (0.014)	0.080** (0.019)
$DPIN_{ijt}$	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.002 (0.002)	-0.003 (0.002)
$DGDP_{ijt}$	-0.017 (0.012)	-0.032* (0.013)	-0.037** (0.013)	-0.039** (0.014)	-0.264** (0.079)	-0.389** (0.107)
$DIST_{ij}$	-0.030** (0.006)	-0.037** (0.007)	-0.036** (0.007)	-0.036** (0.007)	-0.037** (0.007)	-0.041** (0.009)
$TIMB_{ijt}$		-0.064** (0.009)	-0.065** (0.009)	-0.065** (0.010)	-0.074** (0.011)	-0.146** (0.022)
TO_{jt}			0.177* (0.073)	0.186* (0.074)	0.459** (0.123)	0.675** (0.162)
ID_{ijt}				-0.010 (0.007)	-0.010 (0.007)	-0.024* (0.010)
TD_{ijt}					-0.014* (0.006)	-0.015* (0.006)
CD_{ij}						-0.005* (0.002)
Constant	0.241** (0.048)	0.332** (0.057)	0.321** (0.056)	0.326** (0.058)	0.240** (0.062)	0.265* (0.083)
Observations	640	640	640	640	640	640

Note: Standard errors in parentheses; * significant at 0.05 level; ** significant at 0.01 level.

The results presented in Table 5 show that the GMM model used in this study is not sensitive to adding new variables to the equation. Most of the explanatory variables are significant at 0.01 levels, and they do not fluctuate too much through six equations.

$IIT_{ij, t-1}$ is positive and statistically significant at 0.01 level, which means that Vietnam's IIT with partners in the past year has an impact on IIT in the current year. A positive and statistically significant $AGDP_{ijt}$ means that average GDP have a positive impact on IIT with a one percent increase in average GDP leads to an increase of 0.08 percent in IIT. The results showed that the less distance GDP between citizens, the larger IIT. This result is consistent with (Linder, 1961). However, difference in GDP per capita between Vietnam and its trading partner is not

significant. As expected, geographical distance is a hindrance to IIT between Vietnam and its trading partners. Thus, Vietnam tends to have larger share of intra-industry trade with adjacent countries, especially countries in East Asia and ASEAN.

TO_{ijt} is significant at 0.01 levels with positive coefficient. It means that trade orientation promotes IIT more proportionately than IT. On average, a one percent increase in the trading partner's trade orientation leads to 0.675 percent increase in Vietnam's IIT with its trading partner. This finding is coincided with the argument by (Balassa, 1986) that as governments implement liberal trade policies this opens the economy for increased trade. $TIMB_{ijt}$ is one of the factors that reduce IIT. As expected, the coefficient for trade imbalance is negative and significantly. It implies that when $TIMB_{ijt}$ increases by one unit, Vietnam's IIT with its trading partner will reduce 0.146 percent.

ID_{ijt} is significant at 0.05 levels with negative coefficient. It means that as institutional distance between Vietnam and its trading partner increases, the IIT between Vietnam and that trading partner is expected to decrease. More specifically, one percent increase in distance institution between Vietnam and partner leads to a reduction in Vietnam's IIT with that trading partner by 0.05 percent. This result is consistent with Groot et al. (2004). CD_{ij} is significant at 0.05 levels with negative coefficient. This implies that IIT development between Vietnam and the rest of the World is effected by the difference in culture between Vietnam and its trading partner. TD_{ijt} is negative and statistically significant at 0.05 level. This indicates that difference in technological capability between Vietnam and its trading partner reduces IIT between them.

Table 6: Determinants of Vietnam's HIIT

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
$HIIT_{ijt-1}$	0.324** (0.064)	0.280** (0.068)	0.287** (0.068)	0.286** (0.069)	0.263** (0.072)	0.256** (0.073)
$AGDP_{ijt}$	0.040** (0.007)	0.042** (0.007)	0.041** (0.007)	0.043** (0.007)	0.051** (0.007)	0.050** (0.007)
$DPIN_{ijt}$	-0.085** (0.018)	-0.090** (0.018)	-0.102** (0.019)	-0.106** (0.019)	-0.130** (0.020)	-0.126** (0.020)
$DGDP_{ijt}$	-0.004** (0.001)	-0.004** (0.001)	-0.004** (0.001)	-0.004** (0.001)	-0.005** (0.001)	-0.002* (0.001)
$DIST_{ij}$	-0.032** (0.003)	-0.034** (0.003)	-0.032** (0.003)	-0.032** (0.003)	-0.032** (0.003)	-0.029** (0.003)
$TIMB_{ijt}$		-0.031** (0.004)	-0.032** (0.004)	-0.032** (0.004)	-0.033** (0.004)	-0.035** (0.004)
TO_{jt}			0.205** (0.041)	0.208** (0.041)	0.260** (0.044)	0.266** (0.044)
ID_{ijt}				-0.007	-0.006	-0.008*

				(0.004)	(0.004)	(0.004)
TD_{ijt}					-0.009**	-0.008**
					(0.003)	(0.003)
CD_{ij}						-0.005**
						(0.001)
Constant	0.165**	0.191**	0.182**	0.175**	0.154**	0.125**
	(0.030)	(0.032)	(0.032)	(0.031)	(0.031)	(0.034)
Observations	640	640	640	640	640	640

Table 6...

Note: Standard errors in parentheses.

* Significant at 0.05 level; ** significant at 0.01 level.

According to results in Table 6, all coefficients are significant at least 0.05 level, and impacts of variables on HIIT is consistent with the theory. Most variables, except $HIIT_{ijt-1}$, average GDP and trade orientation, have negative impact on Vietnam's HIIT with the rest of the world.

The results show that HIIT of the previous year has a positive impact on Vietnam's HIIT in the current year. The coefficient $AGDP_{ijt}$ is positive and significant. If $AGDP_{ijt}$ increases by one percent, Vietnam's HIIT would increase by 0.05 percent. The coefficient of TO_{jt} is relatively high and is statistically significant. A one unit increase in TO be associated with an increase in Vietnam's HIIT by 0.266 percent.

Other variables such as distance, trade imbalance, different institution, culture distance and different technology also have negative impact on HIIT. Differences in culture institution and technology development may reduce Vietnam's HIIT with its partners because these differences indicate that the demand of inhabitants is different. This view is demonstrated by numerous researches as (Huang, 2007).

Table 7: Determinants of Vietnam's VIIT

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
$VIIT_{ijt-1}$	0.088**	0.057**	0.179**	0.147**	0.269**	0.051**
	(0.007)	(0.008)	(0.023)	(0.024)	(0.024)	(0.018)
$AGDP_{ijt}$	0.011**	0.009**	0.018**	0.019**	0.015**	0.018**
	(0.002)	(0.002)	(0.003)	(0.004)	(0.004)	(0.004)
$DPIN_{ijt}$	-0.000	-0.001	-0.000	-0.000	-0.00	-0.007
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)
$DGDP_{ijt}$	-0.035**	-0.120**	-0.138**	-0.132**	-0.070**	-0.061**
	(0.012)	(0.010)	(0.022)	(0.022)	(0.021)	(0.013)
$DIST_{ij}$	-0.036**	-0.041**	-0.022**	-0.023**	-0.018**	-0.046**
	(0.004)	(0.003)	(0.007)	(0.007)	(0.005)	(0.006)
$TIMB_{ijt}$		-0.089**	-0.077**	-0.080**	-0.071**	-0.081**
		(0.003)	(0.009)	(0.009)	(0.007)	(0.008)

TO_{jt}			1.598**	1.665**	1.756**	0.608**
			(0.249)	(0.263)	(0.197)	(0.194)
ID_{ijt}				-0.004**	-0.003	-0.013**
				(0.001)	(0.002)	(0.002)
TD_{ijt}					-0.001	0.009**
					(0.002)	(0.003)
CD_{ij}						0.022**
						(0.007)
Constant	0.342**	0.515**	0.258**	0.261**	0.238**	0.454**
	(0.042)	(0.027)	(0.074)	(0.074)	(0.052)	(0.068)
Number of Observation	640	640	640	640	640	640

Note: Standard errors in parentheses.

* Significant at 0.05 level; ** significant at 0.01 level.

The last model in this study focuses on the determinants of Vietnam's VIIT. According in Table 7, almost variables (expect $DPIN_{ijt}$ and $DGDP_{ijt}$) just have small changes in their coefficients, which are statistically significant at least 0.05 levels. Average GDP and trade orientation are those variables, which have positive impact on VIIT. As expected, $TIMB_{ijt}$ and ID_{ijt} , are variables which have negative impact on VIIT index and these coefficients are statistically significant at 0.01 level. At the same time, $DGDP_{ijt}$ and $DPIN_{ijt}$ have negative impact on Vietnam's VIIT with the rest of the World. However, the coefficient of $DPIN_{ijt}$ is statistically insignificantly. This implies that the impact of $DPIN_{ijt}$ on Vietnam's VIIT is not clear.

In contrast, TD_{ijt} and CD_{ijt} have a positive influence on VIIT. As in line with the theory on VIIT, Vietnam's VIIT with its trading partners occurs in the products of same industry, but different in quality. From demand side, differences in cultures between Vietnam and its trading partners exhibit different tastes for products differentiated by quality. From the supply side, differences in technological capability between Vietnam and its trading partners indicate differences in ability to produce goods of the same quality. Therefore, differences in technology and culture lead to an increase in Vietnam's VIIT with its trading partners. This finding is consistent with Elsass and Veiga (1994).

CONCLUSION AND POLICY RECOMMENDATIONS

In this study, the authors examined the extent of Vietnam's IIT with the rest of the world, which is further decomposed into Vietnam's HIIT and VIIT. Besides, the authors also analyzed the determinants of Vietnam's IIT, HIIT, and VIIT with its trading partners for the period of 2006-2016. In order to do so, we utilized a system-GMM estimator, which requires three tests: Hadri unit root test, Arellano- Bond test for AR(2) and Sargan test of overidentifying restriction. The

results of those tests showed that all variables used in the model did not have unit root; the instruments used in the model were appropriate. The main results of the models could be summarized as follows:

First, the share of Vietnam's IIT with the rest of the world has increased steadily over years. East Asian and ASEAN countries were those countries which have largest share of Vietnam's IIT. In contrast, Vietnam's IIT with NAFTA and MERCOSUR countries only account for small share. Overall, Vietnam's trade with its trading partners was still dominated by inter-industry trade. Within intra-industry trade, Vietnam's HIIT made up a larger share than its VIIT. Second, the extent of IIT in the previous year was associated with IIT in current year. Similarly with the results found in HIIT and VIIT. This indicated the dynamic nature of Vietnam's IIT, HIIT, and VIIT with the rest of the world. Third, average GDP and trade orientation were main factors which have positive impact on Vietnam's IIT, HIIT, and VIIT. Fourth, differences in per capita income and GDP, trade imbalance, and geographical distance between Vietnam and its trading partners were those factors that hinder Vietnam's IIT, HIIT, and VIIT with the rest of the world. Finally, although technological and cultural distance between Vietnam and its trading partners had negative impact on Vietnam's IIT and HIIT, they had positive impact on Vietnam's VIIT with the rest of the world.

In order to strengthen Vietnam's IIT, HIIT, and VIIT with the rest of the world, to improve GDP and reduce the difference in GDP and per capita income between Vietnam and its trading partners should be taken. In addition, infrastructure should be enhanced in order to reduce the negative impact of geographical distance. Furthermore, solutions to reduce institutional, technological, and cultural distance are important to support Vietnam's IIT and HIIT. Finally, Vietnam should strengthen its technological capability in order to produce diversified commodities so that its VIIT with the rest of the world could be improved.

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APPENDICES

Appendix 1: Countries included in the study

Order	Countries	Order	Countries	Order	Countries
1	Argentina	23	Hong Kong SAR	45	Philippines
2	Australia	24	Hungary	46	Poland
3	Austria	25	Iceland	47	Portugal
4	Belgium	26	India	48	Romania
5	Brazil	27	Indonesia	49	Russia
6	Bulgaria	28	Ireland	50	Singapore
7	Cambodia	29	Israel	51	Slovak Republic
8	Canada	30	Italy	52	Slovenia
9	Chile	31	Japan	53	South Africa
10	China	32	Korea	54	Spain
11	Colombia	33	Latvia	55	Sri Lanka
12	Costa Rica	34	Lithuania	56	Sweden
13	Croatia	35	Luxembourg	57	Switzerland
14	Czech Republic	36	Malaysia	58	Tanzania
15	Denmark	37	Mauritius	59	Thailand
16	Dominican Republic	38	Mexico	60	Turkey
17	Egypt	39	Morocco	61	United Arab Emirates
18	Estonia	40	Netherlands	62	United Kingdom
19	Finland	41	New Zealand	63	United States
20	France	42	Norway	64	Uruguay
21	Germany	43	Pakistan	65	Vietnam
22	Greece	44	Peru		

Appendix 2: Summary of Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
IIT _{ijt}	704	0.123	0.114	0.001	0.518
HIIT _{ijt}	704	0.044	0.055	0.000	0.301
VIIT _{ijt}	704	0.079	0.071	0.000	0.347
AGDP _{ijt}	704	5.562	1.081	3.599	9.150
DPIN _{ijt}	704	9.394	1.480	3.341	11.685
DGDP _{ijt}	704	0.415	0.229	0.152	0.968
DIST _{ij}	704	8.861	0.702	6.772	9.850
TIMB _{ijt}	704	0.506	0.274	0.001	0.992
TO _{jt}	704	0.000	0.024	-0.040	0.163
ID _{ijt}	704	0.283	0.451	0.000	1.000
TD _{ijt}	704	0.288	0.453	0.000	1.000
CD _{ij}	704	2.211	1.269	0.000	5.335