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# The Determinants of China-Japan-Korea's Vertical Intra Industry Trade to ASEAN4 countries

Fithra Faisal Hastiadi

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Copyright ©2011, Department of Economics Department of Economics Building 2nd Floor Depok West Java, Indonesia 16424 Telp. 021-78886252 Email:rusan.nasrudin@gmail.com Web: http://econ.fe.ui.ac.id/workingpage

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# The Determinants of China-Japan-Korea's Vertical Intra Industry Trade to ASEAN4 countries $\stackrel{\bigstar}{\rightarrowtail}$

Fithra Faisal Hastiadi<sup>a</sup>

<sup>a</sup>Department of Economics, Faculty of Economics, Universitas Indonesia

#### Abstract

East Asia has been witnessing an increased trade in parts and components over the last decade. This fact has increased the importance of Intra Industry Trade (IIT) within the region. To differentiate the types of IIT, this paper employs two types of threshold. The first one follows the work of Abdel-Rahman (1991), Greenaway, Hine, and Milner (1994), and Fontagné, Freudenberg, and Péridy (1997), which mainly use a 15% threshold, the second one is based from the work of Fukao (2003) that employs 25% threshold. Should we know to which degree ASEAN-4's exports are dispersed, we could easily extract the proper policy to cope with any economic shocks. Thus said, since China-Japan-Korea (CJK)'s Vertical IIT to ASEAN4 is a very important variable to provide cushions of any possible shocks therefore, it is very crucial to figure out the factors that determine the CJK's Vertical IIT in South East Asia. Employing static panel data models, this paper concludes that logistic performance and the difference in wage or income are major determinants for the CJK's Vertical IIT trend in ASEAN4 countries.

JEL Classifications: F14, F19, C23

Keywords: vertical intra industry trade, product fragmentation, panel data

## 1. Introduction

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Firms have openly responded to the challenges of globalization by giving a process of product integration across national boundaries. Production stages are often conducted in more than one countries rather than producing it in a single country. By doing this, it has the ability to exploit inherent locational advantages such as proximity to markets and access to low-cost labor. This practice gives rise to a sequential method of production in which one country exports a component to another country that uses it to produce a product which is subsequently shipped back to that country or is exported to other countries (Clark, 2005). Hummels et al. (1998) uses the term "vertical specialization" to describe this pattern of production and trade. Outputs from different stages of production that are exported for processing and are subsequently imported contribute to IIT because resulting trade flows involve exchanges of related goods that are often recorded under the same industry classification.

Many previous studies including Athukorala (2006), Ng and Yeats (2001), and Yeats (2001) provide statistical evidence to show that the expansion of trade in East Asia has been accompanied by a rise in Vertical IIT. Moreover, Wakasugi (2009) proves that Vertical IIT has a major contribution to trade expansion in East Asia. He then concludes this fact as a bench-

*Email address:* fithra\_faisal@yahoo.com (Fithra Faisal Hastiadi)

mark towards regional economic integration in East Asia. Being acknowledged as the economic front runners in East Asia, CJK countries are deemed to have crucial role in increasing trend of Vertical IIT. Having said this, it is very crucial to figure out the factors that determine the CJK's Vertical IIT in South East Asia. This paper will do country by country analysis to find out the factors that is causing CJK's Vertical IIT to ASEAN4 countries. So, instead of doing regression as CJK, the author put them separately as China, Japan and Korea. ASEAN4 countries are used as a proxy for South East Asia due to data limitation for the Cambodia-Lao-Myanmar-Vietnam (CLMV) countries due and the incompatibility of Singapore and Brunei.

The remainder of this paper is organized as follows. The second section studies the basic concepts. The third section covers materials and methods. The fourth section examines the result of the regressions. The last section presents conclusion and some concluding remarks.

#### 2. Literature Review

There are some reasons to expect Vertical IIT between the developing countries and the developed countries. Balassa (1960) points out that vertical integration of industries across national boundaries could show up as Vertical IIT, which would be particularly apparent in cases where multinational corporations ship components to developing countries subsidiaries for assembling process and then ship them back the assembled components to home markets. According to comparative-advantage-based theories industrialized countries should not trade with each other (trade should occur between developed and developing countries but not within each of the groups). Given that developed nations are similar in their productive capabilities (and demand patterns) they are likely to have similar comparative advantages and factor endowments (skilled labor, capital), hence trade between such countries would be In actual fact, industriallimited at best. ized countries trade extensively with each other with more than two thirds of all developedcountry trade taking place with other developed countries. The other empirical fact is the existence of IIT. There are two types of IIT: i) Horizontal IIT is the exchange of differentiated products produced with identical factor intensities, featuring the same product quality and carrying the same price; ii) Vertical IIT alludes to quality-differentiated products utilizing different factor intensities and sold at different prices. 80% of IIT was discovered to be vertical IIT, where in empirical analysis price differences are used to distinguish between the two (15-20%).

In Falvey (1981) and Falvey and Kierzkowski (1987), IIT with vertical product differentiation takes place under perfect competition. Falvey and Kierzkowski (1987) assume that the differentiated product sector is of the Heckscher–Ohlin type with constant-returns-to scale technology identical across countries, but Ricardian in terms of technology, with fixed and different factor intensities at the variety level; higher (lower) quality variety is produced with a higher (lower) capital-labor-ratio technology and has a higher (lower) price. Each individual demands only one type of differentiated product according to the individual's income, resulting in an aggregate demand for a variety of quality-differentiated goods. Vertical IIT occurs when two countries with differences in income distribution have different factor endowments or different technologies in the homogeneous product sector. Helpman and Krugman's argue that the bilateral share of IIT will increase when countries become more similar in both economic size and relative factor endowments. They added that a proportional reallocation of productive factors that makes two countries more (less) equal in economic size is shown to increase (reduce) the IIT share. When a reallocation of factors does not alter

the relative size of trading partners, but decreases (increases) the disparity in relative factor endowments, the IIT share will increase (decrease).

Recently the FDI inflow to the South East Asia, especially to the ASEAN4 countries, has been connected with the fragmentation of production process (Ando, 2006). The publication of Krugman and Helpman (1985) was deemed as the first ever article mentioning the impact of the FDI on the Vertical IIT. The authors shed light on the emergence of multinational corporations as leading actors who make transformation on the link between differences in relative factor endowments and the share of intraindustry trade. Fukao, Ishido and Ito (2003) made an attempt to answer the question on how trade patterns are influenced by FDI costs, trade costs, and the factor price gap between the two countries. To be more specific, the authors study the following three situations: first, zero trade costs coupled with prohibitively high FDI costs; second, zero trade and FDI costs; and third, substantial trade costs and zero FDI costs. The main results of the theoretical analysis were summarized as follows. First, Vertical IIT occurs only when both FDI costs and trade costs are small. FDI cost will surpass the gain in doing international division of labor when the cost is a very substantial one. Or to put it colloquially, the firms in the developed country will not carry out vertical FDI which is an important factor for the Vertical IIT. If it is very costly to trade products from the developed country to the developing country, then firms in the developed country will replace their exports from their home country with local production in the developing country. Because of this horizontal FDI, Vertical IIT becomes very small. Second, if there exist substantial costs of FDI, the share of Vertical IIT in total trade will depend on the factor proportion gap between the two countries. If the factor proportion gap is small, then firms will have limited incentive to engage in the international division of labor through FDI, and Vertical IIT will become small. Then, it should follow Fukao et al. famous word: "Vertical intra industry trade is a fragile flower, which flourishes only when both FDI costs and trade costs are small."

This paper is also seeking for the relation between logistic performance and the vertical intra industry trade. Unfortunately, we only have relatively small amount of literature mentioning of it. But we have an ample amount of literatures that offer substantial evidence linking improvements in logistics directly to improvements in export performance. An increased export performance is expected to channel the way to an increased Vertical IIT.

Hummels (1999) compares sales by manufacturers of similar products as he estimated exporters with 1 percent lower shipping costs will enjoy a 5-8 percent higher market share. Next, Limao and Venables (2001) estimate the differences in infrastructure quality that account for 40 percent of the variation in transport costs for coastal countries and up to 60 percent for landlocked countries. Fink et.al (2001) found out that liberalizing the provision of port services and regulating the exercise of market power in shipping could reduce shipping costs by nearly a third hence providing better export performance. A World Bank study by Wilson and others (2002) show that the APEC (Asia Pacific Economic Cooperation) countries could differ substantially in the quality of their logistics and trade facilitation across a broad range of measures, including ports infrastructure, customs clearance, regulatory administration, and e-business use. They found that these differences yield a significant impact to differences in trade performance, and concluded that substantial growth in trade within their block could be accomplished by bringing lagging countries up to median performance levels.

Digging further, Frankel and Romer (1999) show that countries that are closer to world markets enjoy higher levels of trade, and that a 1 percent rise in the trade to GDP ratio increases income per person by at least 0.5 percent. Redding and Venables (2002) estimate that more than 70 percent of the variation in per capita income across countries can be explained by the geography of market and supplier access.

## 3. Methodology

## 3.1. Intra Industry Trade (IIT)

The IIT is a measure of the degree to which trade in a particular sector represents intra-industry trade (based on scale economies and/or market structure). By engaging in IIT, a country can reduce the number of similar goods it produces, and benefit from scale economies. Higher IIT ratios suggest that these sources of gains are being exploited. IIT may also indicate that adjustment costs would be lower with trade expansion.

$$IIT = \frac{(X_{ij} + M_{ij}) - |X_{ij} + M_{ij}|}{(X_{ij} + M_{ij})}$$
(1)

Where  $X_{ij}$  and  $M_{ij}$  are home country's exports of industry i goods to country j and imports of industry i goods from country j, respectively. The absolute value of  $X_{ij} - M_{ij}$  denotes that the sign of the trade balance is ignored.  $IIT_{ij} = 1$ if all trade in industry i goods is intra-industry trade, i.e.  $X_{ij} = M_{ij}$  and  $IIT_{ij} = 0$  if all trade in industry i goods is inter-industry trade, i.e.  $X_{ij} = 0$  or  $M_{ij} = 0$ . When it is expressed in percentage terms, it should multiply by 100 then index would vary from zero to 100 and can be expressed as a percentage of the total trade. In other words, higher index values are associated with greater intra-industry trade as a proportion of total trade which serves best for creating regionalism in East Asia. IIT itself is divided into two types, Horizontal IIT and Vertical IIT.

#### 3.1.1. Threshold System

This paper employs two types of threshold, the first one follows the work of Abd-elRahman (1991), Greenaway, Hine, and Milner (1994), and Fontagné, Freudenberg, and Péridy (1997), which mainly use a 15% threshold to distinguish between horizontally and vertically differentiated products, the second one is based from the work of Fukao (2003) that employs 25% threshold for the IIT identification. This chapter used the SITC data up to a five-digit classification of UN Comtrade. It reflects the raw materials used in production, production stages, product descriptions, technological progress, and other factors as its characteristics, which is appropriate for reflecting the inter-process division of labor. Equation 2 and 3 gives the Horizontal IIT and Vertical IIT formulas respectively. Where unit values of imports  $(UV_{ij}^m)$  and exports  $(UV_{ij}^x)$  for a particular dispersion factor ( $\alpha$ ) satisfy the condition,

$$HIIT = 1 - \alpha \le \frac{UV_{ij}^m}{UV_{ij}^x} \le 1 + \alpha \tag{2}$$

$$VIIT = \frac{UV_{ij}^m}{UV_{ij}^x} < \operatorname{or} \frac{UV_{ij}^m}{UV_{ij}^x} > 1 + \alpha \qquad (3)$$

Where  $\alpha = 0.15$  or 0.25.

## 3.2. Logistic Performance Index (LPI)

The indicator that is taken from the World Bank Survey (2007) summarizes the performance of countries that capture the current logistics environment. They range from traditional areas such as customs procedures, logistics costs (such as freight rates), and infrastructure quality to new areas like the ability to track and trace shipments, timeliness in reaching a destination, and the competence of the domestic logistics industry. None of these areas alone can ensure good logistics performance. The selection of these areas is based on the latest theoretical and empirical research and on extensive interviews with logistics. The LPI and its indicators are given on a numerical scale, from 1 (worst) to 5 (best). This scale can also be used to interpret performance outcomes measures.

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#### 3.3. The Panel Data Model

There are several reasons for the increasing interest in panel data sets. An important one is that their use may offer a solution to the problem of bias caused by unobserved heterogeneity, a common problem in the fitting of models with cross-sectional data sets. A second reason is that it may be possible to exploit panel data sets to reveal dynamics that are difficult to detect with cross-sectional data. This paper employed static panel data model which can be specified as follows:

$$Y_{i}t = X_{i}t\beta + \lambda_{t} + \eta_{i} + \varepsilon_{it}, \qquad (4)$$
  
t=1,...,T; i=1,...,N

 $\lambda_t$  and  $\eta_i$  are time and individual specific effects respectively, x it is a vector of the explanatory variables, (i) is the time component of the panel, (N) is the cross section dimension (or the number of cross section observations), and N x T is the total number of observations. The idea is to run the models in order to have a consistent estimator for the  $\beta$  coefficients, and the model (fixed or random) choice depends on the hypothesis assumed for the relationship between the error term  $(\varepsilon_{it})$  and the regressors  $(x_{it})$ . The static panel data analysis developed in the empirical section of the paper was based on two basic panel models, the fixed (FE) and the random (RE) effect models. The FE estimator uses a transformation in order to remove the unobserved effects  $(\alpha_i)$  and any time constant explanatory variable. A general representation of a FE model is:

$$y_{it} = \beta_i x_{it} + \alpha_i + \varepsilon_{it} \tag{5}$$

Where i = 1,...N and t = 1,...T, where (x) represents the explanatory variables, (y) is the dependent variable and  $(\varepsilon_{it})$  the error term.

If we consider the average over time we have the following:

$$\bar{y}_{it} = \beta_i \bar{x}_{it} + \alpha_i + \bar{\varepsilon}_{it} \tag{6}$$

Subtracting (6) from (5) for each (t) we have:

$$y_{it} - \bar{y}_{it} = \beta_i (x_{it} - \bar{x}_{it}) + \varepsilon_{it} + \bar{\varepsilon}_{it} \tag{7}$$

or

$$\hat{y}_{it} = \beta_i \hat{x}_{it} + \hat{\varepsilon}_{it} \tag{8}$$

The FE transformation is called the within transformation and the FE estimator or the within estimator, which is the ordinary least square (OLS) estimation of equation (8), the pooled OLS. Under the assumption of strict exogeneity for the explanatory variables  $(E(\varepsilon_{it}/x_{it}, \alpha_i) = 0)$  the FE estimator is unbiased. If any explanatory variable is constant over time for all (i), it is swept away by the FE transformation ( $\hat{x}_{it} = 0$ ) the OLS estimation by FE also requires that the errors are homoskedastic and serially uncorrelated over time.

The RE estimator is more adequate if we think that the unobserved effect is not correlated with all the explanatory variables and the estimation is carried on by a generalized least square (GLS) estimation. The equation representing the RE model is:

$$y_{it} = \beta_0 + \beta_i x_{it} + \alpha_i + \varepsilon_{it} \tag{9}$$

If one thinks of the unobserved effect  $(\alpha_i)$ as uncorrelated with each explanatory variable  $(x_it)$  using a transformation (FE estimator) to eliminate  $(\alpha_i)$  will result in inefficient estimators. Estimation of equation (8) for  $(\alpha_i)$  uncorrelated with the explanatory variables is what we call the RE model. If one defines the composite error terms as  $(v_{it} = \alpha + \varepsilon)$ , equation (9) can be written as:

$$y_{it} = \beta_0 + \beta_i x_{it} + u_{it} \tag{10}$$

In this case we have to remember that  $(u_{it})$  are serially correlated over time and the pooled OLS estimator is not the choice since it ignores the positive serial correlation and the idea is to use the GLS to take into account to resolve the serial correlation problem. The GLS estimation will be a pooled OLS estimation of the transformed model, which can be represented as follows:

$$y_{it} - \lambda \bar{y}_{it} = \beta_0 (1 - \lambda) + \beta_i (x_{it} - \lambda \bar{x}_{it}) + (u_{it} - \lambda \bar{u}_{it})$$
(11)

Where  $\lambda = 1 - (\sigma_z^2(\sigma_z^2 + T\sigma_\alpha^2))$  for  $(\hat{x}_{it} = 0), 0 < \lambda < 1$ . One of the advantages of using such transformation and the RE model is that it allows for explanatory variables that are constant over time. By examining equation (4) one can relate the RE estimator (pooled OLS known as POLS) and FE where the POLS is obtained for the case where  $\lambda = 0$  (the unobserved effect,  $(\alpha_i)$  is not important) while the FE is the estimator for  $\lambda = 1$ . The choice between the FE and the RE estimators is based on whether the unobserved effects  $(\alpha_i)$  can be considered as parameters to be estimated or as an outcome of a random variable, suggesting the use of a FE or a RE model respectively.

## 3.3.1. Hausman Test

Given a model and data in which fixed effects estimation would be appropriate, a Hausman test tests whether random effects estimation would be almost as good. In a fixed-effects kind of case, the Hausman test is a test of H0: that random effects would be consistent and efficient, versus H1: that random effects would be inconsistent. (Note that fixed effects would be inconsistent.) The result of the test is a vector of dimension k  $(\dim(\beta))$  which will be distributed chi-square(k). So if the Hausman test statistic is large, one must use FE. If the statistic is small, one may get away with RE.

Hausman's specification test, or m-statistic, can be used to test hypotheses in terms of bias or inconsistency of an estimator. This test was also proposed by Wu (1973). Hausman'smstatistic is as follows. Given two estimators,  $\hat{\beta}_0$ and  $\hat{\beta}_1$ , where under the null hypothesis both estimators are consistent but only  $\hat{\beta}_0$  is asymptotically efficient and under the alternative hypothesis only  $\hat{\beta}_1$  is consistent, the m-statistic is:

$$m = \hat{q}(\hat{V}_1 - \hat{V}_0) - \hat{q} \tag{12}$$

where  $\hat{V}_1$  and  $\hat{V}_0$  represent consistent estimates of the asymptotic covariance matrices of  $\hat{\beta}_0$  and  $\hat{\beta}_1$  respectively, where:

$$q = \hat{\beta}_1 - \hat{\beta}_0 \tag{13}$$

The m-statistic is then distributed  $\chi^2$  with k degrees of freedom, where k is the rank of the matrix  $(\hat{V}_1 - \hat{V}_0)$ . A generalized inverse is used, as recommended by Hausman and Taylor (1982). The linear forms below are the specific model of this paper:

$$IITJP_{t} = \beta_{0} + \beta_{1}logwage_{t} + \beta_{2}FDIJP_{t-1} + \beta EXrate_{t} + \beta_{4}Industry_{t} + \beta_{5}DummyVIIT_{t} + \varepsilon_{t}$$
(14)

$$IITKR_{t} = \beta_{0} + \beta_{1}logwage_{t} + \beta_{2}gdpcap_{t-1} + \beta_{3}EXrate_{t} + \beta_{4}Industry_{t} + \beta_{5}Logistic_{t} + \beta_{6}DummuVIIT_{t} + \varepsilon_{t}$$
(15)

$$IITCH_{t} = \beta_{0} + \beta_{1}gdpcap_{t} + \beta_{2}Logistic_{t-1} + \beta_{3}Industry_{t} + \beta_{4}DummyVIIT_{t} + \varepsilon_{t}$$
(16)

Where:

IITJPt = IIT from Japan to ASEAN4 countries.

IITKRt = IIT from Korea to ASEAN4 countries.

IITCHt = IIT from China to ASEAN4 countries.

FDIJPt-1 = Japan's FDI to ASEAN4 countries, it is taken as lag form to avoid autocorrelation problem.

 $\log waget = \log form of wage.$  Log form is used to capture the growth.

EXratet = The exchange rate of ASEAN4 countries.

DUMMY = Dummy for the types of IIT; 1 for VIIT and 0 for HIIT.

(VIIT)t Industryt = Industrialization in ASEAN4 countries. It takes as percentage value of GDP (value added).

Logistict = Logistics Performance Index

(LPI) of ASEAN4 countries. It is the weighted average of the country scores on the six key dimensions: i) Efficiency of the clearance process ii) Quality of trade and transport related Infrastructure (e.g. ports, railroads, roads, information technology); iii) Ease of arranging competitively priced shipments; iv) Competence and quality of logistics services; v) Ability to track and trace consignments; vii) Timeliness of shipments in reaching destination.

#### $\beta_0 =$ Intercept.

 $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ =The variable's coefficients.

## 3.3.2. Explanation of the Models

Japan; Japan's Vertical IIT for ASEAN4 countries is expected to be determined from different factor of proportion, FDI inflows from Japan to ASEAN4, exchange rate depreciation in ASEAN4 (Japan will face cheaper products from ASEAN4) and the trend of industrialization in ASEAN4. Having said this, we expect to have positive and significant effect on log wage, FDI lag, EXrate and Industry. Japan's Vertical IIT's to ASEAN4 countries is also expected to be diminished over time due to the rapid expansion of production networks. This is captured by a negative sign on Dummy VIIT.

Korea; Korea's Vertical IIT for ASEAN4 countries is expected to be determined from different factor of proportion, good logistic performance in ASEAN4 countries, exchange rate depreciation in ASEAN4 (Korea will face cheaper products from ASEAN4) and the trend of industrialization in ASEAN4. Thus said, we expect to have positive and significant effect on log wage, GDP cap, Logistic, EXrate and Industry. The negative sign of Dummy VIIT captures the wage equalization.

China; China's Vertical IIT for ASEAN4 countries is expected to be determined from different factor of proportion, good logistic performance in ASEAN4 countries, and the trend of industrialization in ASEAN4 countries. So we expect to yield positive and significant effect on GDPcap, Logistic and Industry. The Dummy VIIT gives negative sign as it captures the wage equalization.

#### 3.3.3. Stationarity Test

This paper employs Hadri-Langrange Multiplier (LM) test which performs a test for stationarity in heterogeneous panel data (Hadri,2000). This Lagrange Multiplier (LM) test has a null of stationarity, and its test statistic is distributed as standard normal under the null. The series may be stationary around a deterministic level, specific to the unit (i.e. a fixed effect) or around a unit-specific deterministic trend. The error process may be assumed to be homoskedastic across the panel, or heteroskedastic across units. The test under the null of stationarity, considers the following hypotheses:

## H0: $\lambda = 0$ against H1: $\lambda > 0$

Where,  $\lambda = \sigma_u^2 / \sigma_e^2$  and and  $\sigma_u^2 = 0$  under the null. The Panel can be presented thus:

$$y_i = X_i B_i + e_i \tag{17}$$

Where,  $y'_i = [y_{i1} \dots y_{iT}], e'_i = [e_{i1} \dots e_{iT}]$  and  $X_i$  is a T x 1 unit (1) vector. The LM test is

$$LM = \frac{1}{N} \sum_{i=1}^{N} \frac{1/T^2 \sum_{t=1}^{T} 1S_{it}^2}{\sigma^{*2}}$$
(18)

Where  $\sigma^{*2}$  is the variance estimated from each individual sample and the partial sum of the residuals is  $S_{it} = \sum_{j=1}^{T} \varepsilon_{ij}$ .

## 4. Results and Discussion

## 4.1. The Threshold System

As it is already explained in section on methodology, the threshold system help us to differentiate the types of IIT. This essay combines two thresholds (15% and 25%) in order to have credible result. Table 1 summarizes the result.

The table is derived from traded goods between CJK and ASEAN4 countries that are already fragmented into parts and components.

Table 1:	Intra Inc	lustry Tra	de Calculation
$(UV_{ij}^m/UV_{ij}^m)$	)		
Country	Threshold	HIIT	VIIT
China	0.15	0.03125	0.96875
	0.25	0.03125	0.96875
Japan	0.15	0.03125	0.96875
	0.25	0.0625	0.9375
Korea	0.15	0.40625	0.59375
	0.25	0.46875	0.53125

Source: Author's own calculation from the year of 2000 to 2007

The HIIT and VIIT column is given as a proportion of all the Horizontal IIT and Vertical IIT on each CJK countries to ASEAN4 from the year 2000 to 2007. The Thresholds column gives classifies IIT into two threshold calculations which are 15% and 25%. Let us move on to see the details.

#### 4.1.1. 15% Threshold

m 11

(i) China's IITs to ASEAN4 countries are classified as Vertical IIT. We gain this conclusion since within the year of 2000 to 2007, Vertical IIT (96.88 %) dominated China's IIT compared with the one that are classified as Horizontal IIT (3.12 %); (ii) Japan's IITs to ASEAN4 countries are classified as Vertical IIT. This is taken as a conclusion since within the year of 2000 to 2007, Vertical IIT (96.88 %) dominated Japan's IIT compared with the one that are classified as Horizontal IIT (3.12 %); (iii) Korea's IITs to ASEAN4 countries are classified as Vertical IIT. This is true since within the year of 2000 to 2007, Vertical IIT (59.38 %) overwhelmed Korea's IIT compared with the one that are classified as Horizontal IIT (46.88 %).

## 4.1.2. 25% Threshold

(i) China's IITs to ASEAN4 countries are classified as Vertical IIT. We can say this since within the year of 2000 to 2007, VIIT (96.88 %) dominated China's IIT compared with the one that are classified as Horizontal IIT (3.12) Figure 1: Korea's VIIT to ASEAN4 (Parts and Components)



Source: Author's own calculation from the year of 2000 to 2007

%); (ii) Japan's IITs to ASEAN4 countries are classified as Vertical IIT. The year of 2000 to 2007 is proving the dominance of Vertical IIT (93.75 %) on Japan's IIT compared with the one that are classified as Horizontal IIT (6.25)%); (iii) Korea's IITs to ASEAN4 countries are classified as Vertical IIT. This can be seen from the minor dominance of Vertical IIT (53.13 %)on Korea's IIT from the year of 2000 to 2007, compared with the one that are classified as Horizontal IIT (46.88 %). If we break down the individual relations above into figures, we might find unique characteristics for each country.

Korea has more focus on expanding her capacity in machinery and transport equipment to ASEAN4 countries. She is doing Vertical IIT mostly to Philippines followed by Thailand, Indonesia and Malaysia at the ground level (see Figure 3). When it comes to parts and components, Korea and Japan are alike in a way that they put priority in income gap rather than quality. This explains why Philippines is on the highest ground compared with Thailand, Malaysia and Indonesia that have higher RCAs. As we see Indonesia, her ranking is gone through like roller coaster. At the end of the last period on data analysis, her position is taken over by Philippines and Thailand. This fact will pose a serious problem in the future if Indonesia does not seriously make sound policy in capturing the potential gains from the Vertical IIT.

## 4.2. Panel Data Model-Regression Result

This section will serve us in describing the result from the regression. As the model is differentiated into three parts, we will analyze the result individually for Japan, Korea and China.

## 4.2.1. Japan

From Table 2 we can see that Exrate yields positive and significant impact to the Japan's Vertical IIT to ASEAN4 while Log wage gives negative one. This result concludes that the flow of Vertical IIT from Japan is a result of the difference in wage. A bigger gap in wage will lead to higher Vertical IIT. We also have exchange rate depreciation to determine the Vertical IIT as it lowers the price of exports in ASEAN4 countries. As a result, Japan is facing cheaper product from ASEAN4 countries. Since trade in "vertically differentiated" products distinguished by quality and price, cheaper price is a certain factor for the rise in Vertical IIT. Or to put in other words, the exchange rate depreciation clearly increases the share of Vertical IIT.

As already explained in section two, product fragmentation increases the wage rate in countries where labor is a relatively abundant production factor, while it lowers the wage rate in countries where capital is abundant. This eventually equalizes the wage rate between two countries in the long term. The negative sign in VIIT dummy captures this wage-equalization phenomenon. As a result, in the long run, we might see a pattern change in IIT, from vertical to horizontal. From the result of Hausman specification test in Table 3 (significant P-value, Prob<chi2 smaller than .05) we can conclude that this model serves best when it applies fixed effect.

Table 2: Regression Result-Japan				
Dependent Var	iable: VIIT (Ja	pan to ASEAN4)		
Independent	Coefficient	Std-Error		
Variable				
Log wage	-0.0605519	.0226732***		
LagFDI(Japan	0.0000111	0.000028		
to ASEAN4)				
EXrate	0.0000503	.0000145***		
GDPCap	-0.00000668	0.0000508		
INDUSTRY	-0.005898	0.0041245		
DUMMY	-0.2170011	0935702**		
VIIT				
Constant	. 1.508339	.1266762 ***		
R-Square	0.685			

Note: Statistical significance is indicated by \*(10%), \*\*(5%), and \*\*\*(1%)

Table 3: Hausman Specification Test for Model 1 (Japan)

Test: Ho: difference in coefficients not sys-
tematic
$chi2(5) = (b-B)'[(V_b - V_B)^{(-1)}](b-B) =$
34.44
$\mathrm{W}~\mathrm{Prob}{>}\mathrm{chi2}=0.0000$
$(V_b - V_B \text{ is not positive definite})$

#### 4.2.2. Korea

Table 4 gives us the picture of the determinants of Korea's Vertical IIT to ASEAN4 countries. We have log wage and GDP cap to yield negative and significant impact. This result concludes that the flow of Vertical IIT from Korea is a result of the difference in wage and also the income gap. The bigger gap will lead to higher Vertical IIT. Logistic gives positive and significant impact with a high coefficient. This means that Korea's Vertical IIT to ASEAN4 is largely influenced by the following factors: efficiency of customs clearance process, quality of trade- and transport-related infrastructure, ease of arranging competitively priced shipments, quality of logistics services, ability to track and trace consignments, and frequency with which shipments reach the consignee within the scheduled time. The positive sign in the Exrate means that exchange rate depreciation gives rise to the Vertical IIT as it lowers the price of exports in ASEAN4 countries. As a result, Korea is facing cheaper product from ASEAN4 countries. Cheaper price is certainly giving a pronounce effect for the Vertical IIT. The negative sign in Dummy VIIT captures the wage-equalization phenomenon as a result for the product fragmentation. Consequently, in the long run, we might see a pattern change in IIT, from vertical to horizontal. The Hausman specification test in Table 5 (insignificant P-value, Prob>chi2 larger than .05) suggests the model to use random effect.

## 4.2.3. China

From Table 6 we have Logistic to give positive sign with high coefficient. This concludes that China's Vertical IIT to ASEAN4 is largely influenced by the following factors: efficiency of customs clearance process, quality of trade- and transport-related infrastructure, ease of arranging competitively priced shipments, quality of logistics services, ability to track and trace consignments, and frequency with which shipments reach the consignee within the scheduled time. GDP cap yields negative and significant im-

 Table 4: Regression Result-Korea

Dependent Variable: VIIT (Japan to ASEAN4)					
Independent	Coefficient	Std-Error			
Variable					
Dependent					
Variable:					
VIIT (Korea					
to ASEAN4)					
Independent	Coefficient	Std-Error			
Variable					
Log wage	-0.0778114	.027631***			
GDP cap	-0.0001124	.0000325***			
Logistic	0.8151397	.2137982***			
EXrate	0.0000557	.0000171***			
INDUSTRY	-0.0099362	0.0081155			
Dummy	-0.1504774	$.0207578^{***}$			
VIIT					
Constant	-0.4232231	.3494754 ***			
R Square:	0.832				
Noto: Statistic	al gignificanco	ig indicated by			

Note: Statistical significance is indicated by \*(10%), \*\*(5%), and \*\*\*(1%)

Table 5: Hausman Specification Test for Model 2 (Korea)

Test: Ho: difference in coefficients not sys-
tematic
$chi2(5) = (b-B)'[(V_b - V_B)^{(-1)}](b-B) =$
4.30
W Prob>chi2 = $0.5077$
$(V_b - V_B \text{ is not positive definite})$

Table 6: Regression Result-China					
Dependent Va	riable: VIIT (J	apan to ASEAN4)			
Independent	Coefficient	Std-Error			
Variable					
Dependent					
Variable:					
VIIT (China					
to ASEAN4)					
Independent	Coefficient	Std-Error			
Variable					
LOGISTIC	0.732313	.1538419***			
GDPCap	-0.0001377	.0000216 ***			
INDUSTRY	0.0194726	.0048122***			
Dummy	-0.2340283	.0871763***			
VIIT					
Constant	-1.984063	.2995903 ***			
R-squared	0.9044				
-Overall					

Note: Statistical significance is indicated by \*(10%), \*\*(5%), and \*\*\*(1%)

pact. This result concludes that the flow of Vertical IIT from China is a result of the income gap. But it is important to note China and ASEAN4 countries are actually lying on the same income classification (middle income countries). Having said this, we will not see a pronounce effect of the income gap affecting the Vertical IIT. This fact is captured by relatively small coefficient for the GDP cap. The negative sign in Dummy VIIT serves to capture the wage-equalization process. To determine the right treatment for the model (whether to have random or fixed effect), the Hausman specification test is employed. From the result in Table 7 (significant P-value, Prob<chi2 smaller than .05) we can conclude that this model serves best when it applies fixed effect.

#### 4.3. Stationarity Result

Hadri-LM test result in table 8 gives mixed conclusion for each variables. Log wage, Industry, Intra Industry Trade (China, Japan and Korea), FDI and exchange rate are stationary while GDPcap and Logistic are non-stationary. Table 7: Hausman Specification Test for Model 3 (China)

Test: Ho: difference in coefficients not sys-
tematic
$chi2(5) = (b-B)'[(V_b - V_B)^{(-1)}](b-B) =$
12.00
$\mathrm{W}~\mathrm{Prob}{>}\mathrm{chi2}=0.0074$
$(V_b - V_B \text{ is not positive definite})$

Table 8: Hadri	LM-Test Result
Variable	Result
log Wage	Stationary
Logistic	Non-Stationary
Industry	Stationary
GDPcap	Non-Stationary
Intra Industry Trade	Stationary
FDI	Stationary
Exchange Rate	Stationary

Since the assumption that all series are stationary is strong, and can be violated if even one of the series in differences exhibit nonstationary behavior, we can conclude that we have non-stationary series. But, according to Hall and Mairesse (2002), as long as the model has homoskedasticity and robustness to normality; the model implies the absence of unit root, or stationarity. Figure 2, 3 and 4 show that all models are homoskedastic, implying the absence of unit root.

#### 5. Conclusion

The regression result concludes the three models. For the case of Japan's Vertical IIT to ASEAN4, it is found that the growth of wage,

1	Figure 2:	FGLS	Regres	sion (Jaj	ban)		
ross-sectional	time-series	FGLS reg	ression				
coefficients: canels: correlation:	generalized homoskedasti no autocorre	least squa c lation	ares				
stimated covar stimated autoc stimated coeff	iances orrelations icients	= = =	1 0 6	Number of ol Number of g Obs per grou	os roups up: min avg max	=	31 4 7 7.75 8
				Wald chi2(5) Prob > chi2	)	-	67.42 0.0000

rigure o: Cross-sectional time-series	FGLS real	regres	sion (Korea)	)	
Coefficients: generalized Panels: homoskedast Correlation: no autocorre	least squa ic elation	ares			
Estimated covariances Estimated autocorrelations Estimated coefficients	=	1 0 7	Number of obs Number of groups Time periods Wald chi2(6) Prob > chi2	= = =	32 4 158.44 0.0000

Figure 3: FCIS Regression (Korea)

Figure 4: FGLS Regression (China) Cross-sectional time-series FGLS regression								
Coefficients: generalized Panels: homoskedast Correlation: no autocorre	least squa ic elation	ires						
Estimated covariances Estimated autocorrelations Estimated coefficients	= = =	1 0 5	Number of obs Number of groups Time periods Wald chi2(4) Prob > chi2	= = = =	32 4 302.68 0.0000			

and exchange rate in ASEAN4 countries play significant role. While for the case of Korea, logistic performance, exchange rate and income gap contribute more. In China's case, logistic performance, income gap and exchange rate, and industrialization process, give more pronounce effect.

From each of the cases, we can draw a clear silver line that logistic performance and the difference in wage or income are major determinants for the CJK's Vertical IIT trend in ASEAN4 countries. Income and wage gap are already unique characteristics of Vertical IIT motivation. The gap will eventually diminish along with the expansion of the production networks (fragmentation). So we can see a more horizontal relationship replacing the vertical one in the future. This phenomenon is captured by the negative sign of Dummy VIIT.

This finding supports the work of Jones and Kierzkowski (2001). They argue that the change in price of production factors is caused by the increase of fragmentation. They see that fragmentation improves welfare in two ways. First, it increases the wage rate in countries where labor is a relatively abundant production factor, while it lowers the wage rate in countries where capital is abundant. This eventually equalizes the wage rate between two countries in the long term. Second, the development of fragmentation raises productivity through a realization of the scale economy. Even assuming that the fragmentation is induced by FDI, and that a part of the benefit from FDI is refluxed to the investing country as reward of capital, the fragmentation still contributes to a rise of income through the increase in wage rates and job opportunities. Or to put it in colloquial manner, as the production networks expand in the region, the income gap is expected to diminish in the future. Having said this, we might see a more homogeneous environment in the future with Horizontal Intra Industry Trade. Since the development of fragmentation enhances welfare, the policy to provide a favorable condition for developing fragmentation should be a common goal for East Asian countries.

Logistic performance on the other hand, is a variable that needs to be prepared seriously. Having said this, the ASEAN4 countries need to shape themselves to perform better logistic performance. Indonesia, Philippines, Thailand, and Malaysia are ranked 75, 44, 35, and 29 respectively according to the international Logistic Performance Index (LPI) ranking from 155 countries being surveyed. The modest figure is certainly not enough and leaving the region to mount serious challenge on the process of regionalism.

Nonetheless, looking at the overall result, it is fair to say that Vertical IIT among the ASEAN+3 countries has been progressing at a strong pace over the past 10 years. Vertical IIT is a very crucial component for regional integration in East Asia. By relocating its production offshore to South East Asia countries, CJK is spurring regionalization within East Asia. This gap is fueling the Vertical IIT process which actually incorporating different factor proportion across country. From this fact, we can conclude that regionalism in East Asia is driven by the market or in other words, the bottom up process of regionalism. But, this alone is not enough. The process should be matched with the top down process which assembles leaders and policy makers into one table of negotiation.

Regionalism in East Asia will enable the region to cope with the future challenges of globalization and remain internationally competitive. An integrated East Asia would lead to the advancement in economies of scale, fuller development of production networks. Moreover, Chia (2007) states that East Asian regionalism could hold close the less developed East Asian economies which would otherwise become marginalized as they lack the attraction of sizeable market and lack negotiating resources.

Having said this, institution lead regionalism should replace the existing market lead regionalism. This is important not only to have East Asia as one block of countries that has powerful political and economic abilities but also to create sustainability with the shared welfare among the members. As the former Indonesian Minister of Foreign Affairs Ali Alatas said in 2001, ASEAN plus three is equal to peace plus prosperity as it can contribute substantively to the achievement and maintenance of sustained and sustainable peace, stability and security and welfare in this part of the world.

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