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**Modified Grubel-Lloyd Index:  
Intra-industry Trade and Intra-regional Trade in East Asia**

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# **Modified Grubel-Lloyd Index: Intra-industry Trade and Intra-regional Trade in East Asia**

## **Abstract**

Intra-industry trade (IIT) has increased significantly in the world trade. Meanwhile, intra-regional trade has also risen in parallel with the proliferation of regional economic integrations. One of the prominent empirical tools widely employed to analyze IIT is the Grubel-Lloyd index (Grubel and Lloyd [1975]). This paper aims to examine the intra-industry trade in the intra-regional trade in East Asia. *Firstly*, we modify the Grubel-Lloyd index by considering intra- and inter-regional trade. *Secondly*, the modified index is then applied to investigate IIT in East Asia. We find that the intra-industry trade has increased significantly in the region. The increases are greater in the intra-regional trade than in the inter-regional trade. The inter-industry trade of Japan and Indonesia is still dominant in both intra- and inter-regional trade. In contrast, in the case of the Philippines, its intra-industry trade has overtaken the inter-industry trade in both intra- and inter-regional trade.

JEL: F10, F14, F17.

Keywords: intra-industry trade, intra-regional trade, Grubel-Lloyd index

## **1. Introduction**

The Heckscher-Ohlin model in international trade imposes very strict assumptions<sup>1</sup>. Two most important ones are that the production of each commodity follows constant returns to scale (CRS) and the markets for commodities and factors are under perfect competition. However, such strict assumptions are difficult to fulfill in the real world. Several new approaches relaxing the assumptions have emerged including the imitation lag hypothesis (Posner [1961]), the flying geese model (Akamatsu [1961, 1962]), the product cycle theory (Vernon [1966]), the Linder theory (Linder [1961]), the gravity model (Tinbergen [1962]) the Krugman model (Krugman [1979]), and the reciprocal dumping model (Brander [1981]; Brander and Krugman [1983]), among others. The existence of widespread economies of scale may be obtainable from the different sizes of plants. Market distortions, such as tariff and non-tariff barriers, still exist widely. Since the 1960s, the discourses about economies of scale and imperfect competition in

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<sup>1</sup> The model assumes two countries-two homogenous goods-two homogenous factors of production (2x2x2 model), identical technology, constant returns to scale (CRS), different factor intensities, identical tastes and preferences (utility functions), perfectly competitive markets, perfect mobility of factors of production within each country and their perfect immobility between the two countries, zero transportation costs, and no trade barrier or no policy restriction.

the theory of international trade have taken much attention. Verdoorn [1960], Balassa [1963, 1966, 1967] and Grubel [1967], among others, examined the effects of tariff reductions on the pattern of specialization. Kojima [1964] investigated the increasing and the pattern of international trade among advanced countries. In this context, the concepts of intra- and inter-industry trade become significant to be considered. The intra-industry trade is defined as trade in the same industry; in contrast, inter-industry trade is defined as trade among different industry.

There have been changes in the pattern of world trade due the development of technology in transportation and communication (information technology, IT). World becomes borderless. Transaction costs in international trade have greatly decreased. Searching a country's comparative advantage may not focus on final products anymore but may focus on intermediate products. International production fragmentation has become an interesting phenomenon<sup>2</sup> in East Asia. It is defined as cross-border dispersion of component production/assembly within the vertically integrated production process, with each country specializing in particular stage of the production sequence (Athukorala and Yamashita [2006]). The international production sharing is strongly supported by the belief, that the most important determinant of productivity (economies of scale) or unit costs is not the size of plant but the organization of production within a plant for a given size (Verdoorn [1960]).

Having this large number of production sharing activities, East Asia is sometimes called as the East Asia's de facto economic integration. Intra-regional trade, especially in parts and components industry, has increased. Assembly activities have increased drastically in the region. Gaulier *et al.* [2006] found that vertical production/distribution

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<sup>2</sup> The alternative names are frequently used such as 'vertical specialization' (Hummels *et al.* [2001], Yi [2003]), 'slicing the value chain' (Krugman [1995]).

networks in the region have formed a “triangular trade” pattern, where the multinational corporations (MNCs) use China as an export base for the final assembly, in order to export final goods to the United State (US) and the European Union (EU). As far as regionalism, trade liberalization, and economies of scale are concerned, intra-industry trade and intra-regional trade become an important issue in East Asia. This paper aims to examine the phenomena of intra-industry trade and intra-regional trade in East Asia<sup>3</sup>. Specifically, this paper is addressed to answer some questions. *First*, has the intra-regional trade had bigger portion than the inter-regional trade in the region? Spirit of regionalism and trade liberalization through free trade agreements (FTA: the ASEAN-China FTA, the ASEAN-Korea FTA) and comprehensive economic partnership agreements (CEP: the ASEAN-Japan CEP) among countries can push the trade flows in the region. Trade creation and trade diversion considerably affect the trade pattern in the region. *Second*, has the intra-industry trade been stronger in the intra-regional trade rather than in the inter-regional trade?

The rest of this paper is organized as follows. Part 2 describes trends in the inter- and intra-regional trade in the East Asia region, the European Union (EU), the North America Free Trade Area (NAFTA) and the Rest of the World (ROW). Part 3 shows the methodology. In this part, we describe the modification of the Grubel-Lloyd index. The modified index incorporates the intra- and inter-regional trade. It is applied to analyze the trade patterns of the East Asian countries. The calculation results and analysis are exhibited in Part 4. Finally, concluding remarks are presented in Part 5.

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<sup>3</sup> In this paper, the East Asia consists of Japan, China, Hong Kong, Korea, Singapore, Indonesia, Malaysia, Thailand, the Philippines.

## **2. Trends in the Intra- and Inter-regional Trade**

The regional trade depends on the complementarities of countries in the region. Many empirical researches applying the gravity model, e.g. Feenstra [1998] and Ng and Yeats [2003], among others, commonly suggest that the most important trade partners of a specific country are countries with short-geographical distance, large economic distance (gap of GDP), relatively similar language, etc. Hence, neighbor countries with large number of complementarities are potential trade partners. Ng and Yeats [2003] found a negative relationship between bilateral trade intensity and the geographical distance. The WTO [2007] found that the inter-regional trade flows between North America, Europe and Asia accounted for only 23 percent of the world trade in 2006. Meanwhile, the intra-regional trade flows of the three regions took 53 percent of the world trade and almost two third of the total trade of these regions. In addition, the Europe's intra-regional trade represented the highest share (31 percent), followed by Asia (14 percent) and North America (8 percent), while the other regions (Commonwealth of Independence States, South and Central America, Middle East and Africa) account only for 2.5 percent of their total exports in the same period.

The increasing regional trade has also affected by the existing trade agreements and cooperation among countries. Regionalism and economic integration have proliferated since the 1980-s and 1990-s. The special treatments among member countries in such regionalism and economic integration, to some extent, have encouraged intra-regional through trade creation and trade diversion (Viner [1950]). Fruedenberg and Paulmier [2006] found that East Asia as a whole is more protected region compared with the NAFTA and the EU. Ironically, they also found that East Asia discriminates against itself vis-à-vis these two major regions. For All products, East Asia imposed higher tariff

on commodities originating from East Asia itself (7.4%) than that from the NAFTA (5.5%) and the EU (7.2%). The EU imposed lower tariff on commodities originating from the EU itself (1.9%) than that from the East Asia (7.6%) and the NAFTA (7.7%). Similarly, the NAFTA imposed lower tariff on commodities originating from the NAFTA itself (0.7%) than that from the East Asia (5.7%) and the EU (5.3%). Relatively higher tariffs have been imposed in the sensitive sector i.e. Agriculture, Food and beverages and Light industry.

Figure 1 describes the trends in intra- and inter-regional trade flows (based on exports and imports data) in the East Asian region, the NAFTA, the EU and the rest of the world (ROW). Intra-regional trade in the EU (in both exports and imports) was very high around 66% for 1991-2006. In the early 1980, inter-regional trade flows of the East Asia and the NAFTA were around 70% of their total trade flow, meanwhile intra-regional trade was only around 30%. However, there have been upward trends in the intra-regional trade of the both regions. In exports, the NAFTA had slightly higher increases in intra-regional trade compared with the East Asia. The NAFTA recorded intra-regional trade around 54%; meanwhile the East Asia had intra regional trade about 44% in 2006. However, in the case of imports, the East Asia had higher intra-regional trade (i.e. about 49% in 2006) than that of the NAFTA (i.e. about 34% in 2006).

In the case of East Asia and the NAFTA, increasing intra-regional trade flows in exports have been followed by increasing intra-regional trade in imports. Reallocation of industries (especially low level of technology industries, labor-intensive industries) from the US and Japan to Mexico have created higher exports of these products from Mexico to mainly the US. The Japanese investments to the US are mainly ‘anti-trade’ type of investments (Kojima [1995]). These investments required products from the East Asian

countries. As the result, the NAFTA's imports from East Asia are higher than from the EU or the ROW.

**Figure 1. about here.**

### **3. Methodology**

In the previous Part, we have shown the increasing portion of intra-regional trade in the East Asia, the EU and the NAFTA. We will analyze further the pattern of intra- and inter-regional trade in the East Asia. Are they more dominated by the intra- or inter-industry trade? In this Part, we modify the Grubel-Lloyd index of intra- and inter-industry trade by incorporating intra- and inter-regional trade.

#### **3.1. Data**

This paper uses data on exports and imports by commodities, by exporter countries and by importer countries taken from the UN-COMTRADE for the periods 1980, 1985, 1990, 1995, 2000 and 2006. The classification of commodities follows 3-digit SITC Revision 2, consisting 239 groups of products. This classification is chosen because it provides us with the long-range availability of data. In analyzing intra- and inter-industry trade in East Asia, this paper focuses the nine exporter and importer countries, i.e. Japan, Korea, Hong Kong, China, Singapore, Indonesia, Malaysia, Thailand and the Philippines.

#### **3.2. Trade by industry and trade by region**

Many researches have been conducted to analyze the phenomena of intra-industry trade. Grubel and Lloyd [1971] examined the intra-industry trade in the cases Australia and the major industrial countries of OECD. Greenaway and Milner [1981] investigated the trade balance effects in the measurement of intra-industry trade. Hamilton and Kniest



[1991] analyzed the relationship between trade liberalization and the levels of IIT, i.e. whether trade liberalization under Australia-New Zealand Closer Economic Relations (CER) has encourage more IIT. So far, regional aspects (inter- and intra regional trade) are left to be examined. This paper, therefore, combines trade by industry and trade by region, as depicted in Figure 2. Trade by industry consists of intra-industry trade (IIa) and inter-industry trade (IIe). Meanwhile, trade by region covers intra-regional trade (IRa) and inter-regional trade (IRe). Figure 2 shows the four possible combinations i.e. (A) Intra-industry trade in intra-intra regional trade, (B) Intra-industry trade in inter-regional trade, (C) Inter-industry trade in intra-regional trade, (D) Inter-industry trade in inter-regional trade.

**Figure 2. about here.**

This paper analyses trade by regions i.e. the East Asia (EA consisting the nine East Asian countries), the European Union (EU) and the North American Free Trade Area (AFTA). The three regions have very big shares in the total world trade. In 2006, almost 83% of the world trade was dominated by the three regions. Intra-regional trade is trade within region; meanwhile, inter-regional trade is trade among countries in the different regions. For example, intra-regional trade of East Asia is trade among countries in East Asia; and inter-regional trade of East Asia is trade between East Asian countries and non-East Asian countries. Their shares in the total exports or imports describe the importance of intra-regional trade and inter-regional trade.

Trade by industry consists of intra- and inter-industry trade. This paper uses the definition of industry corresponding with the 3-digit SITC Revision 2. At 3-digit level of aggregation of the SITC, the resultant aggregates of internationally trade goods roughly match to ‘industries’, as the concept is used commonly in economic empirical analysis

(Grubel and Lloyd [1975]). Accordingly, intra-industry trade is defined as trade in the same industry or in the same SITC. In contrast, inter-industry trade is trade in the different industry or in the different SITC.

### 3.3. The measurement of intra- and inter-industry trade

We apply a measurement of inter-industry trade (Iie) and intra-industry trade (IIa) by Grubel and Lloyd [1975]<sup>4</sup>. However, we consider the export destination markets (in the case of exports, X) or the region source of imports (in the case of imports, M) to incorporate intra-regional trade or inter-regional trade (shown by the subscript k) in the analysis. Inter-industry trade is defined as net exports or imports of an industry,  $|X_{ijk} - M_{ijk}|$ . Meanwhile, intra-industry trade is defined as the value of exports of the industry, which is exactly matched by the imports of the same industry,  $(X_{ijk} - M_{ijk}) - |X_{ijk} - M_{ijk}|$ . It is clear that intra industry trade is the value of total trade  $(X_{ijk} + M_{ijk})$  remaining after subtraction of the net exports or imports of the industry  $|X_{ijk} - M_{ijk}|$ . For comparative study, for example across countries, it may be useful to describe inter- and intra-industry trade as portion of the total trade. Comparisons regarding different industries and countries will be easier. The measures of inter- and intra-industry trade are respectively formulated as follows (Grubel and Lloyd [1975:21]):

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<sup>4</sup> There are other measurements of intra-industry trade trade such as the ones proposed by Verdoorn [1960],  $U_{ij} = \frac{X_{ij}}{M_{ij}}$ ; Balassa [1966],  $\bar{D} = \left(\frac{1}{n}\right) \sum_i \left[ \frac{|X_{ij} - M_{ij}|}{X_{ij} + M_{ij}} \right]$ ; and Michaely [1962],  $\bar{E}_{ij} = \sum_i \left| \frac{X_{ij}}{\sum_i X_{ij}} - \frac{M_{ij}}{\sum_i M_{ij}} \right|$  or  $\bar{F}_{ij} = 1 - \frac{1}{2} \sum_i \left| \frac{X_{ij}}{\sum_i X_{ij}} - \frac{M_{ij}}{\sum_i M_{ij}} \right|$ ; Lineman [1966],  $G_{ij} = \frac{\sum_i (X_{ij} M_{ij})}{\left( \sum_i X_{ij}^2 \sum_i M_{ij}^2 \right)^{\frac{1}{2}}}$ , among others. See, for examples Grubel and Lloyd [1975], Brühlhart [1994] and Kol and Mennes [1986], for the very good discussion on the measurements.

$$\Pi e_{ijk} = \frac{|X_{ijk} - M_{ijk}|}{(X_{ijk} + M_{ijk})} * 100 \quad (1)$$

$$\begin{aligned} \Pi a_{ijk} &= \frac{(X_{ijk} + M_{ijk}) - |X_{ijk} - M_{ijk}|}{(X_{ijk} + M_{ijk})} * 100 \\ &= \left( 1 - \frac{|X_{ijk} - M_{ijk}|}{(X_{ijk} + M_{ijk})} \right) * 100 \end{aligned} \quad (2)$$

where i, j and k are industry (SITC), country, the exports destination markets or the region source of imports, respectively. As far as this research only focuses on trade in the East Asian region, k can be East Asian regions (intra-regional trade) or non-East Asian region (inter-regional trade).  $X_{ijk}$  is the country j's value of exports of industry i to region k; meanwhile  $M_{ijk}$  is country j's value of exports of industry i from region k. The indexes of both intra- and inter-industry trade range from 0 to 100 (%). In an industry, when the exports exactly equal imports,  $\Pi a$  is 100. When there are exports but no imports, or vice versa,  $\Pi a$  is 0<sup>5</sup>.

### 3.4. Adjustment of FOB or CIF

In the real world, exports and imports are valued using different measurements. Exports are measured by FOB (free on board), meanwhile imports are measured by CIF (cost, insurance and freight). Theoretically, the values of exports and imports in the intra-regional trade must be the same. For example, the values of exports and imports in the intra-regional trade in the East Asia must be the same. In fact, they are different due to evaluations made by FOB and CIF. To measure intra- and inter-industry trade, therefore, both exports and imports should be valued consistently in FOB or in CIF (Grubel and Lloyd, 1975). Of the two, FOB valuations are preferable because they measure the value

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<sup>5</sup> Neither exports nor imports exist; the measures  $\Pi a$  and  $\Pi e$  (as portion of total trade) are not defined. However, if it is not described as portion of total trade, the inter-regional trade  $|X_{ijk} - M_{ijk}|$  and the intra-regional trade  $(X_{ijk} + M_{ijk}) - |X_{ijk} - M_{ijk}|$  are zero.

of commodities produced in each industry, excluding the value added by international transporters of the home countries or of a third foreign country.

The UN-COMTRADE records exports in FOB and imports in CIF. Therefore, this paper makes adjustments from the imports CIF to the imports FOB by employing the procedure as follows. *First*, using data of exports and imports 3-digit SITC for intra-regional trade (trade among East Asian countries) and inter-regional trade (trade between East Asian countries and ROW), the adjustment coefficients are calculated:

$$\alpha_{ikl} = \frac{X_{ikl}}{M_{ikl}} \quad (3)$$

where  $\alpha_{ikl}$  is the region's k adjustment coefficient industry i for region l.  $X_{ikl}$  and  $M_{ikl}$  are region k's exports value for region l and import value from region l, respectively. Therefore, if l equal to k,  $\alpha_{ikk}$  is the adjustment coefficient for intra-regional trade. In contrast, if l is different from k,  $\alpha_{ikl}$  is the adjustment coefficient for inter-regional trade. *Second*, from the fact that exports are FOB and imports is CIF, it is the case that

$\alpha_{ikl} = \frac{X_{ikl}}{M_{ikl}} \approx \frac{FOB_{ikl}}{CIF_{ikl}}$  or  $CIF_{ikl} \approx \frac{FOB_{ikl}}{\alpha_{ikl}}$ . Therefore, country j's (which belongs to region k) imports of industry i from region l can be expressed in term of FOB by applying the following formula:

$$M_{ijl}^{FOB} = \frac{M_{ijl}}{\alpha_{ijl}} \quad (4)$$

Substituting (4) into (1) and (2), the inter-industry trade and intra-industry in the inter-regional and intra-regional trade are formulated as follows (country j is belongs to region k):

- Inter-industry trade in inter-regional trade:

$$\Pi e_{ijl} = \frac{\left| X_{ijl} - \frac{M_{ijl}}{\alpha_{ikl}} \right|}{\left( X_{ijl} + \frac{M_{ijl}}{\alpha_{ikl}} \right)} \times 100 \quad (5)$$

- Inter-industry trade in intra-regional trade:

$$\Pi e_{ijk} = \frac{\left| X_{ijk} - \frac{M_{ijk}}{\alpha_{ikk}} \right|}{\left( X_{ijk} + \frac{M_{ijk}}{\alpha_{ikk}} \right)} \times 100 \quad (6)$$

- Intra-industry trade in inter-regional trade:

$$\Pi a_{ijl} = \left( 1 - \frac{\left| X_{ijl} - \frac{M_{ijl}}{\alpha_{ikl}} \right|}{\left( X_{ijl} + \frac{M_{ijl}}{\alpha_{ikl}} \right)} \right) \times 100 \quad (7)$$

- Intra-industry trade in intra-regional trade:

$$\Pi a_{ijk} = \left( 1 - \frac{\left| X_{ijk} - \frac{M_{ijk}}{\alpha_{ikk}} \right|}{\left( X_{ijk} + \frac{M_{ijk}}{\alpha_{ikk}} \right)} \right) \times 100 \quad (8)$$

### 3.5. The aggregation

The most useful statistic for summarizing the distribution of the calculation results of the equations (5), (6), (7) and (8) is the mean. We apply the weighted mean. The weights are the relative size of exports plus imports of each industry in the total value of exports plus imports of the set of n industries (in this paper n=239 SITC). Therefore, in the weighted mean of (5), (6), (7) and (8) are:

- Inter-industry trade in inter-regional trade:

$$\overline{\Pi e}_{ijl} = \frac{\sum_i^n \Pi e_{ijl} (X_{ijl} + \frac{M_{ijl}}{\alpha_{ikl}})}{\sum_i^n (X_{ijl} + \frac{M_{ijl}}{\alpha_{ikl}})} \quad (9)$$

- Inter-industry trade in intra-regional trade:

$$\overline{\Pi e}_{ijl} = \frac{\sum_i^n \Pi e_{ijk} (X_{ijl} + \frac{M_{ijk}}{\alpha_{ikk}})}{\sum_i^n (X_{ijk} + \frac{M_{ijk}}{\alpha_{ikk}})} \quad (10)$$

- Intra-industry trade in inter-regional trade:

$$\overline{\Pi a}_{ijl} = \frac{\sum_i^n \Pi a_{ijl} (X_{ijl} + \frac{M_{ijl}}{\alpha_{ikl}})}{\sum_i^n (X_{ijl} + \frac{M_{ijl}}{\alpha_{ikl}})} \quad (11)$$

- Intra-industry trade in intra-regional trade:

$$\overline{\Pi a}_{ijl} = \frac{\sum_i^n \Pi a_{ijk} (X_{ijl} + \frac{M_{ijk}}{\alpha_{ikk}})}{\sum_i^n (X_{ijk} + \frac{M_{ijk}}{\alpha_{ikk}})} \quad (12)$$

#### 4. Results and Analysis

Theoretically, if countries have constant marginal rates of transformation (shown by the straight lines of production possibility frontier, PPF), they will have complete specializations, i.e. only producing products with comparative advantage and importing products with comparative disadvantage. In contrast, if countries have increasing rates of transformation (shown, for example, by concave PPF), they will have partial specializations, i.e. producing and importing the same products. It is difficult to find a country with a complete specialization. In East Asia, Brunei Darussalam might be close

to the case. It has the export specialization only on oil products but imports almost all traded products.

Market forces affect trade patterns. Trade in the different industry (inter-industry trade) might increase due to homogeneity of products, imperfect competition and economies of scale. *First*, the homogeneity of products means that products from, say, countries A and B are perfect substitutes. As they are not differentiated, countries A and B will compete with each other on that product; those two countries must eventually determine the product with comparative advantage. As a result, countries will have trade in the different products. *Second*, imperfect competition always means the existence of 'market power' (Samuelson and Nordhaus [2001:183]). For example in the monopoly market, the supplier has 'market power' to set the price of product. Imperfect competition might happen due to government regulations or policies such as trade barriers (tariff or non-tariff barriers) and industrialization of import substitution, etc. To protect the infant industries in the imports substitution strategy, a government commonly imposes very high tariff on the imports. The government also gives incentives such as tax exemption, input subsidy, credit, etc. Since domestic markets are supplied by the infant industry, countries are obliged to have inter-industry trade. Imports substitution strategy is commonly implemented by East Asian countries in the 1960s and 1970s (Masuyama, 1997). *Third*, there are sources of economies of scale in a given industry: size of plants, length of production runs and size of firm (Grubel and Lloyd, 1975). Industry, for example in the technology intensive industry, with very high initial investment will create large size of firms. Then, advanced countries will have comparative advantage in this industry. Meanwhile, less developed countries will have comparative advantage in the

industries with low economies of scale. Inter-industry trade happens between advanced countries and less-developed countries.

**Table 1. about here.**

**Figure 3. about here.**

Table 1 and Figure 2 show trends of intra-industry trade and inter-industry trade in both intra-regional trade (left hand side) and inter-regional trade (right hand side) in East Asian countries. From the Table and Figure, we can draw the following three conclusions. *First*, in the past, inter-industry trade dominated international trade both in intra-regional trade and in inter-regional trade. It supports the mainstream international economics saying that country specializes in product with absolute and comparative advantage such that inter-industry takes place. The traditional international trade theory, for example Heckscher-Ohlin-Samuelson (HOS) model, fails to account for intra-industry trade. Therefore, several models were developed to provide theoretical basis for the trade in similar goods since the 1960-s. Lloyd and Grubel [2003] noted that publications of intra-industry trade started appearing in the 1960s. It has been commonly identified as a specialized areas of empirical and theoretical research since the mid-1970s. Moreover, since the 1980s it has become new important theories of international trade, which are focused on examining the welfare effects of trade specialization and trade within industries.

In the real world where trade is constrained by significant tariffs, an industrial core is likely to develop in every country to supply domestic market regardless of the initial allocation of factors. In the past, all East Asian countries implemented ‘double track’ strategy i.e. protecting domestic industry and promoting exports (Hiratsuka, 2006). In East Asia, the portion of inter-industry trade has also declined since 1980s. Until 2006,



inter-industry trade has still dominated inter-regional trade of the East Asian countries, excepting the Philippines. Inter-industry trade has covered around 70% of inter-regional trade.

Only Singapore and the Philippines have less than 50% of the inter-regional trade covered by inter-industry trade. In the case of the Philippines, intra-industry trade has bigger portion than inter-industry trade in inter-regional trade since 2000. It might not be very surprising since this country also closely engages in trade with other countries other than East Asian countries, especially the US and the EU. About 53% of the Philippines' exports went to the EU and US in 1995 and it became 35% in 2005. In the case of Japan and Indonesia, the dominance of inter-industry trade still exists. Since Japan as the most industrialized country in the region and as leader in the flying geese formation<sup>6</sup>, Japan has strict specialization in technology intensive industry. Therefore, Japanese inter-industry trade is more dominant than its intra-industry trade in both intra- and inter-regional trade. Strict specialization creates more inter-industry trade than intra-industry trade. The same reason is also applied in the case of Indonesia, which relies mainly on oil exports, *primary* products and *natural resource*-intensive industries.

*Second*, the increase of intra-industry trade in intra-regional trade is much higher than that in inter-regional trade. It is sometimes claimed that *de facto* economic integration has occurred in East Asia. In an integrated zone (*de facto* integration like East Asia), and when transportation cost are not too high, production is concentrated to benefit from economies of scale. Trade liberalization may cause a significant reallocation of

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<sup>6</sup> The 'flying geese' paradigm was introduced by Kaname Akamatsu in the 1930s articles in Japanese. Kaname Akamatsu presented to world academia after the World War II in 1961 and 1962 articles in English. 'Flying geese' model intends to explain the catching-up process of industrialization of latecomer economies from intra-industry, inter-industry and international aspects. It might be argued that the structural transformation of industrialization in East Asia follows this 'flying formation'. Garment, Steel, Popular TV, Video and HDTV are frequently used to illustrate the formation. Those products have been transformed from Japan to Newly Industrialized Economies (NIEs: Hong Kong, Taiwan, Singapore and Korea); from NIEs to the ASEAN4 (Malaysia, Indonesia, Thailand and Philippine) in the next term; from the ASEAN4 to latecomers and latest-comers.

factors across countries in the region. Therefore, intra-industry trade in intra-regional trade increases in the higher rate than that in inter-regional trade. For an example, the European integration was accompanied by an increase in intra-industry trade between member countries. The European integration process shows that the observed increases in similar product exchanges could be a result of this regional economic integration.

*Third*, intra-industry trade can overtake inter-industry in intra-regional trade in the period of massive liberalization. Hong Kong saw this in 1985, Korea and Singapore in 1990, Malaysia in 1995, and Thailand, the Philippines and China in 2000. The East Asian countries, as members of the World Trade Organization (WTO), are also required to reduce their trade protections such as tariff and non-tariff barriers (NTB). Trade liberalization is not only encouraged under the most favored nation (MFN) clauses, but also by very active bilateral, multilateral and multi-regional trade arrangements such as the ASEAN FTA, the ASEAN-China FTA, the ASEAN-Korea FTA, the ASEAN-Japan CEP, etc. In this sense, the liberalization will bring efficient allocation of factors. Firms, especially multinational corporations (MNC), will search for locations for their investment with promising comparative advantage and economies of scale. As result, intra-regional trade is more likely increasing.

## **5. Concluding Remarks**

The proliferation of regionalism has increased concerns over the changes in international trade pattern i.e. from inter-regional trade to intra-regional trade. Meanwhile, trade liberalization, economies of scale and differentiated products encourage intra-industry trade rather than inter-industry trade. Many researches on trade by region and on trade by industry have been made. However, they analyze both trade by region and trade

by industry, separately. This paper, therefore, considers them simultaneously. *First*, original intra-industry trade and inter-industry trade measures by Grubel and Lloyd [1975] are slightly modified, incorporating regional trade. From this modification, four combinations are as follows: (1) intra-industry trade in intra-regional trade, (2) intra-industry trade in inter-regional trade, (3) inter-industry trade in intra-regional trade, and (4) inter-industry trade in inter-regional trade. *Second*, the modified analytical measures are then applied in the case of East Asian countries.

Three main conclusions are withdrawn. *First*, intra-regional trade increased significantly in the case of East Asia and the NAFTA. *Second*, the more significant intra-industry trade has reduced the dominance of inter-industry trade in East Asia. *Third*, intra-industry trade in intra-regional trade has higher increases than that in inter-regional trade. It suggests that more trade liberalization among East Asian countries is required to increase intra-industry trade in intra-regional trade in the region. Trade liberalization can be tariff reduction and elimination of non-tariff barrier. Searching countries' comparative advantage and firms' economies of scale is easier in the competitive markets than in the distorted (imperfect) markets.

The increasing significance of intra-industry trade in intra-regional trade in East Asia also indicates competitions among multinational corporations (MNCs) searching for countries' comparative advantages through foreign direct investment (FDI). FDI is affected by location, transaction cost and internalization advantages. Location advantages are determined by domestic market, the availability of suppliers and human resources, factors endowment, transportation cost (infrastructures), and the investment facilities measures (including tax incentive, subsidy, etc) provided by the governments. Transaction cost relates with contract, which covers identification (what should be

included in the contract, reward and punishment, dispute, etc), implementation and monitoring. Internalization advantage relates with the ownership of firm. Intra-industry trade might be increased due to the existence of transport, storage and selling cost, differentiated products (with different inputs requirements, different economies of scale, differentiation by style, differentiation by quality), technological-gap, product cycle and foreign processing. The establishments of the ASEAN-Korea Free Trade Agreement (AKFTA), the ASEAN-China Free Trade Agreement (ACFTA) and the ASEAN-Japan Comprehensive Economic Partnership (AJCEP) can create more investment and trade liberalizations in the region.

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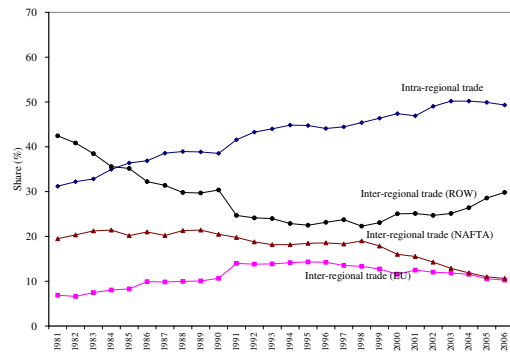
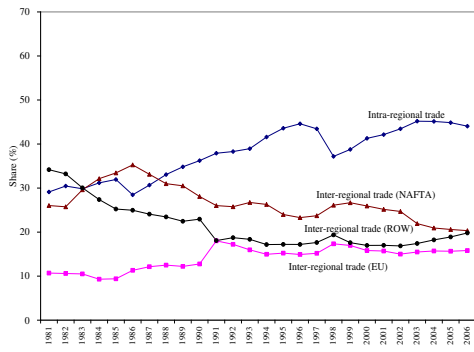
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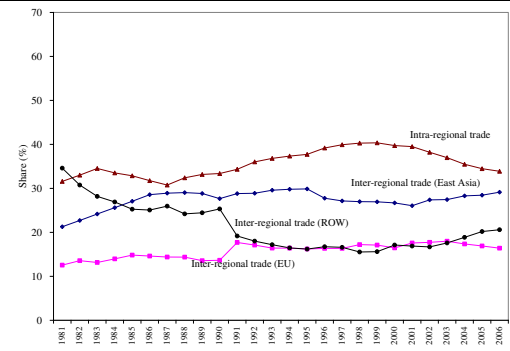
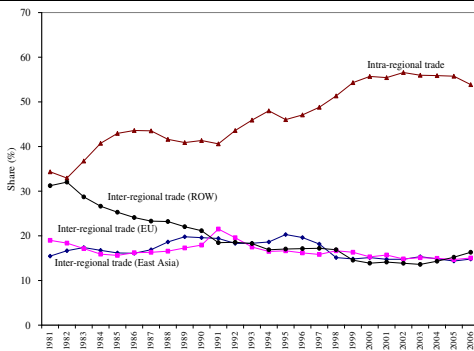
## Trade Flows

### Exports

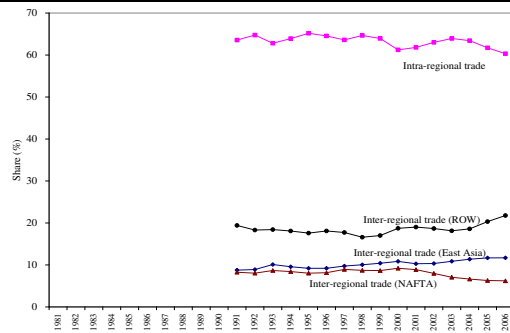
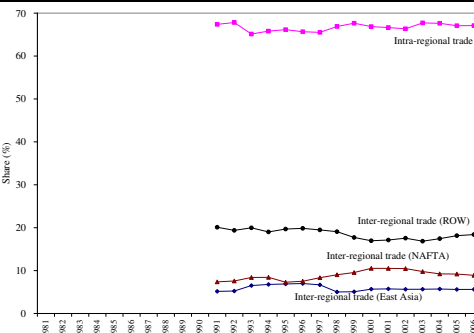
### Imports



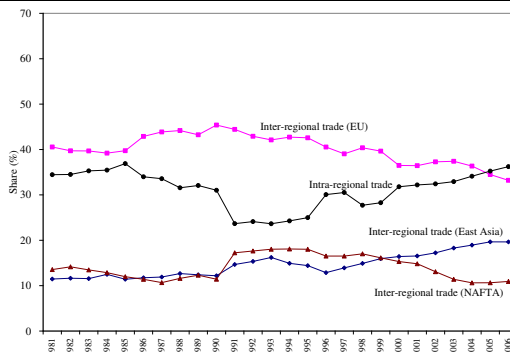
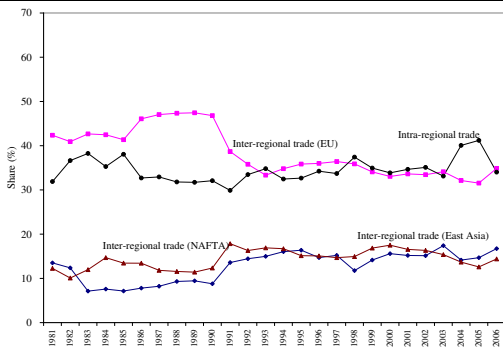
### a. the East Asia



### b. the NAFTA



### c. the EU



### d. the ROW

Source: UN-COMTRADE, author's calculation

**Figure 1. Intra-regional and Inter-regional Trade: East Asia, EU and NAFTA**

Trade Pattern		Trade by REGION	
		Intra-Regional Trade (IRa)	Inter-Regional Trade (IRe)
<b>Trade by INDUSTRY</b>	Intra-Industry Trade (IIa)	A Intra-Industry Trade Intra-Regional Trade (IIa-IRa)	B Intra-Industry Trade Inter-Regional Trade (IIa-IRe)
	Inter-Industry Trade (IIe)	C Inter-Industry Trade Intra-Regional Trade (IIe-IRa)	D Inter-Industry Trade Inter-Regional Trade (IIe-IRe)

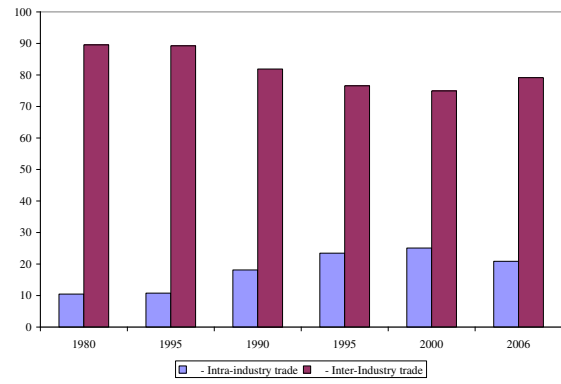
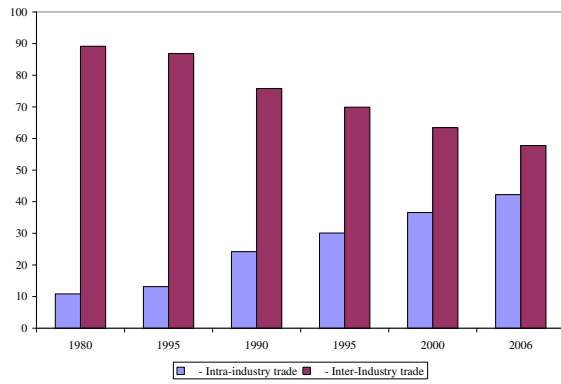
**Figure 2. Trade Pattern: by Industry and by Region**



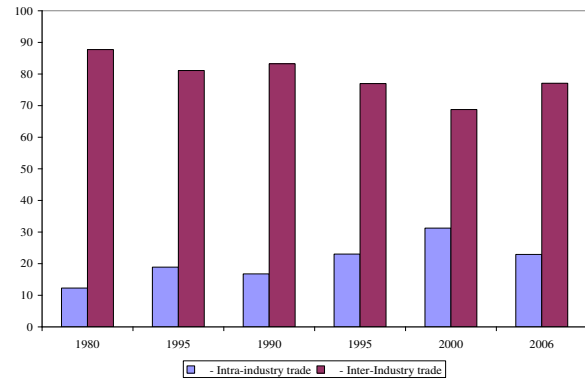
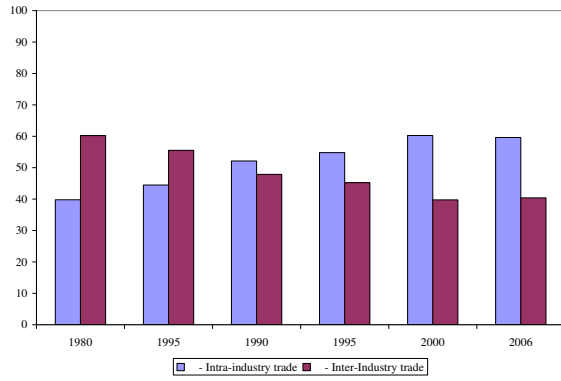
## Trade by Region

### Intra-Regional Trade

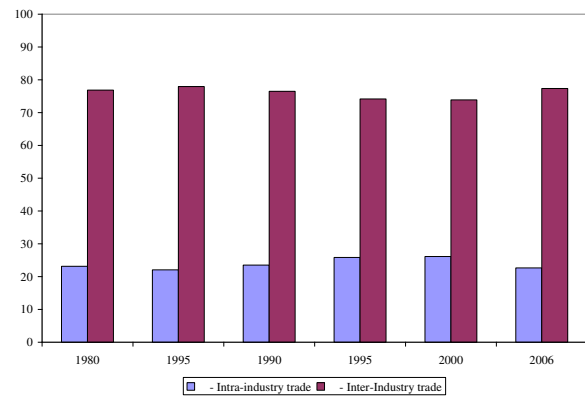
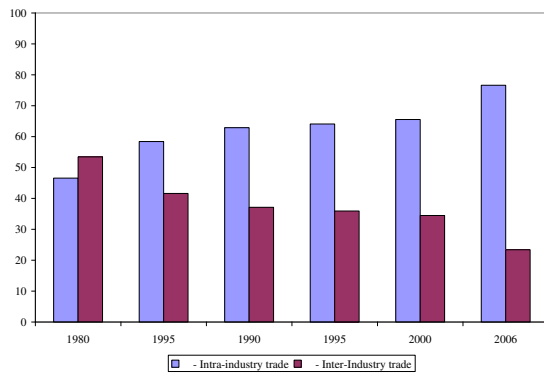
### Inter-Regional Trade



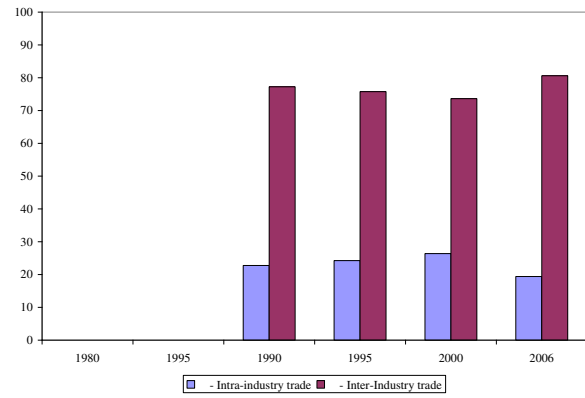
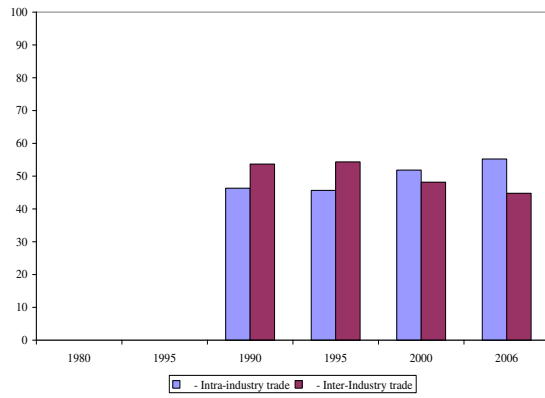
### a. Japan



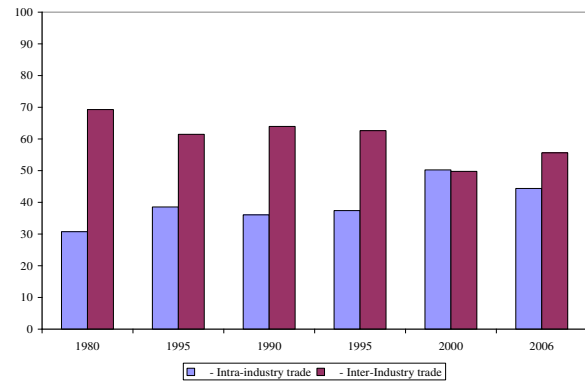
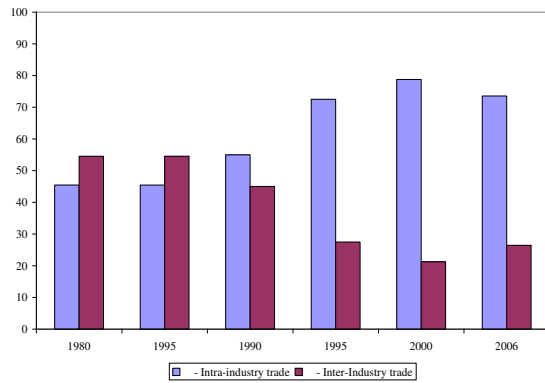
### b. Korea



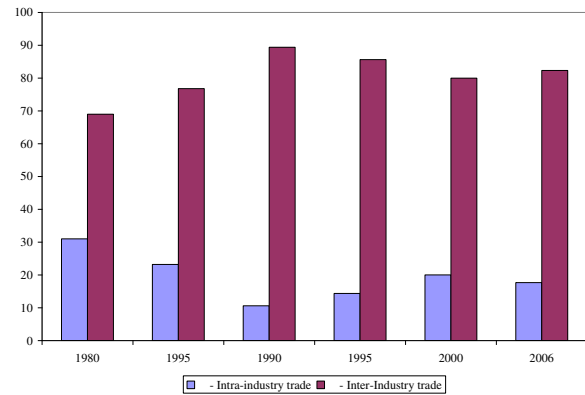
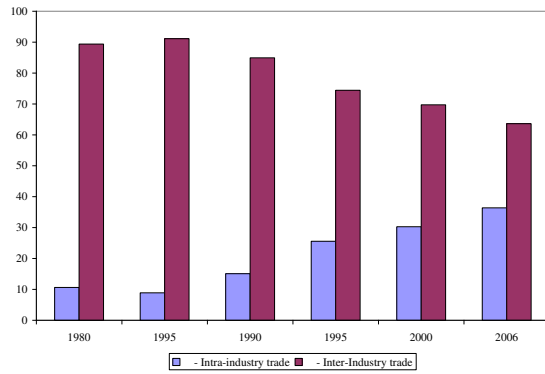
### c. Hong Kong



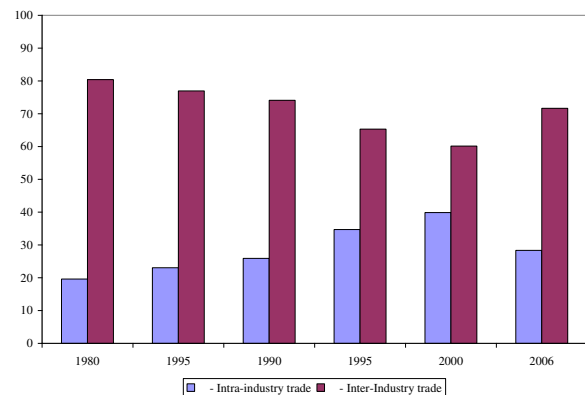
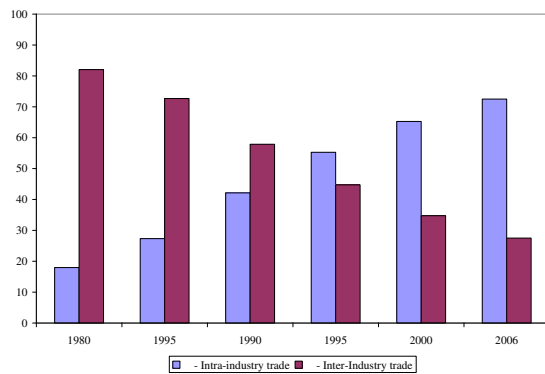
d. China



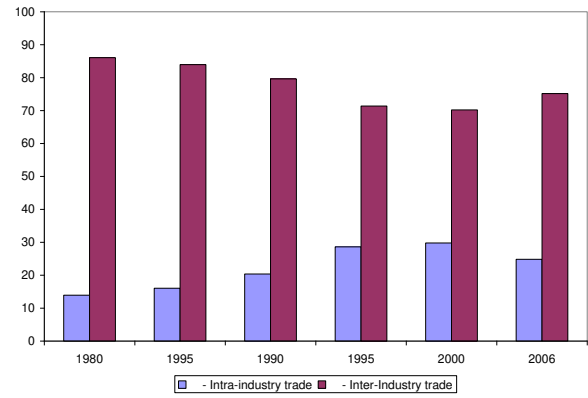
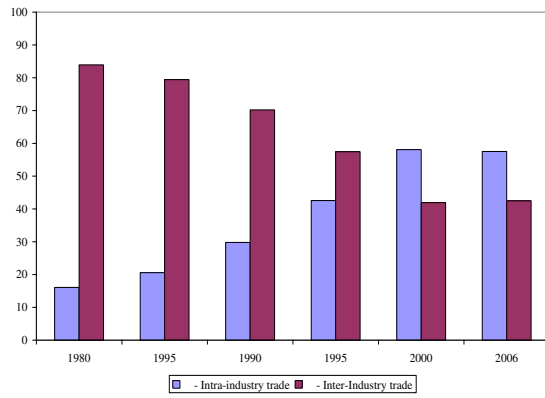
e. Singapore



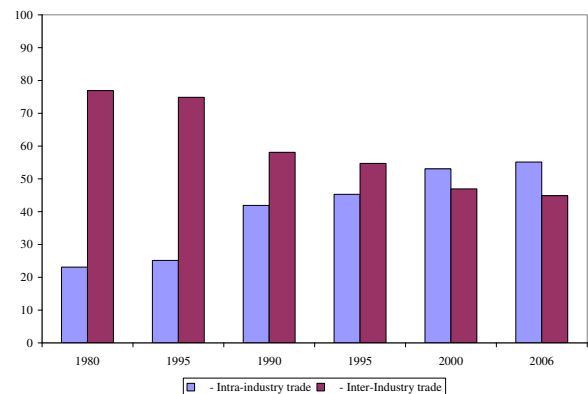
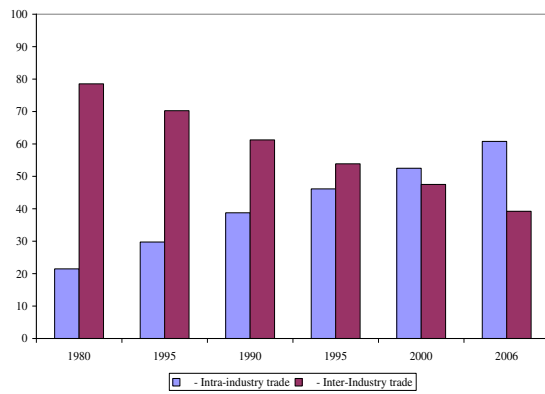
f. Indonesia



g. Malaysia



h. Thailand



i. the Philippines

Legend: ■ - Intra-industry trade ■ - Inter-Industry trade

Source: UN-COMTRADE, author's calculation

**Figure 3. Intra-industry and Inter-industry Trade: East Asian Countries**

**Table 1. Intra- and Inter-industry Trade (%):  
East Asian Countries for 1980, 1985, 1990, 1995, 2000 and 2005**

	1980	1985	1990	1995	2000	2006	Growth 1980-2006
<b>1. Japan</b>							
a. Intra-regional trade							
- Intra-industry trade	10.8	13.1	24.2	30.1	36.6	42.2	289.5
- Inter-Industry trade	89.2	86.9	75.8	69.9	63.4	57.8	-35.2
b. Inter-regional trade							
- Intra-industry trade	10.5	10.8	18.1	23.4	25.1	20.9	99.4
- Inter-Industry trade	89.5	89.2	81.9	76.6	74.9	79.1	-11.6
<b>2. Korea</b>							
a. Intra-regional trade							
- Intra-industry trade	39.8	44.5	52.1	54.8	60.3	59.6	49.8
- Inter-Industry trade	60.2	55.5	47.9	45.2	39.7	40.4	-32.9
b. Inter-regional trade							
- Intra-industry trade	12.3	18.9	16.8	23.0	31.3	22.9	86.5
- Inter-Industry trade	87.7	81.1	83.2	77.0	68.7	77.1	-12.1
<b>3. Hong Kong</b>							
a. Intra-regional trade							
- Intra-industry trade	46.6	58.4	62.9	64.1	65.5	76.6	64.5
- Inter-Industry trade	53.4	41.6	37.1	35.9	34.5	23.4	-56.2
b. Inter-regional trade							
- Intra-industry trade	23.2	22.1	23.5	25.8	26.1	22.7	-2.1
- Inter-Industry trade	76.8	77.9	76.5	74.2	73.9	77.3	0.6
<b>4. China</b>							
a. Intra-regional trade							
- Intra-industry trade			46.3	45.7	51.8	55.2	19.2
- Inter-Industry trade			53.7	54.3	48.2	44.8	-16.6
b. Inter-regional trade							
- Intra-industry trade			22.8	24.3	26.4	19.4	-14.8
- Inter-Industry trade			77.2	75.7	73.6	80.6	4.4
<b>5. Singapore</b>							
a. Intra-regional trade							
- Intra-industry trade	45.5	45.4	55.0	72.5	78.8	73.6	61.8
- Inter-Industry trade	54.5	54.6	45.0	27.5	21.2	26.4	-51.5
b. Inter-regional trade							
- Intra-industry trade	30.7	38.5	36.1	37.4	50.2	44.4	44.4
- Inter-Industry trade	69.3	61.5	63.9	62.6	49.8	55.6	-19.7
<b>6. Indonesia</b>							
a. Intra-regional trade							
- Intra-industry trade	10.6	8.9	15.1	25.6	30.3	36.4	242.4
- Inter-Industry trade	89.4	91.1	84.9	74.4	69.7	63.6	-28.8
b. Inter-regional trade							
- Intra-industry trade	31.0	23.2	10.6	14.4	20.0	17.7	-43.0
- Inter-Industry trade	69.0	76.8	89.4	85.6	80.0	82.3	19.3
<b>7. Malaysia</b>							
a. Intra-regional trade							
- Intra-industry trade	18.0	27.3	42.1	55.3	65.3	72.5	303.6
- Inter-Industry trade	82.0	72.7	57.9	44.7	34.7	27.5	-66.5
b. Inter-regional trade							

- Intra-industry trade	19.6	23.1	25.9	34.7	39.9	28.4	44.6
- Inter-Industry trade	80.4	76.9	74.1	65.3	60.1	71.6	-10.9
<hr/>							
8. Thailand							
a. Intra-regional trade							
- Intra-industry trade	16.1	20.6	29.8	42.6	58.1	57.5	257.9
- Inter-Industry trade	83.9	79.4	70.2	57.4	41.9	42.5	-49.4
b. Inter-regional trade							
- Intra-industry trade	13.9	16.0	20.4	28.6	29.8	24.8	78.2
- Inter-Industry trade	86.1	84.0	79.6	71.4	70.2	75.2	-12.7
<hr/>							
9. Philippine							
a. Intra-regional trade							
- Intra-industry trade	21.5	29.8	38.8	46.1	52.5	60.8	183.2
- Inter-Industry trade	78.5	70.2	61.2	53.9	47.5	39.2	-50.1
b. Inter-regional trade							
- Intra-industry trade	23.1	25.1	41.9	45.3	53.1	55.1	138.7
- Inter-Industry trade	76.9	74.9	58.1	54.7	46.9	44.9	-41.7
<hr/>							

Source: UN-COMTRADE, *author's calculation*