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THE CHANGING PATTERNS OF INTERNATIONAL TRADE: A STUDY OF THE ASIAN NEWLY INDUSTRIALIZED COUNTRIES

by
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A DISSERTATION

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for the degree of Doctor of Philosophy in the
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DEDICATION

To my mother, Hui-Ching Chin, for her dedication to all her six children. To all my brothers and sisters for their supports. To my beloved girlfriend, Haimin Chen for her good faith in me.

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Chapter 1
Introduction

Eastern Asia countries have an astonishing record of high, prolonged economic growth. One of the more phenomenal events in the east Asian economy, even in the world economy, since 1965, has been the emergence of the four Asian Pacific-Rim Newly Industrialized Economies (NIE), which are also called the "Asian Four Tigers" or "Four Little Dragons"---Hong Kong, Singapore, South Korea, and Taiwan. Woronoff (1986) uses the term "miracle economies" to describe the most successful industrial countries in the post-war era. Total world exports reached $3,455 billion dollars in 1990, which was almost twenty times the 1965 level, according to *International Financial Statistics* from IMF. During this same period, 1965-1990, world nominal GDP grew about approximately tenfold. The total exports of the four Asian NIEs rose more than eighty-eight hundred percent to $266.95 billion dollars in 1990 from $2.76 billion dollars in 1965. For the same period, the nominal of these nations GDP increased by thirty-six hundred percent. By 1990 this area's shares in world exports and imports were 7.7% and 7.8%, respectively.

It took almost a decade for development economists to become aware of the rising stars of the Eastern Asian countries. The pioneer writings in the 1960s, such as those of Chenery, Higgins, and Rosenstein-Rodan, did not include the four Asian NIEs as part of their list of economies which were most likely to succeed. Among the first few economists who paid attention to the phenomenon of East Asian success are Hughes (1971) and Myint (1969). But their attention only focused on Singapore and Hong Kong.

Most publications explaining the economic performance of East Asian NIEs are from the latter part of the1970s and the 1980s.

The economic miracle of the Asian NIEs is a success story of a forward-looking and export-oriented development strategy. Development economists have become increasingly interested in the possibility of repeating the success story with the same strategy for other developing countries. Regarding this subject, it is worth pointing out the peculiar geographical and compositional features of the Asian NIEs' exports. First, the Asian NIEs depend heavily on the Japanese and U. S. markets for their exports. As the international trade flow matrices in Table 5 and Table 6 in Appendix A shows, the United States and Japan took 35.3% of the exports of the four Asian NIEs in 1990, up from 34.9% in 1980. However, the size of the U.S. market has been more than twice that of the Japanese market. Generally speaking, while exports to the developed countries are extremely important for the export-orient development strategy of the Asian NIEs, the Japanese and European Economic Community markets seem to be less open than the American market. Secondly, most of the exports of the Asian NIEs were manufactured goods. For the period from 1980 to 1989, on the average, 95% of their total exports were manufactures. The nature of the manufactured goods exported has been becoming more and more sophisticated because of the availability of a relatively cheap skilled labor force, aggressive international marketing and promotions, and continuing transfers through OEM (Original Equipment Manufacturing) and foreign investments.

Our analysis has the following features that distinguish it from previous studies:

Firstly, this is the first comprehensive investigation of changing trade patterns of Asian NIEs during a twenty-year period, from 1967 to 1987. The significance of this period is that the economies of Asian NIEs have taken off since the 1960s. Our study will

be the first to trace the Asian NIEs' path from their early stages to their current development. The most critical part of our analysis is that we include Taiwan in our investigation. Trade statistics on Taiwan are hardly found in the publication of international organizations due to Taiwan's isolation from international diplomatic channels. Consequently, not many studies about the Asian NIEs have investigated Taiwan's case. Therefore, the complete analysis of Asian NIEs with Taiwan's data will be the special feature of this analysis.

Secondly, in this analysis we are also intending to empirically examine the so-called Asian growth model that has been debated over the years. Trade theorists contend that developing countries should become more like developed countries in terms of trading patterns. Therefore, we are interested in whether the so-called Asian growth model has specific features since their takeoff in 1960s. Could it be possible that the Asian NIEs are only following Japan's path or resemble other high-income countries in their economic development? We would like to find out the general path of growth for the all Asian NIEs and specific path of growth path for each individual Asian NIE. We utilize import market share, import profiles, and intra-industry trade ratios to trace the changing trade patterns of Asian NIEs from 1967 to 1987.

Chapter 2
Literature Review

2.1 Traditional Trade Theories

International trade theorists have long investigated how trade happens. Several theoretical explanations have been advanced over the years, but the main issue is still around comparative advantage. The comparative advantage concept has useful applications. It provides a basic explanation of the fundamental concept in (or positive) descriptive theories regarding international trade. Furthermore, it can provide guidelines for government policies on resource allocation and trade. In other words, it plays an important role in prescriptive (or normative) economics. It is not possible to discuss all such explanations. Hence, basically we are confined to the most significant postulates.

2.1.1 Absolute Advantage

This postulate was set forth by Adam Smith in the *Wealth of Nations*. His basic idea was that a country would export those commodities that it could produce with less labor than its trading partner. This was a simple explanation that has been criticized by numerous trade theorists as naive. Critics asked what happens when one country has an absolute advantage in all lines of production. According to Smith's explanation, trade would be ruled out in this circumstance unless the more productive country lacks the necessary recourses to produce goods that the other country produces.

2.1.2 Comparative Advantage

Smith's doctrine was further refined by Torrens (1815) and Ricardo (1817). Using two country, two commodity examples, they developed the case where one country has an absolute advantage in all lines of production and found that international trade is determined by comparative factor productivity or relative output/factor ratios. In other words, international trade is determined by comparative rather than absolute advantage.

International trade theorists have tried to investigate the background of differences that cause international trade. Basically, the question is why one country is able to produce more cheaply than the other country. There is only one answer: comparative advantage. To search for a meaningful answer for this question is to analyze the factors that determine how nations specialize in production and which commodities are exported and imported. In other words, trade theorists try to identify the sources of comparative advantage that are able to explain the trade patterns among different countries. Various explanations have emerged to describe the trade pattern. Following are the major ones over years.

2.1.2.1 Factor Proportion

Although Richardo's comparative advantage takes Smith's analysis a step further, it is still unable to explain why factor productivity differs between commodities and countries. Factor proportion model purports to solve the puzzle. This model was independently developed by Heckscher (1919) and Ohlin (1933). Samuelson (1948, 1949, 1953, 1956, 1967, etc.) supplied the bulk of rigorous analysis based on this model in international trade theory. Therefore, usually, we refer to this factor-proportion model as either the Heckscher-Ohlin model or the Hechscher-Ohlin-Samuelson model.

The Heckscher-Ohlin model of international trade involves three basic elements: the factor intensity of commodities, the factor endowment of countries, and the pattern of trade flows. This model shows that the pattern of trade is dependent on the interactions between factor intensity and factor endowment, so that nations tend to export those goods that require relatively large amounts of their relatively abundandt factors. The most famous empirical study challenging the Heckscher-Ohlin model is the finding of Leontief (1953), which is known as the Leontief Paradox. The Paradox simply states that U.S. exports were less capital-intensive than U. S. imports. Tatemoto and Ichimura (1959) also found that 1951 Japanese exports were more capital-intensive than 1951 imports. Later, Roskamp (1963) discovered just the opposite to the Japanese case for 1954 West German international trade. The various explanations suggested for the above findings omitted some essential variables, such as natural resources, the possibility of factor-intensity reversals, and the neglect of human capital and technology. It is of interest that the simple factor proportion theory had surprisingly good performance in the case of export twenty-four-country sample (see Hufbauer, 1970).

Of course, there is still a massive literature supporting the Heckscher-Ohlin model, as well as some literature contradicting them and the critics of Leontief's paradox. Most critics focus on the choice of year, statistical problems, and Heckscher-Ohlin assumption, etc.

It is difficult to apply this simple factor proportion model of two commodities and two factors to more commodities and factors. Melvin (1968) agreed that in the case of a model composed of more commodities than factors, the Hechscher-Ohlin trade theory cannot be supported. Deardorff (1979) also found out that there are weak links in the chain of comparative advantage in a model based on two factors and many commodities.

The implication of all these similar findings is that any systematic relationship between country factor endowment, product factor intensity and the pattern of trade breaks down when the simple model is extended beyond its limit of two countries, two factors, and two commodities.

The analysis of this model becomes more complicated when many countries, commodities, and factors are involved. Chipman (1966), Vanek (1968), and Chacholiades (1978) have done extensive investigation on this case of n-country, m-commodity, and x-factor. Vonek's (1968) general model of many countries, many factors, and many products is called the factor content version of factor proportion model. Vanek contends that each country indirectly exports its abundant production factors and imports the scarce ones. Another weak version of the factor proportions hypothesis is proposed by Deardorff (1980). The author found a generalized covariance between factor intensity, factor endowment, and net exports is positive across all factors, goods, and countries. Hence, the basic argument is that interaction between the factor intensity of commodities and the factor of endowment of countries still determines the pattern of international trade in an average sense. This means that countries are eager to export those commodities the production of which makes relatively intensive use of the factors in which they are relatively abundant.

2.1.2.2 Human skills

Kravis (1956) discovered that high-wage industries provided most of the U.S. exports, while U.S. imports compete with low-wage industries. The further explanation for this phenomenon is that wage differentials are the product of skill differences; therefore, the international trade flow simply reflects the differential application of education and training to worker. Actually, in Leontief's original paper, he contended

that the labor efficiency could be the resolution of his famous paradox. Later, Kenen and Yudin (1965), Bhagwati (1964, 1967), Kenen (1965, 1979), and Koesing (1960) hypothesized that human skills are important to formulate international trade. The basic contention for this human skills trade theory is that countries relatively endowed with skilled workers will export commodities that are intensive in their use of skilled workers. On the other hand, countries relatively well endowed with unskilled workers will export commodities which are intensive in their use of unskilled workers. Obviously, this is just the refinement of Heckscher-Ohlin hypothesis. Evidence has been presented on this question by Bharadwaj and Bahawati (1967), Roskamp and McMeekin (1968), Balassa (1979), and others.

2.1.2.3 Stages approach

Balassa first proposed a stages approach in 1977. The concept simply states the idea that the manufactured goods structure of a country's comparative advantage changes over time due to the accumulation of material capital, the formation of human capital, and increased sophistication in technology and related processes. Therefore, Balassa agreed, a country can be expected to increase its comparative advantage in more capital-intensive, more skill-intensive, and technologically more advanced and sophisticated goods in the course of time. In the contrast to comparative advantage, the comparative disadvantage would worsen. For example, an industry with relatively low capital intensity will be anticipated to be at a comparative disadvantage industry as time passes. Hence, the stages of comparative advantage are reflected by the changes in the industry-specific factor orientation of comparative advantage.

Balassa's empirical test (1980) implied that developed countries export human-skill intensive and capital intensive goods and import unskilled-worker intensive goods.

Stern and Maskus (1981) also show that the United States has a consistent trade pattern with Balassa's result, that is, exporting capital intensive and human-skill intensive goods and importing unskilled-labor goods.

2.1.2.4 Product Cycle

The first concept of product cycle hypothesis was proposed by Vernon (1966), followed by Hirsch (1967) and Wells (1969). The basic doctrine for this hypothesis is that, in the early phase, production and export advantages lie with sophisticated firms in advanced nations. Production will be fulfilled with relatively large amounts of skilled workers. As the product cycle evolves, however, firms and countries with less technical expertise begin manufacturing and exporting the commodity.

According to product cycle hypothesis, if the human skills factor is singled out for consideration, the product's transition from one phase to another phase will be followed by a decrease in the skill orientation index. This should be the case for modeling the changing pattern of trades because the successive phases in a product's life cycle are characterized by a decrease in skill intensity. Therefore, a shift of comparative advantage occurs to nations that are relatively less abundant in skills. This model, consequently, is able to explain the pure forms of change in factor orientation coupled with invariant distribution of resource supplies.

2.1.2.5 Technological Gaps

Technological gaps at the industrial level may be able to explain the pattern of trade in commodities. Posner (1961) and Vernon (1966) proposed this postulate to explain international trade. They agree that a nation that invents or modifies a new

product or a new production process may develop a brief monopoly power in the specific industry. Hence, the nation could either increase its export of this specific technology related product or reduce its import of it. This hypothesis further agrees that pattern of trade could be explained by the gap between innovation and imitation. In other words, a nation's monopoly will last as long as other nations are unable to imitate its innovation. Hence, other countries have to import this specific product from the technologically monopolistic country.

2.1.2.6 Other Postulates:

Kravis (1956) argued that the unavailability of some commodity domestically is the driving force of international trade. Unavailability could be interpreted in an absolute sense, but it could also be explained in the sense that domestic supply of a commodity is inelastic. This inelasticity implies that increasing domestic production would follow relatively high costs. Kravis justifies his theory by arguing that obstacles on trade, transportation costs, cartelization, and similar factors eliminate from international trade goods that can be produced domestically at relatively higher cost.

Linder (1961) first proposed that international trade in primary products can be explained in terms of the Heckscher-Ohlin model by relative natural resource endowment, but trade in manufactured products, he further contended, would be interpreted by the demand pattern of both trade partners. In other words, he argued that the greater the similarity in demand patterns of the pair trading countries, the higher the volume of trade in manufactures of a country with each of her trading partners will be. The criticism for this hypothesis is that it is only interpreted in terms of per capita incomes rather than culture and broad economic consideration. This theory eventually evolved into fundamental structure for intra-industry trade theory.

2.2 Measurement of Comparative Advantage.

The pioneer empirical study of measuring comparative advantage was conducted by Balassa (1965). His work showed that comparative advantage could be revealed. Revealed comparative advantage has become a standard tool to examine trade pattern and policy since then.

The basic problem associated with measuring comparative advantage is that the idea of comparative advantage is usually formulated in terms of autarkic price relationships. It is impossible to derive true comparative advantage indices based on pre-trade relative prices, since all empirical data are based on events in the world of trade. Deardorff (1980) and Ethier (1984) have shown that we should only expect a "weak" form of comparative advantage; that is, differences in free-trade relative prices are positively correlated with free trade net exports. A similar correlation between autarkic relative prices and export share measures is also verified by Hillman (1980). Therefore, all the measurement of comparative advantage must be regarded as approximation of the underlying true relationship.

However, since relative autarkic prices are not observable and post-trade prices are strongly influenced by trade flows themselves, prices have limited value in identifying the true pattern of comparative advantage. Ballance, Forstner, and Murray (1987) argued that, instead of using relative prices, other post-trade data such as production, exports, consumption, and imports could be utilized as a measurement of revealed comparative advantage. Using post-trade statistics to measure comparative advantage also generates some other difficulties. First, how can the amplitude of production, exports, consumption, and imports be related to country size and product

significance? Second, how can the aggregation problem in the data be solved? Even the most detailed trade data related to product categories rather than to products. As a consequence, countries often show in the statistics as both importers and exporters in a given product category. Another question is how to accord trade data on domestic production and consumption. It is also difficult to deal with government policies that distort trade: for instance, government subsidies to export industries. In this case, the actual trade flows do not reflect the underlying pattern of comparative advantage.

Any attempt to measure a country's endowment of physical capital will encounter the conceptual difficulties from the traditional counting of physical capital among the primary factors of production, but capital goods (for example, machines) are obviously produced themselves. Furthermore, the aggregation of different types of machinery, buildings, inventories, etc., into one factor called physical capital will be another problem. A similar problem can be applied to the aggregation of physical and human capital into one category that is called total capital. The problems of measuring skill-cum-technology are even more critical. The earlier so-called neo-factor proportions theory of international trade thought of capital as including both physical and human capital. Branson and Monoyios (1977) later attempted to identify the separate effects on trade patterns of the two types of capital. Aquino (1981) argued that the including technological inputs in a factor proportions from work can be regarded as an alternative formulation of human capital. It is difficult to separate human skills and technological advancement. The same principle can be applied to technology and physical capital. This is because part of a country's technology endowment is the technology blended with its physical capital. Hence, the indices used to estimate countries' endowments of physical capital and skill-cum-technology can be regarded as proxies only, but these indices can be used to sketch resource profiles accurately enough.

The precise measurement of revealed comparative advantage will be impeded by the problem of statistical inference. It is difficult to isolate precisely the effects of each factor on patterns of international comparative advantage due to high correlation among the various indicators of factor endowment across countries. Ballance, Forstner, and Murray (1987) contended that statistical criteria should not be the basis for choosing among alternative seemingly reasonable revealed comparative advantages.

There are numerous empirical studies about comparative advantage. MacDougall (1951, 1952) and MacDougall et al. (1962) were the pioneering works offering a statistical investigation of the validity of comparative advantage postulate. Stern (1962), Balassa (1963), Bhagwati (1964), and Agarwal et al. (1975) followed these works.

2.3 The Evolution of Intra-Industry Trade Theories

2.3.1 Background

Intra-industry trade (IIT) is the simultaneous export and import by a country of products in the same industry. It is also known as two-way trade or trade overlap. The development of IIT model was an accident.[1] The traditional theories of international trade theory based on the principle of comparative advantage cannot explain IIT phenomenon. But this does not mean that all the IIT models reject the traditional theory completely. Bergstrand (1983) claimed that the development of IIT should be regarded as

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[1] Tharakan (1983) stated,

> "In his study of the changes in the pattern of intra-bloc trade of the Benelux Union (BLEU), Verdoorn (1960) calculated the bilateral trade ratios of a sample of 121 products at comparable levels of international trade classification, for two different points in time. He noticed that the number of the extreme values of the ratio had been reduced while their median increased since the formation of the Benelux Union. Fro this he inferred that specialization, if it did accompany the intra-bloc trade, was to be found within rather than between the different categories of trade (p. 1)"

complements to traditional theory. Generally speaking, most theoretical IIT literature is based on the H-O model.

It is worthwhile to point out the pioneer research in IIT. We can identify those postulates from comparative advantage in trade theory being used to explain the IIT phenomena. The early findings of Dreze's (1960, 1961) research indicated that interaction between scale of economies and product differentiation in the study of Belgium's trade within EEC partners. To analyze product differentiation among industries across countries, Linder (1961) utilized a demand-side approach to interpret the relationship between product differentiation and internal demand. Michaely (1962) calculated an index of dissimilarity of exports and imports in five classes of commodities for thirty-six countries. The finding of the research indicated that there is similarity in the commodity composition of exports and imports of high income countries, but the opposite held true for the developing countries in the study. Balassa (1963) also has a similar conclusion to Verdoorn's (1960) research that much of increase in trade in manufactures in E.E.C. happened within rather between commodity groups. Kojima (1964) studied the pattern of international trade among advanced countries and had results similar to those of Balassa (1963).

A wave of research in trade within commodities groups emerged in the mid-1970s, for example, Gray (1973) and Grubel and Lloyd (1975). Grubel and Lloyd's (1975) was the first to investigate the IIT comprehensively among industrialized countries. In late 1970s, there were several influential theoretical works on IIT to show insights into alternative models to deal with preference diversity and scale economies in a general equilibrium frame work (Dixit and Stiglitz, 1977; Lancaster, 1979) and in an open-economy setting (Krugman, 1979; Lancaster, 1980).

2.3.2 IIT Theoretical Models

The theoretical part of IIT is derived from the H-O-S model, for example, the technological gap model (Posner, 1961) and the product life cycle theory (Vernon, 1966). Grubel and Lloyd (1975) contended that most of these hypotheses could be used as models to predict IIT. Basic categories for theoretical IIT can be found as following discussion.

2.3.2.1 Functional Homogeneous Commodities and IIT

One of the assumptions of the H-O model is that products are homogeneous. Grubel and Lloyd (1975) called this assumption "functional homogeneity." They argued that geographical characteristics of countries will result in border trade (bilateral trade) by costs of production and transportation. They also contended that bilateral trade will arise from differentiation by time. One trade pattern from the differentiation by time is periodic trade, and the other is cycle goods trade. Periodic trade is the trade in electricity, agricultural, and similar goods, and cycle goods trade is due to the lumpiness of some investments and unequal phases and amplitudes of business cycles in different countries. Another type of functional homogeneous commodities trade involves what Grubel and Lloyd (1975) called re-export trade. They further argued that governmental regulations also contributed to the functional homogeneous commodities bilateral trade. Other authors (Brander, 1981; Brander and Krugman, 1983; Brander and Spencer, 1984) claimed that IIT within functional homogeneous products is the result of price discrimination for the same product among different countries.

2.3.2.2 Differentiated Commodities and IIT

According to Grubel and Lloyd (1975), there are two types of differentiated commodities: quality differentiation and style differentiation. The research of Dreze (1960, 1961), Corden (1970), and Grubel and Lloyd (1975) indicated that style difference is the source of IIT between countries. The model of style differentiation is based on the assumption of products with similar input requirements and economies of scale with homogeneous products. Dreze (1960, 1961) used his native country, Belgium, as an example to support his argument about IIT. His reasoning is that a small country like Belgium does not have large enough numbers of consumers with homogeneous tastes to keep production costs of some styles products lower to compete with imports. Therefore, Belgium will import differentiated products by style from other countries.

The two model, style differentiation and quality differentiation models, share similar assumptions except one that the relationship between countries' income distributions and the elasticity of demand for quality with respect to levels of income plays an important role in the quality differentiation model. Deviating from the previous assumption, Falvey (1981) developed a model in differentiated quality IIT without an economies of scale requirement. Falvey argued that differentiation in quality can be considered as a function of capital to labor ratio in producing the product.

2.3.2.3 Technology, Product Cycles and IIT

Differentiation in technology is the outcome of innovations due to either legal or natural protection, such as patent and copyright laws and economies of scale. Therefore, IIT could be the result of the technological gap between trading partners. The product cycle model contends that the innovative country creates new technology and exports the

products utilized this technology. When the technology is matured, its production will be transferred to low cost countries. Hence, IIT happens between an innovative country and less developed countries. Posner (1961) was the pioneer to propose this technological gap model and the research of Vernon (1966) was first one in product cycle model. Grubel and Lloyd (1975) claimed that there is no clear line to distinguish technological gap and product cycle models. Greenaway and Milner (1986) also argued that this phenomena because the diffusion and adjustment process is not instantaneous or because such innovations are continually occurring. Gordon (1979) and Dearforff (1984) contended that these two models are dynamie version of Ricardian model. Hufbauer (1970) pointed out the difference between these two models: that is, the technological gap model has stressed time lags and the product cycle model emphasized technological differentiation and standardization.

2.4 Measurement of IIT

The discussion in this section be on the chronicle basis to introduce the measurement of IIT. Because of the nature of measuring IIT, a number of the measurements have some fundamental parts in common.

Verdoorn Index

The earliest empirical measurement of IIT in trade literature was Verdoorn (1960). The ratio was computed as

$$V_i = \frac{X_i}{M_i}$$

where Xi and Mi are exports and imports of an industry i.

This ratio can vary between 0 and infinity. When the ratio approaches 1, it suggests a tendency toward IIT specialization. Except in the case of unity, this ratio does not readily and directly measure the extent to which imports and exports are matched in a specific industry (see Greenaway and Milner, 1986).

Michaely Index

Michaely (1962) computed an index, Ci, using three-digit SITC classification data.

$$C_i = \sum_i^n \left| \frac{X_i}{X} - \frac{M_i}{M} \right|$$

where Xi and Mi: exports and imports of industry i.

X and M: total exports and imports.

The range of this index is from 0 to 2. The index of zero implies that there is a perfect similarity in the commodity composition of inports and exports. In the case of index of 2, it implies perfect inter-industry trade. The criticism for this index is that it does not consider the trade imbalance effect, which will be discussed later.

Kojima Index

Kojima (1964) proposed a measure of the degree of "horizontal trade" in product i. The index is defined as

$$K_i = \frac{X_i}{M_i} \times 100 \quad \text{if Mi} > \text{Xi}$$

$$K_i = \frac{M_i}{X_i} \times 100 \quad \text{if Mi} < \text{Xi}$$

In the meantime, Kojima also developed an aggregate horizontal trade index that is a weighted average of Ki. It is defined as

$$K_i = \sum_i^n \frac{X_i}{M_i} \times \frac{X_i + M_i}{M + X} \qquad \text{if Mi} > \text{Xi}$$

$$K_i = \sum_i^n \frac{M_i}{X_i} \times \frac{X_i + M_i}{M + X} \qquad \text{if Mi} < \text{Xi}$$

This index also has been criticized for lacking a correction for trade imbalance, especially in the case of small country--big country trade flows.

Balassa Index

Balassa (1966) proposed an index to measure IIT in the following formula:

$$B_i = \frac{|X_i - M_i|}{X_i + M_i}$$

The range of Bi is between 0 and 1. Bi is inversely related to IIT. The index of 1 implies that there is no IIT and pure inter-industry trade between trading partners. On the other hand, when the index approaches 0, $X_i = M_i$, it implies all trade in industry i is IIT. If we sum the index across industries and take the arithmetic mean, we can get the measurement of the degree of a country's inter-industry specialization. This index has been criticized for failing to reflect the different weight of each industry and having no correction for aggregate trade imbalance.

Grubel and Lloyd Index

Grubel and Lloyd (1975) transformed the Balassa index into the index that is the standard and most extensively used in IIT literature. The index is defined as

$$GL_i = 1 - B_i$$
$$= \frac{(X_i + M_i) - |X_i - M_i|}{(X_i + M_i)}$$

As Bi is directly associated with the level of IIT, GLi is directly associated with the level of IIT. The range of the index is from 0 (pure inter-industry trade) to 1 (pure intra-industry trade). By aggregating the GLi across industries and taking into account their different weights by the ratios of each industry exports plus imports to the total value of exports plus imports of the whole sample of industries, we can get the weighted average AGLi as follows:

$$AGL_i = \frac{\sum_i^n (X_i + M_i) - \sum_i^n |X_i - M_i|}{\sum_i^n (X_i + M_i)}$$

Correction for Aggregate Trade Imbalance

Grubel and Lloyd (1975) noticed that the mean, AGLi, is a biased downward measure of IIT if the country's total commodity trade is imbalanced. Without balance between exports and imports, the mean will be less than unity. Grubel and Lloyd (1975) proposed a correction for trade imbalance. The adjustment measure of IIT for the trade imbalance is as follows:

$$AdGL_i = \frac{\sum_i^n (X_i + M_i) - \sum_i^n |X_i - M_i|}{\sum_i^n (X_i + M_i) - \left| \sum_i^n X_i - \sum_i^n M_i \right|}$$

The amendment for the problem of previous index is to consider all commodity trade adjusted for aggregate trade imbalance expressing IIT as a proportion of total commodity export plus import trade less the trade imbalance.

The Aquino Correction

Aquino (1978) criticized the trade imbalance problem over the whole Grubel and Lloyd index family. He argued that the measure of IIT in Grubel and Lloyd is downward biased. Aquino (1978) proposed a adjustment index for measuring IIT. The Aquino index is defined as follows:

$$AQ_i = \frac{\sum_i^n (X_i + M_i) - \sum_i^n |X_i^e - M_i^e|}{\sum_i^n (X_i + M_i)}$$

where

$$X_i^e = X_i \times \frac{\frac{1}{2} \times \sum_i^n (X_i + M_i)}{\sum_i^n X_i}$$

$$M_i^e = M_i \times \frac{\frac{1}{2} \times \sum (X_i + M_i)}{\sum_i^n M_i}$$

$$\sum_i^n X_i^e = \sum M_i^e = \frac{1}{2} \times \sum_i^n (X_i + M_i)$$

Substituting X_i^e and M_i^e into AQ_i and simplify it, we can get

$$AQ_i = 1 - \tfrac{1}{2} \times \sum_i^n \left| \frac{X_i}{\sum_i^n X_i} - \frac{M_i}{\sum_i^n M_i} \right|$$

This index is almost identical to the Michaely (1962) index. As trading patterns move toward IIT, the index approaches to 1. It reaches zero when imports and exports are concentrated in different industries. Greenaway and Milnes (1986) claimed that the relationship between the signs on industry and the aggregate trade imbalances affects the direction of adjustment to the industry Grubel and Lloyd indices. Aquino claimed that this index has two advantages over the Grubel and Lloyd index. First, it avoids the problem of the correction for trade imbalance. Second, it is not dependent on the value of the expression $\sum_i^n X_i - M_i$, which makes the Grubel and Lloyd index dependent on the level of aggregation.

Other Adjustments

Balassa (1979) claimed that an adjustment of trade imbalance to permit for inter-industry specialization between primary and manufactured goods. Bergstrand (1983) proposed that industry level bilateral trade flows should be adjusted for multilateral trade imbalance instead of bilateral.

Chapter 3

Methodology

3.1 The Data

Five cross-sectional international trade flow data matrices have been obtained from the Institute of Developing Economies (IDE) of the Ministry of International Trade and Industry (MITI), Japan by Dr. David Cheng.[2] These matrices contain export and import data at the four-digit SITC (Standard International Trade Classification) Revised 1 of Japan, the United States and the European Economic Community for the following years: 1967, 1973, 1977, 1982, and 1987. The data set at three-digit SITC Revised 1 for Asian NIEs covers 1972, 1977, 1982, and 1987. For the purpose of this investigation, these data are grouped into three major markets, namely, the United States, the European Economic Community, and Japan. It is worthwhile mentioning two special features about this data set. First of all, all the exports and imports data have been converted into the same SITC Revised Version 1[3]. Since the international trade data after 1977 contained in the data-bank of IMF, United Nations, and World Bank are all expressed in terms of SITC Revised Version 2, it is difficult to analyze the changing trade patterns over the longer period from the late '60s to the late '80s. The conversion computer program at the IDE of MITI in Japan has made possible a long-term analysis based on a consistent trade data-base covering the period from 1967 to 1987 for the Asian NIEs, the United States,

[2]I am very thankful for Dr. David Cheng's effort to collect these data and his generosity of permitting me to use these data.

[3] Except for 1987 Asian NIEs data which are SITC Revised 2 format, but we convert it into Revised 1 according to same rules as IDE did to maintain the consistency of the data set. Sample conversion table is provided in the appendix.

the European Economic Community, and Japan. Secondly, the major data-banks mentioned above do not contain the trade data of Taiwan because Taiwan is not a member of the United Nations. IDE of MITT has made special efforts to obtain Taiwan's data classified according to the customs codes, which are in turn converted into the SITC and integrated with the world trade data-bank maintained at the IDE. Other data are from Penn World data bank, various issues of Taiwan Statistical Data Book, and IMF's IFS.

3.2 Global Comparative Advantage

To extend Kojima's model of global comparative advantage, we would like to include primary products into our analysis in this section. Including primary products we believe, gives us broader sense of global competitions. Following Kojima's model, we classify all traded commodities into four broad groups[4]:

A group: consists of agricultural products such as staple and processed foodstuffs, tobacco, and agricultural raw materials.

N group: natural-resource-intensive commodities outside of agriculture. For example, minerals, metals, and fuels.

L group: Labor-intensive industries, such as light manufacturing industries and part of heavy and chemical industries (cameras, sewing machines, bicycles, medicine, etc.).

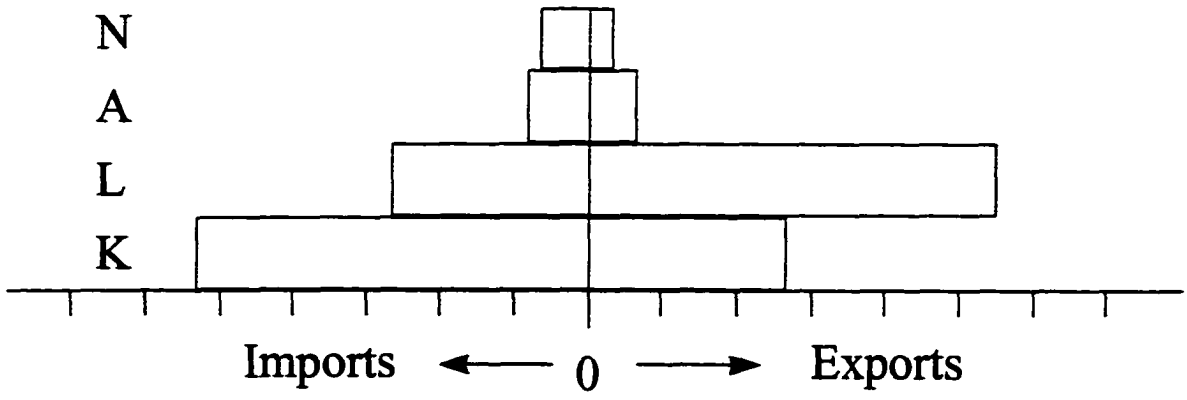
K group: capital-intensive heavy manufactures and chemicals.

Then the composition of exports and imports would be represented for each Asian NIEs with US, Japan, and ECC for the period of 1967, 1972, 1977, 1982, and 1987. The percentage share of each commodity group in total exports and imports is shown by the length of the blocked areas in the following sample diagram. The staircase shapes of

[4] The grouping method for each product group is listed in Appendix B.

these blocked areas reflect global comparative advantages in each NIE's trade with the rest of the world.

Figure 3.1 Kojima's Global Comparative Advantage



Through this exposition, we are able to identify the changing pattern of global comparative advantage for each country or region under this study for the period 1967-87. Applying the same techniques, we would also like to investigate the patterns of bilateral trade. In other words, an examination of the intensity of each Asian NIEs' exports of particular group commodities into each trading partner, for example, US, ECC and Japan, will be presented for the period 1967-1987. We also apply this grouping method in conducting following investigation of changing trade patterns for Asian NIEs.

3.3 The Import Market

The investigation of this section is limited to manufactured goods, including labor and capital intensive products, according to Kojima's grouping. The reason is that numerous amount of international trade among nations is manufactured goods. United States, the European Economic Community, and Japan take a lion's share of the exports

of Asian NIEs. Therefore, in this section the investigation will start with the analyses of the imports market of the United States, the European Economic Community, and Japan from the four Asian NIEs. Based on the concept of revealed comparative advantage developed by Balassa (1965), a country's RCA index for each SITC category in the import market under study, namely the United States or the European Economic Community, is defined as the ratio of a country's share of the import market of a particular commodity to its share of total import market. That is,

$$RCA_{ij} = \left(\frac{M_{ij}}{M_j} \Big/ \frac{M_i}{M}\right) \times 100$$

where M_{ij} = Imports of commodity j from country i.

M_i = Total imports from country i

M_j = Total imports of commodity j

M = Total imports

The RCA concept has been applied to the analysis of the imports of manufactures of the United States and the European Economic Community.

The investigation will start with the analysis of the imports market, by the RCA computation, of the United States and the European Economic Community from the four Asian NIEs. Many trade theorists have argued that a country's share of imports market of the other country (for instance, United States) is a function of the exporting country's characters. Various studies have been made to test their performance (see Hufbauer, 1970). The Heckscher-Ohlin postulate states that a country exports those commodities that use relatively intensively its relatively abundant factor. Therefore, a country's exports reflect an important character of that country.

The RCA indices of 1967, 1973, 1977, 1982, and 1987 are computed for Taiwan, Hong Kong, South Korea, Singapore, the Asian NIEs, and Japan. In this study, we are especially interested in the question of whether or not the Asian NIEs really follow Japanese characters if the stages postulate is valid. Therefore, the correlation matrices of RCA indices will be established for each imports market of United States, the European Economic Community, and Japan. These matrices will also be used to compare RCA indices of each SITC category for each Asian NIEs. This comparison will make it easy to identify the comparative advantage of each SITC category for each Asian NIEs, and their changing pattern of trade during the course of time.

3.4 The Import Profiles

The next investigation will be the analysis based on import profiles. We will examine the changing import profiles of manufactures from the Asian NIEs in the markets of the United States, the European Economic Community, and Japan. The import profile of manufactures from country i is defined as the vector of the shares of the 3-digit SITC products imported from country i. Our interest also lies in whether the profiles of the imports from the Asian NIEs are becoming similar over time or whether their profiles are becoming more and more like those of the developed countries. A large positive correlation coefficient for two countries suggests similar profiles of their products in the market in which they are competing.

3.5 Intra-Industry Trade Country Hypotheses

There are a variety of hypotheses have been put forward as to the effects of country characteristics on IIT. We examine following country characteristics in our research.

Hypothesis I: The higher the average per capita income of the trading partners, the higher the ratio of IIT to total trade. Linder (1961) first proposed this argument and used the demand structures of two economies to explain the IIT. He claimed that more similar the demand structures of two economies, the more intensive the IIT between these two economies. He further claimed that the level of average income is the most important factor influencing the demand structure; hence, he suggested that the higher the per capita income, the higher will be the degree of quality characterizing the demand structure as a whole. In other words, the higher the average per capita income level, the more intensive the IIT between two economies.

Following Linder's argument, Loertscher and Wolter (1980) utilized per capita income as a variable for the level of the economic development stage in their empirical analysis of IIT. They listed three reasons to interpret the relationship between IIT and the level of economic development stage. First, they argued that the more developed an economy, the greater its capability to innovate, therefore, the greater its capacity to develop and produce differentiated goods. Second, they used similar arguments of demand structure to claim that the more developed an economy, the higher the demand for differentiated goods will be. This highly differentiated demand will allow for the exploitation of economies of scale in the production of differentiated commodities. Third, the more developed an economy, the more effective and highly developed information and communication linkages. All these factors enhance the relationship between IIT and the level of economic development stages.

According this hypothesis, the extent of IIT between two economies is expected to be positively correlated with their average per capita income. In our analysis, $APCI_{ij}$ represents the natural logarithm of average per capita income in the US dollars of trading partners i and j as the level of economic development stage.

Hypothesis II: The smaller the difference in the per capita income between two economies, the higher the ratio of IIT to total trade. This hypotheses is based on the argument that a similar level of per capita income means similar consumer demand structure. This similarities will generate markets for differentiated products and increase IIT (Linder, 1961; Helpman, 1981; Krugman, 1981; Helpmand & Krugman, 1985) Similarly, Loertscher and Wolter (1980) argued that economies having similar level of economic development stage are likely to have similar consumer preference and factor price relations. Hence, production of only slightly differentiated goods and intense IIT are likely.

Following Balassa and Bauwens (1988), instead of taking absolute values of inter-economies differences in per capita incomes, we use a relative measure that take values between 0 and 1. The reason is the absolute values of the differences are affected by the magnitudes of the values taken in the individual countries. The relative inequality measure ($INPCI_{ij}$) is computed by

$$INPCI_{ij} = 1 + [(w) \ln (w) + (1- w) \ln (1 - w)]/\ln 2$$

where w is the ratio of per capita income of country i to the sum of the per capital income of country i and j. If the difference is large, INPCI will approach 1. Otherwise, it will appoach zero. According to this hypothesis, the share of IIT will be negatively correlated with the difference in per capita income between two economies.

Hypothesis III: The larger the average of the market size of the trading partners, the higher the ratio of IIT to total trade. This rationale is based on the Lancaster (1980) thesis, which argued that, due to economies of scale, the differentiated products number will be greater if the market size is larger. Loertscher and Wolter (1980) further interpreted the relationship by a demand-side factor. They claimed the larger market size the greater demand for foreign differentiated goods. Hence, the potential for IIT is high. The natural logarithm of average GDP of country i and j, AGDPij, in US dollars, indicates average market size. According to the hypothesis, the share of IIT will be positively correlated with the average GDP of two economies.

Hypothesis IV: The smaller the difference in the market sizes of two trading partners, the higher the ratio of IIT to total trade. The rationale is that similar levels of GDP implies similar capacities to manufacture differentiated products (Dixit and Norman, 1980; Helpman, 1981). Loertscher and Wolter (1980) indicated that if the markets of both economies are large, there is more extent for IIT than in cases where the markets are of very different sizes. The similar relative inequality measure, $INGDP_{ij}$, as the one in measuring relative inequality for per capita income is utilized. According to the hypothesis, the share of IIT will be negatively correlated with the difference in market sizes between two economies.

Hypothesis V: The greater the transportation costs between two trading partners, the smaller the ratio of IIT to total trade. Krugman (1980) argued that greater transportation

costs will reduce IIT. Gray and Martin (1960) and Lee (1989) claimed that IIT is more sensitive to the difference in transportation costs, due to high elasticities for differentiated products, than inter industry trade. Loertscher and Wolter (1980) and Balassa and Bauwens (1988) suggested that the availability of information on the characteristics of differentiated goods decreases and its cost increases with distance. Hence, the possibility for a substantial exchanging of highly differentiated products is based on cheaper costs of exchange information between trading partners.

Since fixed transportation costs make total transportation costs increase proportionally less than transportation distance increase, we use square root of the distance between the center of two economies, SD_{ij}, as the measurement of transportation costs. According to the hypothesis, the share of IIT will be negatively correlated with the square root of distance between two economies.

Hypothesis VI: The greater the trade barriers between two trading partners, the smaller the ratio of IIT to total trade. We use the difference in degree of openness between two economies as a variable to measure trade barriers between trading partners. INOPij, a relative inequality measure as we used in Hypothesis I and II, is used as the variable to measure the difference of openness between two economies. Therefore, the greater the difference in degree of openness between two economies, the smaller the ratio of IIT to total trade. According to this hypothesis, the share of IIT will be negatively correlated with the difference in degree of openness between trading partners.

Hypothesis VII: Similar culture between two economies will generate higher ratio of IIT to total trade. The argument is based on that similarity in culture will generate similar demand structure. Therefore, we use a dummy variable, Culture, to capture this characteristic. All the Asian NIEs and Japan are influenced by Chinese culture.

3.6 Approach of Analysis For Intra-Industry Trade

The unadjusted Grubel and Lloyd IIT index, the Aquino IIT index, and the adjusted total trade imbalance IIT index will be computed. Applying any IIT index directly as a dependent variable will generate biased coefficient, owing to the truncations of the continuous distribution at 0 and 1 (Caves,1981; Bergstrand, 1983). To remedy this problem, the logit transformation of the IIT index was proposed as

$$LIITij = \log [\, IITij / (1 - IITij)].$$

Although ordinary least squares with the logit transformation of IIT index generate unbiased estimates, they cause heteroskedasticity problem. To correct this problem, a weighting procedure is applied to both dependent and independent variables (Theil, 1972). The weight, $[IITij\ (1 - IITij)]^{1/2}$, multiply to both dependent and independent variables before performing ordinary least squares method.

In our analysis, all the original IIT indices and logit transformation IIT indices, to which the weighting procedure will be applied correct the heteroskedasticity problem, are computed as dependent variables. We then perform the ordinary least squares method to test those determinants of IIT theory.

Chapter 4

Comparative Advantage and Import Market Analysis

4.1 Global Comparative Advantage Analysis

The analysis in this section focus on broader picture of Asian NIEs competitiveness in world market. We extend Kojima's approach to classify all commodities traded internationally into four groups and apply them to Asian NIEs'. A group consists of agricultural products. N group covers natural resource intensive products outside of agriculture. L group comprises labor intensive manufactures. K group consists of capital intensive manufactures. Through the following diagrams we are easily able to identify the competitiveness pattern for each Asian NIEs over the studied period. Each diagram shows the composition of exports and imports for each Asian NIE for each year we investigated. The percentage share of each commodity group in total exports and imports is by the length of the blocked area in each graph. The left hand side of the vertical axis shows imports, and the right hand side shows exports. The staircase shapes of these blocked areas indicate global comparative advantage in each Asian NIE's trade with the rest of the world.

The patterns of global comparative advantage for each Asian NIE are quite different, according to Figure 4.1 to 4.16. None of the Asian NIEs has global comparative advantage in K group commodities. Korea has the least narrow margin in 1987 to balance the imports and exports of K group products. Hong Kong and Taiwan have similar growth patterns in global comparative advantage over time, particularly having global comparative advantage in L group products and the dominance of imports in N, A, and K

Figure 4.1 Hong Kong 1972 Global Comparative Advantage

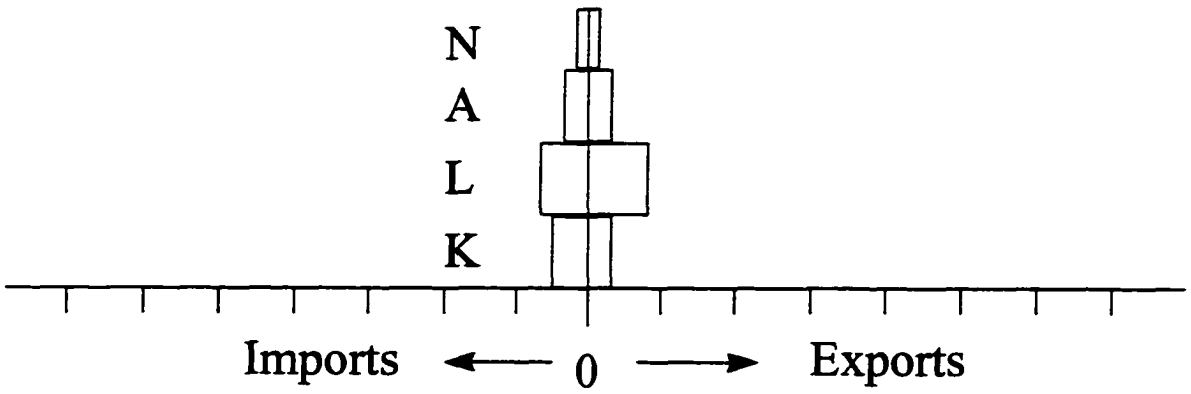


Figure 4.2 Hong Kong 1977 Global Comparative Advantage

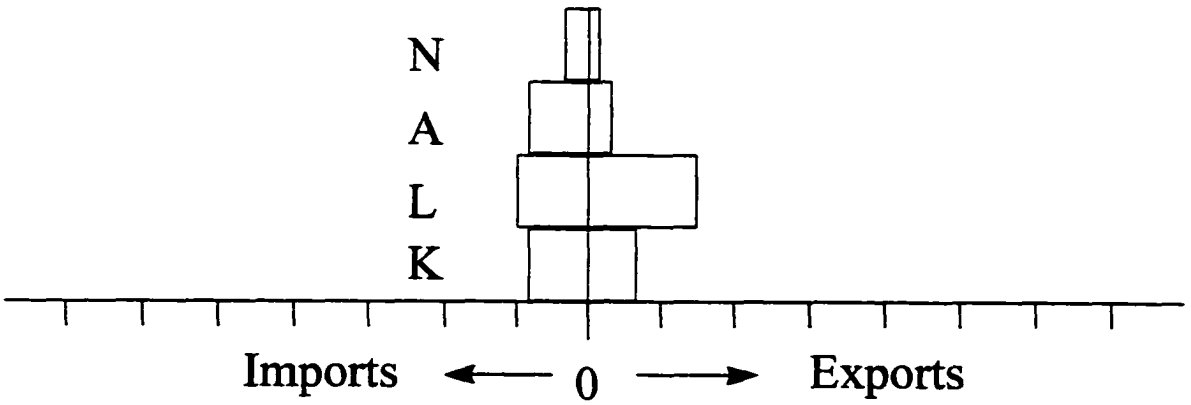


Figure 4.3 Hong Kong 1982 Global Comparative Advantage

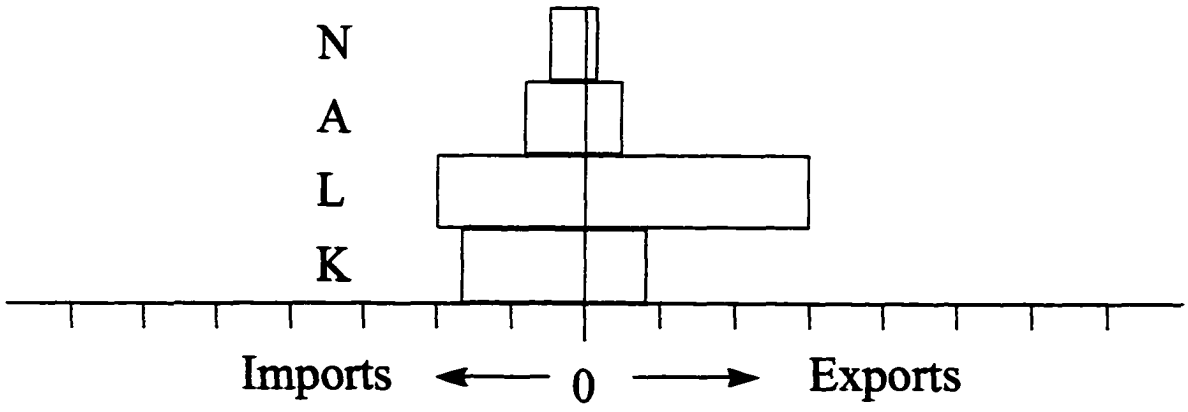


Figure 4.4 Hong Kong 1987 Global Comparative Advantage

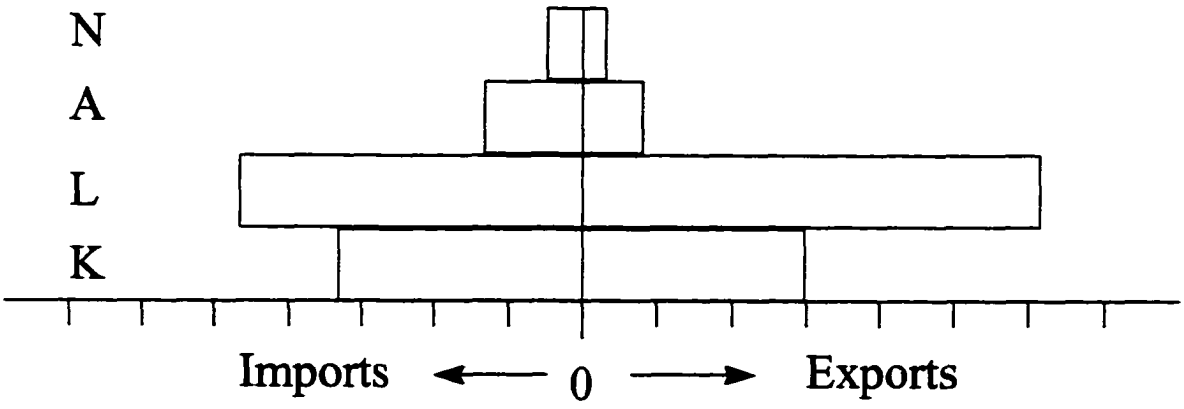


Figure 4.5 Korea 1972 Global Comparative Advantage

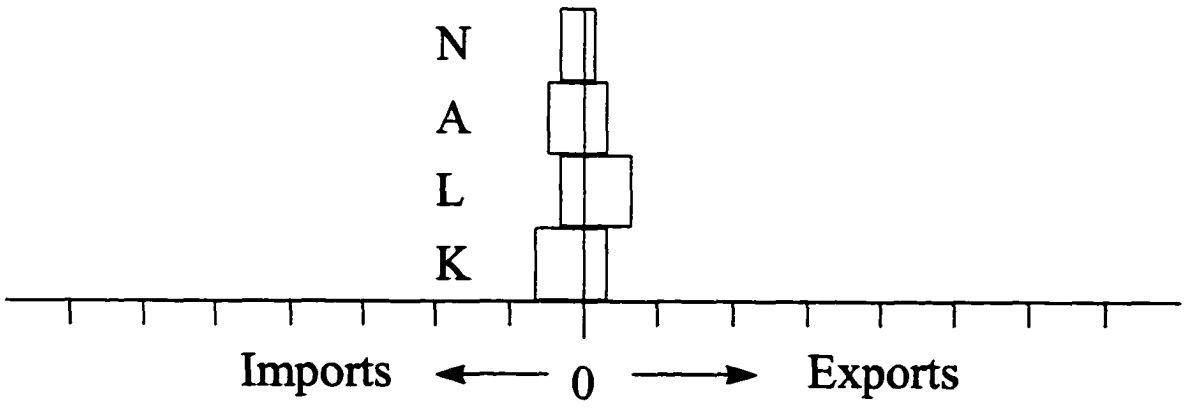


Figure 4.6 Korea 1977 Global Comparative Advantage

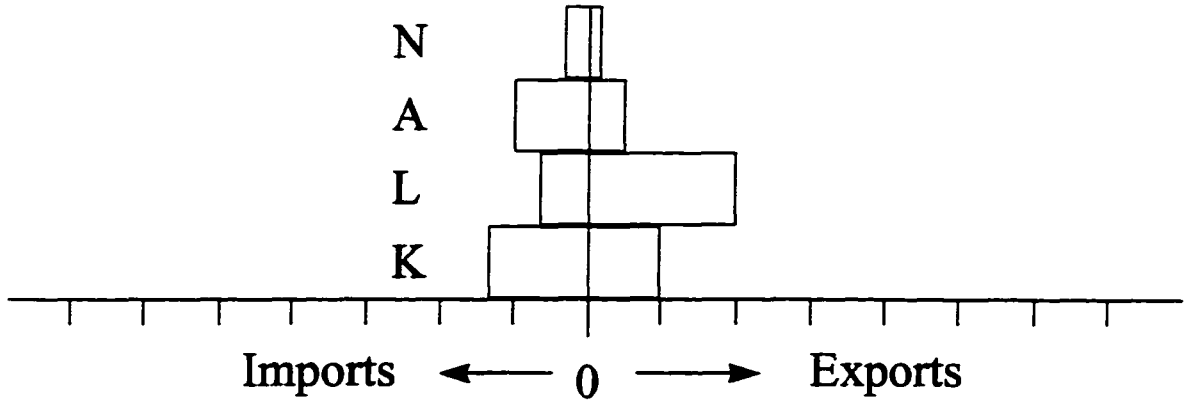


Figure 4.7 Korea 1982 Global Comparative Advantage

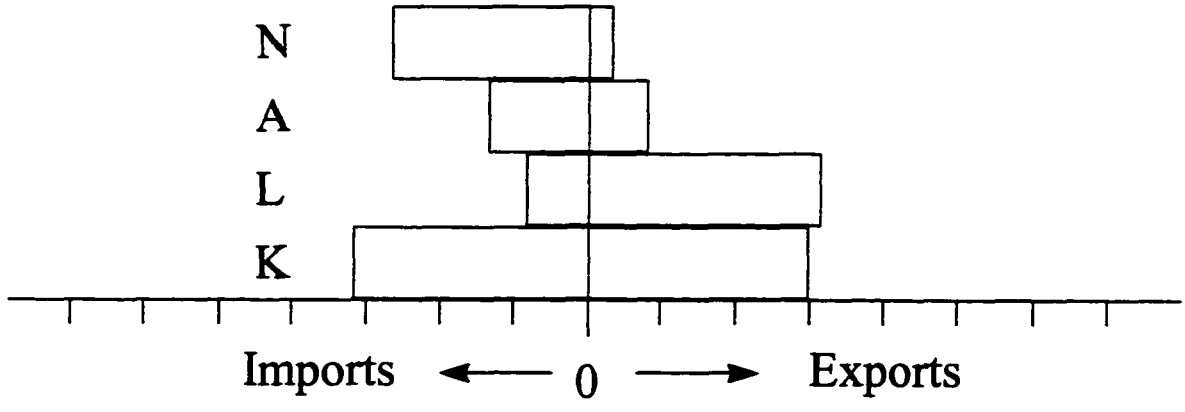


Figure 4.8 Korea 1987 Global Comparative Advantage

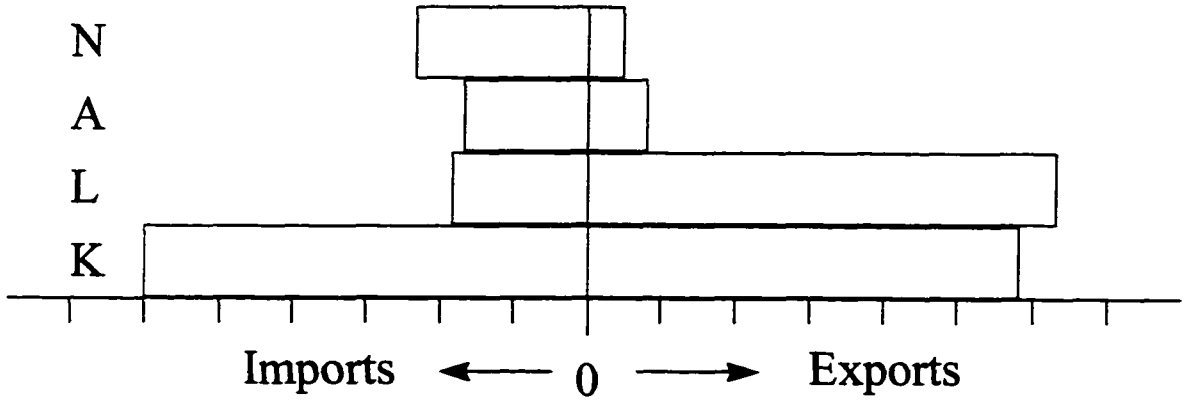


Figure 4.9 Singapore 1972 Global Comparative Advantage

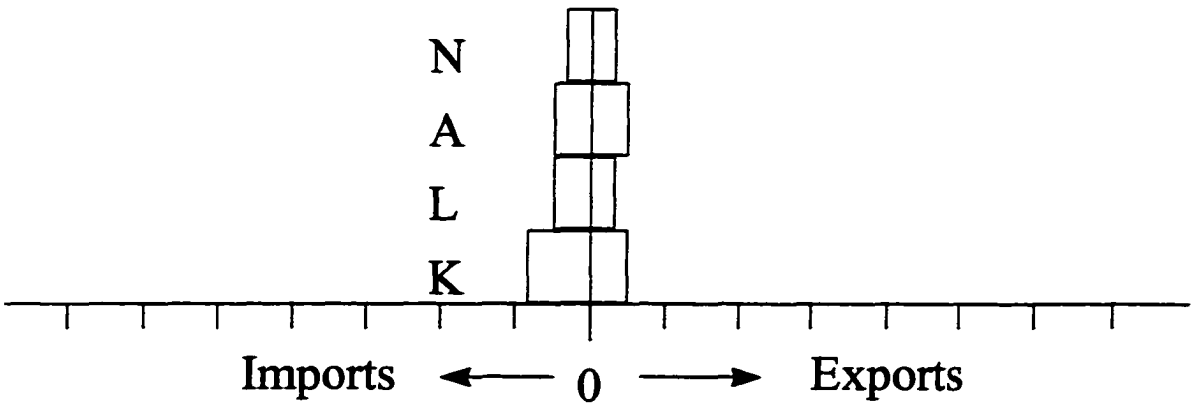


Figure 4.10 Singapore 1977 Global Comparative Advantage

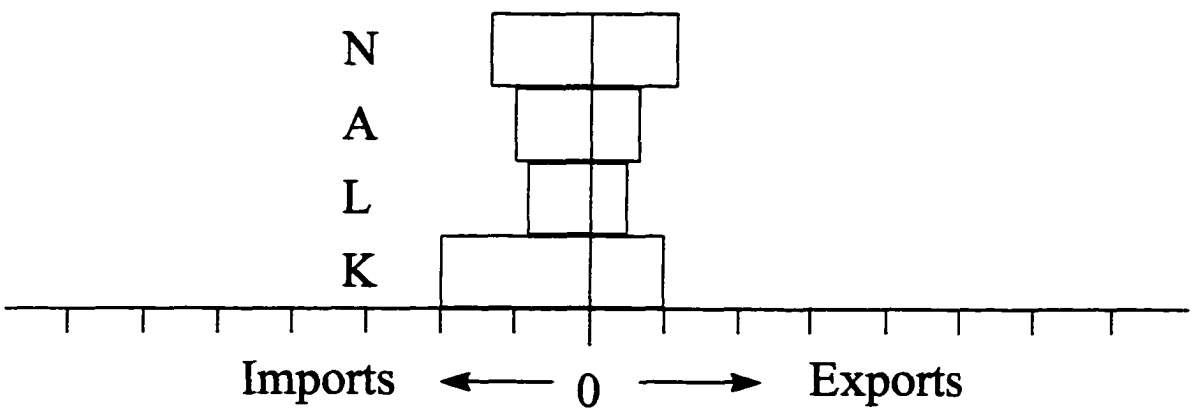


Figure 4.11 Singapore 1982 Global Comparative Advantage

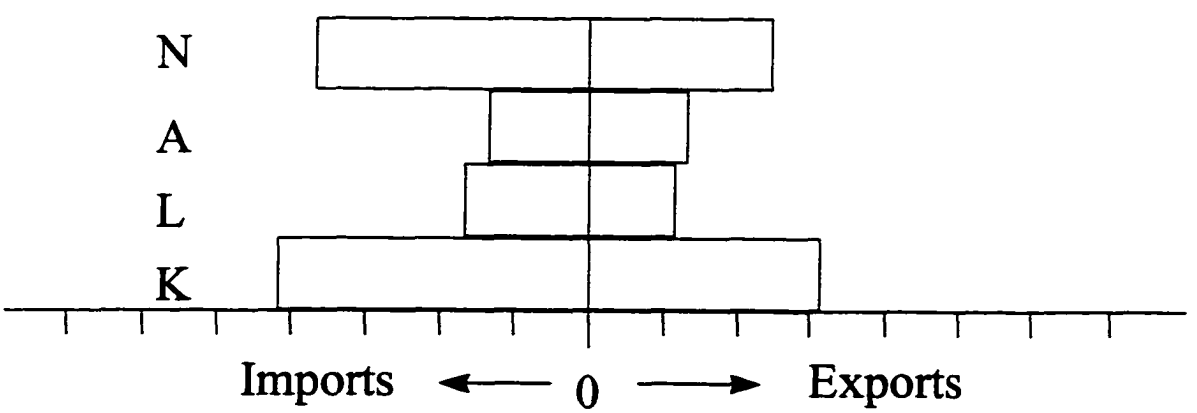


Figure 4.12 Singapore 1987 Global Comparative Advantage

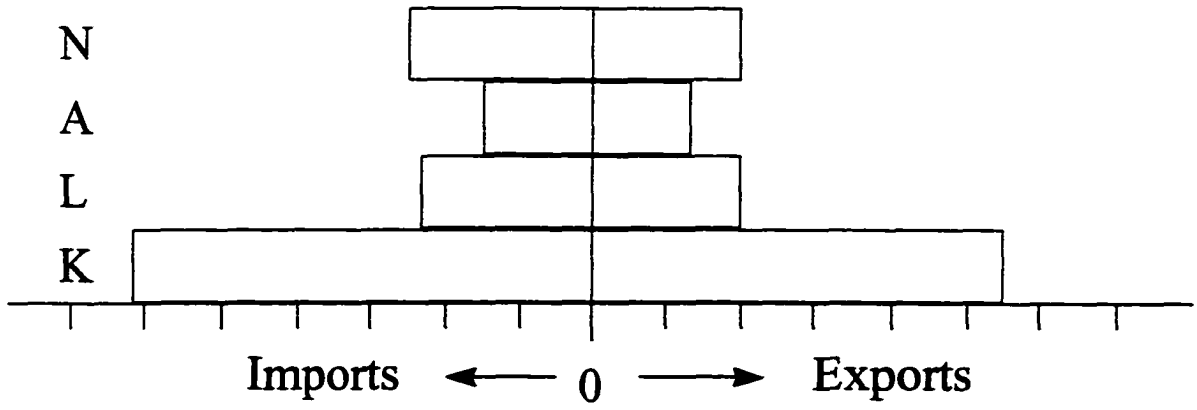


Figure 4.13 Taiwan 1972 Global Comparative Advantage

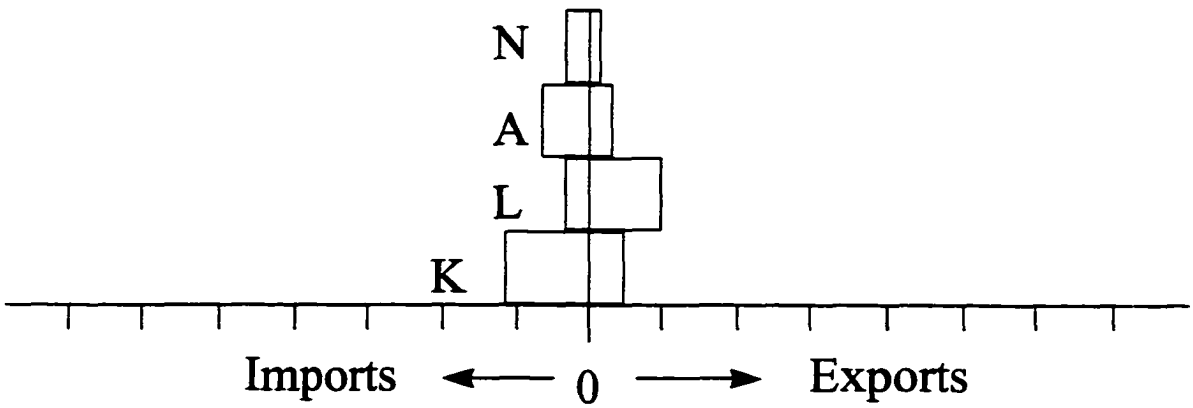


Figure 4.14 Taiwan 1977 Global Comparative Advantage

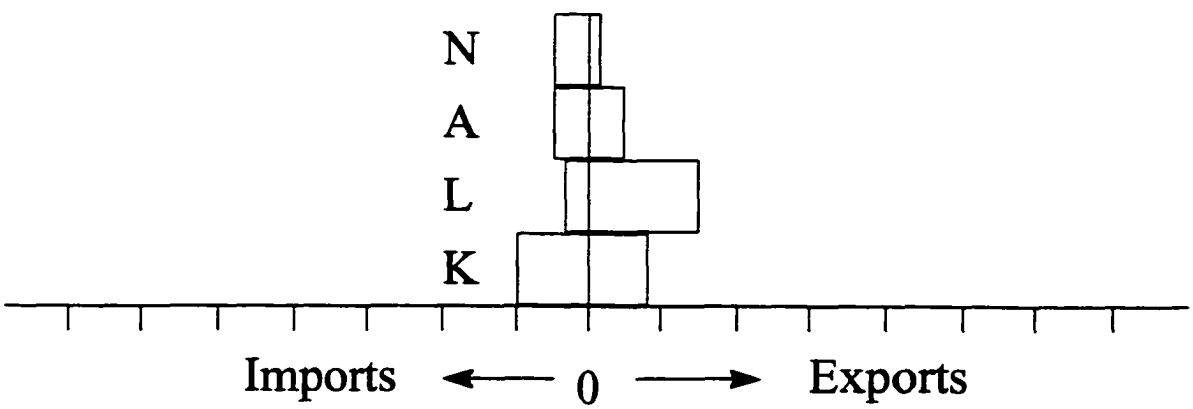


Figure 4.15 Taiwan 1982 Global Comparative Advantage

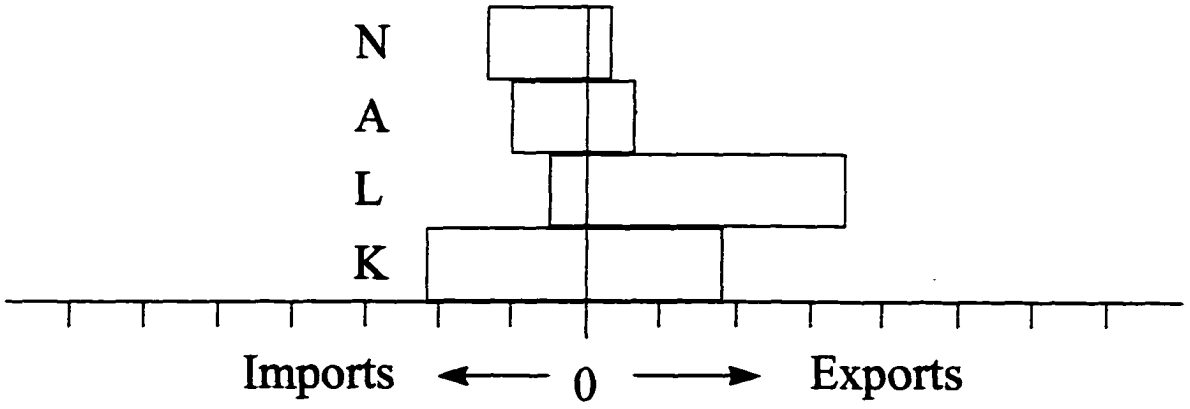
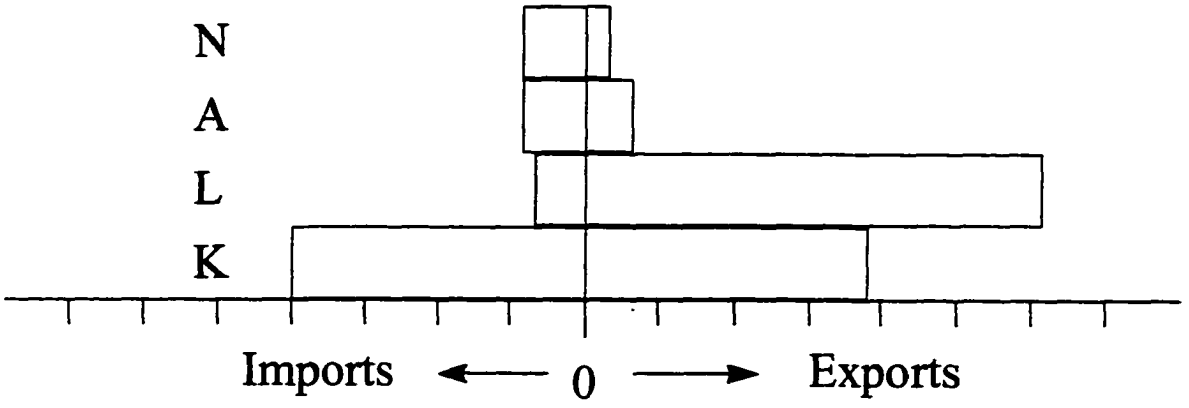


Figure 4.16 Taiwan 1987 Global Comparative Advantage



groups products over the period 1972 to 1987. Hong Kong has a more relatively symmetric blocked area of L group products than does Taiwan. This reflects that Taiwan's economic policy in favor of labor intensive industry and the size of firm. The small size firms could not enjoy economies of scale; therefore, they particularly concentrated on labor intensive industry. Hong Kong's role of entrepot resulted in more balanced exports and imports in manufactures.

Korea's imports of N group commodities in 1982 and 1987 were much more than the exports of them. This reflects that Korea's heavy chemical industry industrialization policy promoting fast growth in K group products sector that relied on the imports of raw material from N group commodities from the world market.

Most of the Asian NIEs have net imports of N and A groups commodities. One exception in our analysis is Singapore. In 1972, Singapore had the global comparative advantage in N group products. Singapore also leads other three Asian NIEs in exporting N group commodities. This indicates that Singapore's strength in refinery of crude oil industry due to its geographic location. Our study also shows that exports of N group commodities of Singapore surpassed L group products, which dominated the exports of the other three Asian NIEs to the world market. On the contrary to other Asian NIEs, the L group products of Singapore is the group exporting least to the world market, compared to other groups except in 1987. Taiwan's industrialization policy was similar to Korea's, but the results of those policies are different. Taiwan's exports of L group were much larger than K group in 1980s, but Korea's exports of K group products were close to L group's exports. Explanation for this phenomena is the difference in firm size. The Korean government subsidized bigger size firms, but the Taiwan government encouraged small business.

4.2 Market Share Analysis

In this section we utilize the changes in market share in US and EC imports market of K and L group products for each Asian NIEs to investigate their competitiveness in each market. EC and US markets takes a lion share of these four Asian NIE exports. The periods of time we investigate the change in market share are 1967-1972, 1972-77, 1977-1982 and 1982-1987. Japan is included in our studies in order to investigate the competitiveness of four Asian NIEs against Japanese manufactures in these two markets. A negative correlation coefficient indicates competition for market share in each commodity group between two countries. Only manufactured group products, K and L group products, are examined in this analysis.

Table 4.1 EC 1967-72 K Group Import Market
Changing in Market Share Correlation Coefficient Matrix

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.459	0.178	0.327	0.625
HKG	0.459	1	0.106	0.39	0.646
KOR	0.178	0.106	1	0.136	0.171
SNP	0.327	0.39	0.136	1	0.674
TWN	0.625	0.646	0.171	0.674	1

Table 4.2 U.S. 1967-72 K Group Import Market
Changing in Market Share Correlation Coefficient Matrix

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.178	-0.308	-0.193	0.198
HKG	0.178	1	-0.086	-0.459	0.038
KOR	-0.308	-0.086	1	0.74	-0.032
SNP	-0.193	-0.459	0.74	1	-0.005
TWN	0.198	0.038	-0.032	-0.005	1

For the period of 1967-1972, none of the Asian NIEs was able to compete with Japan for the K group products in EC import market according to their positive correlation coefficient with Japan in Table 4.1. During the same period of time, each Asian NIE gained market share in the K group products of EC import market, but the gaining was relatively much smaller than Japanese counterpart. In the same period of time, Korea and Singapore competed with Japanese K group products in US import market according to Table 4.2. But the magnitude of gaining market share in US import market for Asian NIEs was significantly larger than those figures in EC market. For example, the United States imported significant amount of SITC 664, glass, from Taiwan during 1967-72 period, but the EC almost imported nothing of the products from Taiwan during the same period of time. This implied Taiwan's export industry mainly focused on the US market since government purposefully devalued New Taiwan dollar against US dollars to facilitate exports to US. Within the same period of time, Asian NIEs also competed with each other in US market and gained market share in EC market at expense of other non-Asian NIE countries in the K group products.

In the period 1967-72, Korea and Singapore started to compete with Japan in US imports market of K group products, but the gaining in the US market share for both countries were still relatively much smaller than the same Japanese products. The competition among Asian NIEs for US imports market of K group products also got started. Especially, the competition between Hong Kong and Singapore was higher than ones among other Asian NIEs due to the similarity of economic development between

these two countries. Both Korea and Singapore had SITC 729 on the top of gaining market share of US imports market of K group products for the period of 1967-72.

Table 4.3 EC 1972-77 K Group Import Market
Changing in Market Share Correlation Coefficient Matrix

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.105	0.257	0.753	0.316
HKG	0.105	1	0.462	0.621	0.739
KOR	0.257	0.462	1	0.586	0.577
SNP	0.753	0.621	0.586	1	0.756
TWN	0.316	0.739	0.577	0.756	1

Table 4.4 US 1972-77 K Group Import Market
Changing in Market Share Correlation Coefficient Matrix

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.111	-0.257	0.093	0.224
HKG	0.111	1	-0.187	0.738	-0.01
KOR	-0.257	-0.187	1	-0.01	0.094
SNP	0.093	0.738	-0.01	1	-0.046
TWN	0.224	-0.01	0.094	-0.046	1

In fact, in the period 1972-77, each Asian NIE was gaining market shares in the EC import market of K group products according to Table 4.3. But the gain was so relatively small that still faced stiff competition against Japanese products in the same product category. For example, during 72-77, the SITC 724, telecommunications apparatus products, led other K group products in gaining market share for all Asian NIEs. Compared with Japanese top growth product, SITC 735, ships and boats, in the K group, the Asian NIEs gaining in SITC 724 was much smaller than Japanese one in SITC 735. The gain in market share was only about one-fifth of the Japanese gain in market for

the same product, SITC 724. The product composition of the top 8 gaining in market share had changed from the mix of SITC section 5, 6, and 7 to only SITC section 7 products from the period 1967-1972 to the period 1972-1977. During the same period of time, the top 8 products in gaining market share for Hong Kong changed from mix of SITC section 6 and 7 products. This reflects Hong Kong flexibility in adjusting production according to changes in market condition. Korea's adoption of a heavy and chemical industries drive policy in the early 1970s changed its composition of top 8 products gaining market share in the EC market from the period 1967 -72 to 1972-1977. In the meantime, Korea's number of products with positive growth rate in gaining market share almost tripled from the period 1967-1972 to 1972-1977 due to the adoption of heavy and chemical industry drive policy. Singapore had fewer industries gaining market share within the period of 1967-1972 than the period 1972-1977.

In the period 1972-1977, only Korea was able to compete with Japanese K group products in the US market, according to Table 4.4. Singapore and Hong Kong had the same top two products, SITC 725 and 714, in gaining US market shares; in this, they squeezed out the Japanese top performer, SITC 725, in the US imports market of K group products. Korea also competed with Hong Kong and Singapore in the US market. The percentage of gaining US market share from Taiwan's products was much larger than those counter ones from the other three Asian NIEs.

Table 4.5 EC 1977-82 K Group Import Market
Changing in Market Share Correlation Coefficient Matrix

	JPN	HKG	KOR	SNP	TWN
JPN	1	-0.015	-0.153	0.29	0.131
HKG	-0.015	1	-0.147	0.082	-0.087
KOR	-0.153	-0.147	1	-0.206	0.029
SNP	0.29	0.082	-0.206	1	0.132
TWN	0.131	-0.087	0.029	0.132	1

Table 4.6 US 1977-82 K Group Import Market
Changing in Market Share Correlation Coefficient Matrix

	JPN	HKG	KOR	SNP	TWN
JPN	1	-0.133	-0.191	-0.188	0.088
HKG	-0.133	1	0.427	0.648	0.369
KOR	-0.191	0.427	1	0.413	0.145
SNP	-0.188	0.648	0.413	1	0.228
TWN	0.088	0.369	0.145	0.228	1

There was a dramatic change in the competition from four Asian NIEs in the EC imports market of K group products within 1977-1982 period. Hong Kong and Korea started to compete with Japanese K group products in the EC import market, according to Table 4.5. Japanese SITC 735 products, ships and boats, fell from the top growth rate in market share within 1972-1977 to the bottom of K group products within period of 1997-1982. We are not sure whether or not this has been because of direct competition from four Asian NIEs, but evidence showed that all four Asian NIEs had positive growth rate in changing market share for the same product. SITC section 7 products still dominated the top 8 high growth rate in gaining market share for each Asian NIE. Taiwan's SITC 724 is still on the top of gaining market share of EC import market of K group products within the period 1977-1982. This indicates that in the early 1970s, relatively high

value-added industries, such as precision machinery, electronics, electrical machinery, optical equipment, and plastics, were given higher priority in the export industry by the Taiwan government. In the meantime, Hong Kong's SITC 725, domestic electrical equipment, doubled its market share from previous period, 1972-1977, and squeezed the old champ, SITC 724, to the bottom of the K group products. This implies that there is no specific economic policy in Hong Kong to direct industry development. On the other hand, Asian NIEs started to compete with each other in the EC market within this period of time, especially in electrical machinery, apparatus, and appliances products (SITC division 72).

Within the 1977-1982 period, Korea, Hong Kong and Singapore were able to compete with Japanese in the US imports market of K group products. But the competitiveness from these three Asian NIEs was not significant. Korea and Hong Kong both had the same product, SITC 725, which topped the ranking of gaining the US market share for this period. In the meantime, the top two ranking products for Hong Kong and Singapore were still the same, SITC 725 and 714, as in the previous period, 1972-77. Taiwan's SITC 725 also was ranked number 2 in gaining US market share while Japanese counter one was falling into bottom and was losing market share to Asian NIEs.

Table 4.7 EC 1982-87 K Group Import Market
Changing in Market Share Correlation Coefficient Matrix

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.153	-0.276	0.016	0.237
HKG	0.153	1	0.489	0.074	0.459
KOR	-0.276	0.489	1	0	0.349
SNP	0.016	0.074	0	1	0.168
TWN	0.237	0.459	0.349	0.168	1

Table 4.8 US 1982-87 K Group Import Market
Changing in Market Share Correlation Coefficient Matrix

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.043	-0.119	-0.091	-0.196
HKG	0.043	1	-0.428	-0.373	-0.344
KOR	-0.119	-0.428	1	-0.202	0.119
SNP	-0.091	-0.373	-0.202	1	0.143
TWN	-0.196	-0.344	0.119	0.143	1

For the period of 1982-1987, only Korea was able to compete with Japanese K group products in EC import market according to Table 4.7. Hong Kong's SITC 724 product was riding the roller coaster. It rolled back from the bottom of gaining market share to the top four again and dived almost to bottom. Korea, Singapore, and Taiwan almost doubled their growth rate in gaining market share in this product but Hong Kong was doing the opposite. In the meantime, the Korea's top five of high growth industries in gaining market share were all within SITC section 7 product category, machinery and transport equipment. Japanese SITC section 7 even took more shares of EC import market of K group than the Asian NIEs did. All top 10 products group gaining market share were from the SITC section 7 product category. All the positive correlation

coefficients among Asian NIEs indicate that Asian NIEs were gaining market share, not competing with each other, at expense of other non-Asian NIEs.

In the same period of time, 1982-87, Taiwan joined with Korea and Singapore to compete with Japanese K group products in the US imports market. Hong Kong competed with all other three Asian NIEs in the US market. Korea and Singapore still had the same products at the top of gaining market share in US market. Korea also competed with Hong Kong and Singapore in the US market.

Table 4.9 EC 1967-72 L Group Import Market
Changing in Market Share Correlation Coefficient Matrix

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.116	0.11	0.095	-0.188
HKG	0.116	1	-0.398	-0.002	-0.179
KOR	0.11	-0.398	1	0.26	0.363
SNP	0.095	-0.002	0.26	1	0.279
TWN	-0.188	-0.179	0.363	0.279	1

Table 4.10 US 1967-72 L Group Import Market
Changing in Market Share Correlation Coefficient Matrix

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.101	-0.207	-0.094	-0.405
HKG	0.101	1	-0.209	-0.079	-0.019
KOR	-0.207	-0.209	1	0.496	0.425
SNP	-0.094	-0.079	0.496	1	0.359
TWN	-0.405	-0.019	0.425	0.359	1

For 1967-1972 period, only Taiwan was able to compete with Japanese in the L group products according to the above table. Taiwan also had more industries which

gaining a market share in the EC import market of L group products than did Japan. Singapore and Taiwan both had wood-related industries topped the gaining market share L group products (SITC 631 and 632, respectively). SITC 891, musical instruments, sound recorders, etc., was the leading industry for Japanese in gaining a market share of the EC import market of L group product for the period, and no Asian NIE was able to challenge Japan in this product category. Hong Kong and Korea had high percentage of similar products within the top 10 growth rate in gaining market share. This explains why there is a higher negative correlation coefficient between Hong Kong and Korea in market share change of EC import market of L group products. The changing in market share was also greater in L group products than in K group products for Asian NIEs. For example, for the period, 1967-1972, all the top growth rate in gaining market share of Asian NIEs were greater than Japanese counter one.

In the same period of time, except Hong Kong, all Asian NIEs contested with Japanese L group products in US market. Taiwan was the only Asian NIE which had similar rate of gaining US market share as Japan had. Japanese top ranking products in gaining market share were similar between the EC and US markets in the same period of time. But these varied with each Asian NIE.

Table 4.11 EC 1972-77 L Group Import Market
Changing in Market Share Correlation Coefficient Matrix

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.393	-0.32	-0.075	-0.17
HKG	0.393	1	0.125	-0.22	0.232
KOR	-0.32	0.125	1	0.383	0.514
SNP	-0.075	-0.22	0.383	1	0.078
TWN	-0.17	0.232	0.514	0.078	1

Table 4.12 US 1972-77 L Group Import Market
Changing in Market Share Correlation Coefficient Matrix

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.052	-0.34	0.038	-0.3
HKG	0.052	1	-0.086	0.427	-0.182
KOR	-0.34	-0.086	1	0.009	0.247
SNP	0.038	0.427	0.009	1	0.417
TWN	-0.3	-0.182	0.247	0.417	1

Korea and Singapore also jumped on the bandwagon with Taiwan to compete with Japan in the EC market. Both Japanese and Hong Kong had SITC 864 product, watches and clocks, on the top ranking of gaining market share in the EC import market of L group products. In the meantime, the same industry for Singapore and Taiwan rose really fast in gaining market share of EC import market of L group products. Both Korea and Taiwan had SITC 831, travel goods, handbags etc., on the top performer list for gaining the EC import market share of L group products.

Korea was more aggressively in gaining US imports market of L group products in the period 1972-1977. During this period, only Korea and Taiwan were competing

with Japanese L group products in gaining market share of US imports market. Hong Kong and Singapore had the same product, SITC 864, watches and clocks, at the top of gaining the US market share during this period.

Table 4.13 EC 1977-82 L Group Import Market
Changing in Market Share Correlation Coefficient Matrix

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.204	-0.011	0.011	-0.175
HKG	0.204	1	0.117	0.078	-0.132
KOR	-0.011	0.117	1	0.341	0.349
SNP	0.011	0.078	0.341	1	0.221
TWN	-0.175	-0.132	0.349	0.221	1

Table 4.14 US 1977-82 L Group Import Market
Changing in Market Share Correlation Coefficient Matrix

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.042	-0.256	-0.172	-0.421
HKG	0.042	1	-0.103	-0.11	-0.104
KOR	-0.256	-0.103	1	0.11	0.088
SNP	-0.172	-0.11	0.11	1	-0.134
TWN	-0.421	-0.104	0.088	-0.134	1

For this period of time, 1977-82, in the EC market Japanese competitors for gaining a market share in L group products were Taiwan and Korea, according to Table 4.13. Among Asian NIEs, only Hong Kong and Taiwan were competing each other in this market. Other than that, all Asian NIEs were gaining a market share in the EC market at the expense of other non-Asian NIEs countries. In the US imports market, except for Hong Kong, all Asian NIEs contested with Japan in gaining market share. Among Asian NIEs, Taiwan only competed with Hong Kong in this market but Korea competed with

Hong Kong and Singapore. Singapore also contested with Korea and Hong Kong in gaining a US market share.

Table 4.15 EC 1982-87 L Group Import Market
Changing in Market Share Correlation Coefficient Matrix

	JPN	HKG	KOR	SNP	TWN
JPN	1	-0.119	-0.046	0.171	-0.304
HKG	-0.119	1	0.02	-0.197	-0.254
KOR	-0.046	0.02	1	0.146	0.389
SNP	0.171	-0.197	0.146	1	0.494
TWN	-0.304	-0.254	0.389	0.494	1

Table 4.16 US 1982-87 L Group Import Market
Changing in Market Share Correlation Coefficient Matrix

	JPN	HKG	KOR	SNP	TWN
JPN	1	-0.195	-0.142	0.02	-0.604
HKG	-0.195	1	-0.184	0.204	0.014
KOR	-0.142	-0.184	1	0.065	0.435
SNP	0.02	0.204	0.065	1	0.004
TWN	-0.604	0.014	0.435	0.004	1

Except for Singapore, all Asian NIEs were competing with Japanese L group products in gaining EC and US market share with 1982-87 period. Taiwan and Singapore competed with Hong Kong in EC market. Korea contested with Hong Kong in gaining US market share for this period. Most of Asian NIEs were gaining both EC and US market shares at expense of other countries. This indicates that product cycle of most Japanese L group products had matured and production started to shift to overseas, like the Asian NIEs.

4.3 Import Profiles Analysis

We are also interested in whether or not US and EC imports of manufactures from Asian NIEs are more like that from Japan. We utilize import profiles, defined as the manufactures from country i, as the vector of share distribution of US or EC imports of manufactures from country i with the share computed as a percentage of the total US or EC imports from that country. A positive coefficient between an Asian NIE and Japan indicates similar profiles in the US or EC import market of manufactures. If the positive correlation coefficient increases over time, it would suggest that the imports from the Asian NIEs are becoming more and more like that from Japan. The same methodology is also applied to the correlation coefficient among Asian NIEs themselves to whether or not Asian NIEs also had similar pattern of import profiles in the US and EC import market.

4.3.1 Import Profiles of EC Market

Labor Intensive Products Group

Table 4.17 EC 1967 Import Profiles Correlation Matrix: L Group

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.427	0.281	0.24	0.303
HKG	0.427	1	0.586	0.377	0.629
KOR	0.281	0.586	1	0.44	0.969
SNP	0.24	0.377	0.44	1	0.528
TWN	0.303	0.629	0.969	0.528	1

Table 4.18 EC 1972 Import Profiles Correlation Matrix: L Group

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.09	0.155	0.467	0.135
HKG	0.09	1	0.955	0.522	0.912
KOR	0.155	0.955	1	0.543	0.935
SNP	0.467	0.522	0.543	1	0.529
TWN	0.135	0.912	0.935	0.529	1

Table 4.19 EC 1977 Import Profiles Correlation Matrix: L Group

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.045	0.041	0.263	0.075
HKG	0.045	1	0.969	0.826	0.88
KOR	0.041	0.969	1	0.875	0.909
SNP	0.263	0.826	0.875	1	0.744
TWN	0.075	0.88	0.909	0.744	1

Table 4.20 EC 1982 Import Profiles Correlation Matrix: L Group

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.031	0.019	0.123	0.033
HKG	0.031	1	0.962	0.915	0.799
KOR	0.019	0.962	1	0.886	0.833
SNP	0.123	0.915	0.886	1	0.772
TWN	0.033	0.799	0.833	0.772	1

Table 4.21 EC 1987 Import Profiles Correlation Matrix: L Group

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.059	0.083	0.261	0.115
HKG	0.059	1	0.95	0.862	0.646
KOR	0.083	0.95	1	0.85	0.74
SNP	0.261	0.862	0.85	1	0.706
TWN	0.115	0.646	0.74	0.706	1

In 1967, the imports of Hong Kong was more similar than other Asian NIE imports to those from Japan, but with the passage of time, Hong Kong became less like imports of L group products from Japan in EC market according to above tables. In the same year, most of Asian NIEs had higher coefficient. This indicates that in 1967 Japanese L group products were still the major exports for Japan. In later years, when Japan exported more K group products to EC market, the coefficient between Asian NIEs and Japan dropped. There are no clear pattern to conclude that EC imports from any Asian NIE are more like that from Japan in L products group. The general trend is that the coefficient was decreasing over time. As the Japanese industrial structure moved toward more capital intensive industries and phased out low-end labor intensive products, the possibility for the imports from Asian NIEs in EC market would be more like that from Japan is low. Interestingly, the high coefficient between Korea and Hong Kong over time indicates the imports from Hong Kong and Korea were more like each other in the EC market. The similarity between Taiwan and Korea, and between Taiwan and Hong Kong, was decreasing over time. But imports from Taiwan in the EC market were more like that from Singapore over time.

Capital Intensive Products Group

Table 4.22 EC 1967 Import Profiles Correlation Matrix: K Group

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.393	0.209	0.079	0.439
HKG	0.393	1	0.203	0.193	0.415
KOR	0.209	0.203	1	-0.013	0.63
SNP	0.079	0.193	-0.013	1	0.054
TWN	0.439	0.415	0.63	0.054	1

Table 4.23 EC 1972 Import Profiles Correlation Matrix: K Group

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.502	0.474	0.357	0.517
HKG	0.502	1	0.603	0.609	0.957
KOR	0.474	0.603	1	0.411	0.604
SNP	0.357	0.609	0.411	1	0.685
TWN	0.517	0.957	0.604	0.685	1

Table 4.24 EC 1977 Import Profiles Correlation Matrix: K Group

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.394	0.474	0.51	0.415
HKG	0.394	1	0.903	0.868	0.925
KOR	0.474	0.903	1	0.873	0.901
SNP	0.51	0.868	0.873	1	0.944
TWN	0.415	0.925	0.901	0.944	1

Table 4.25 EC 1982 Import Profiles Correlation Matrix: K Group

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.941	0.939	0.93	0.562
HKG	0.941	1	0.873	0.947	0.941
KOR	0.939	0.873	1	0.895	0.939
SNP	0.93	0.947	0.895	1	0.97
TWN	0.562	0.941	0.939	0.97	1

Table 4.26 EC 1987 Import Profiles Correlation Matrix: K Group

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.528	0.582	0.558	0.555
HKG	0.528	1	0.961	0.884	0.872
KOR	0.582	0.961	1	0.853	0.821
SNP	0.558	0.884	0.853	1	0.979
TWN	0.555	0.872	0.821	0.979	1

From 1967 to 1982, all Asian NIEs had the coefficient in increasing fashion with Japan in the K group, according to the above tables. That means that during this period, all the K group imports from Asian NIEs in EC market were more like that from Japan. In 1987, all Asian NIEs also had highly similar profiles to that of Japan in the EC import market of K group products. Taiwan had very highly similar profile to that of Hong Kong, Korea, and Singapore in the EC import market of K group products in 1977-87. And all Asian NIEs had larger coefficient among themselves during 1977 and 1987. This indicates that all Asian NIEs had switched their industrial structure from labor intensive to capital intensive in the observed periods. But, in the meantime, Japan moved to higher development level; therefore, the coefficients between Japan and Asian NIEs dropped in 1987 from the previous period.

4.3.2 Import Profiles of US Market

Labor Intensive Products Group

Table 4.27 US 1967 Import Profiles Correlation Matrix: L Group

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.546	0.487	0.544	0.549
HKG	0.546	1	0.691	0.789	0.68
KOR	0.487	0.691	. 1	0.765	0.861
SNP	0.544	0.789	0.765	1	0.944
TWN	0.549	0.68	0.861	0.944	1

Table 4.28 US 1972 Import Profiles Correlation Matrix: L Group

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.355	0.332	0.397	0.366
HKG	0.355	1	0.827	0.922	0.891
KOR	0.332	0.827	1	0.919	0.912
SNP	0.397	0.922	0.919	1	0.906
TWN	0.366	0.891	0.912	0.906	1

Table 4.29 US 1977 Import Profiles Correlation Matrix: L Group

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.166	0.176	0.253	0.166
HKG	0.166	1	0.853	0.883	0.848
KOR	0.176	0.853	1	0.719	0.965
SNP	0.253	0.883	0.719	1	0.752
TWN	0.166	0.848	0.965	0.752	1

Table 4.30 US 1982 Import Profiles Correlation Matrix: L Group

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.138	0.105	0.276	0.155
HKG	0.138	1	0.854	0.926	0.854
KOR	0.105	0.854	1	0.819	0.949
SNP	0.276	0.926	0.819	1	0.795
TWN	0.155	0.854	0.949	0.795	1

Table 4.31 US 1987 Import Profiles Correlation Matrix: L Group

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.103	0.127	0.327	0.127
HKG	0.103	1	0.853	0.922	0.701
KOR	0.127	0.853	1	0.79	0.904
SNP	0.327	0.922	0.79	1	0.656
TWN	0.127	0.701	0.904	0.656	1

In the US import market of L group products, there was a clear pattern for Asian NIEs about import profiles. Hong Kong, Korea,[5] and Taiwan had correlation coefficients with Japan in decreasing fashion over our study period. This indicates that in the US market the imports from these Asian NIEs were becoming less and less like that from Japan. Singapore had a mixed result. It decreased from 1967 to 1977, then it was up until 1987. Singapore had correlation coefficient with Taiwan and Korea in decreasing trend. In other words, In the US import market of L group products, imports from Taiwan and Korea were less and less like that from Singapore. The coefficients between Taiwan and Hong Kong, and Taiwan and Korea were high but with no obvious pattern. The coefficient between Hong Kong and Korea was increasing over time. This implies the imports from Hong Kong was more and more like that from Korea in US import market. The correlation coefficients between Hong Kong and Singapore were always high but had no clear pattern of increasing or decreasing. This indicates that import profiles for the two nations were very similar in the US import market. In other words, it reflects the similarity in their industrial structure.

[5] Actually, the coefficient of correlation between Korea and Japan was up a little in 1987. But it dropped dramatically in 1982.

Capital Intensive Products Group

Table 4.32 US 1967 Import Profiles Correlation Matrix: K Group

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.716	0.624	-0.07	0.852
HKG	0.716	1	0.973	-0.035	0.864
KOR	0.624	0.973	1	-0.036	0.75
SNP	-0.07	-0.035	-0.036	1	-0.035
TWN	0.852	0.864	0.75	-0.035	1

Table 4.33 US 1972 Import Profiles Correlation Matrix: K Group

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.341	0.159	0.164	0.413
HKG	0.341	1	0.778	0.815	0.823
KOR	0.159	0.778	1	0.978	0.307
SNP	0.164	0.815	0.978	1	0.351
TWN	0.413	0.823	0.307	0.351	1

Table 4.34 US 1977 Import Profiles Correlation Matrix: K Group

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.288	0.249	0.146	0.344
HKG	0.288	1	0.903	0.819	0.849
KOR	0.249	0.903	1	0.926	0.763
SNP	0.146	0.819	0.926	1	0.529
TWN	0.344	0.849	0.763	0.529	1

Table 4.35 US 1982 Import Profiles Correlation Matrix: K Group

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.225	0.281	0.193	0.309
HKG	0.225	1	0.765	0.826	0.832
KOR	0.281	0.765	1	0.829	0.824
SNP	0.193	0.826	0.829	1	0.664
TWN	0.309	0.832	0.824	0.664	1

Table 4.36 US 1987 Import Profiles Correlation Matrix: K Group

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.262	0.889	0.221	0.375
HKG	0.262	1	0.549	0.826	0.909
KOR	0.889	0.549	1	0.37	0.661
SNP	0.221	0.826	0.37	1	0.721
TWN	0.375	0.909	0.661	0.721	1

The correlation of coefficient for Singapore with any other nations in our study was negative in 1967 according to Table 4.32. This means that US imports from Singapore was very different from other countries, including Japan. The coefficients of correlation between Taiwan and Japan, and Hong Kong and Japan had similar pattern. Both decreased from 1967 until 1987. This means that US imports of K group products from Taiwan and Hong Kong were less and less like that from Japan until 1987. After 1977, the correlation coefficient between Korea and Japan, and Singapore and Japan were in an increasing pattern. Therefore, after 1977, profiles of Korea and Singapore in the US import market was becoming more like Japanese ones. The correlation coefficient between Hong Kong and Singapore was in an increasing fashion over time. It implies that US imports of K group products from Hong Kong was more and more like that from Singapore. Taiwan and Singapore also had the similar trend in the coefficient changing.

4.4 Revealed Comparative Advantage

4.4.1 EC Import Market

Capital Intensive Products Group

Table 4.37 RCA: 1967 EC Import Market K Products Group Correlation

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.296	0.288	0.092	0.178
HKG	0.296	1	-0.033	-0.04	0.73
KOR	0.288	-0.033	1	-0.061	-0.037
SNP	0.092	-0.04	-0.061	1	0.228
TWN	0.178	0.73	-0.037	0.228	1

Table 4.38 RCA: 1972 EC Import Market K Products Group Correlation

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.271	-0.005	0.043	0.113
HKG	0.271	1	-0.041	0.186	0.884
KOR	-0.005	-0.041	1	-0.05	-0.047
SNP	0.043	0.186	-0.05	1	0.502
TWN	0.113	0.884	-0.047	0.502	1

Table 4.39 RCA: 1977 EC Import Market K Products Group Correlation

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.041	0.536	0.361	0.137
HKG	0.041	1	0.012	0.02	0.495
KOR	0.536	0.012	1	0.04	0.101
SNP	0.361	0.02	0.04	1	0.289
TWN	0.137	0.495	0.101	0.289	1

Table 4.40 RCA: 1982 EC Import Market K Products Group Correlation

	JPN	HKG	KOR	SNP	TWN
JPN	1	-0.048	-0.038	-0.027	-0.067
HKG	-0.048	1	0.12	0.237	0.372
KOR	-0.038	0.12	1	-0.04	0.051
SNP	-0.027	0.237	-0.04	1	-0.019
TWN	-0.067	0.372	0.051	-0.019	1

Table 4.41 RCA: 1987 EC Import Market K Products Group Correlation

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.001	0.143	-0.042	0.1
HKG	0.001	1	0.037	0.461	0.216
KOR	0.143	0.037	1	-0.001	-0.044
SNP	-0.042	0.461	-0.001	1	0.091
TWN	0.1	0.216	-0.044	0.091	1

In this products group, the RCAs of four Asian NIEs were far below Japan in terms of correlation coefficient according to above tables. The highest one was Korea in 1977. The reasonable explanation was the result of Korea's heavy chemical industry industrialization policy. Korea also had higher correlation coefficient than other Asian NIEs over time.

Labor Intensive Products Group

Table 4.42 RCA: 1967 EC Import Market L Products Group Correlation

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.575	0.449	0.025	0.337
HKG	0.575	1	0.682	0.218	0.406
KOR	0.449	0.682	1	0.036	0.708
SNP	0.025	0.218	0.036	1	0.318
TWN	0.337	0.406	0.708	0.318	1

Table 4.43 RCA: 1972 EC Import Market L Products Group Correlation

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.475	0.639	0.203	0.375
HKG	0.475	1	0.549	0.353	0.659
KOR	0.639	0.549	1	0.306	0.284
SNP	0.203	0.353	0.306	1	0.509
TWN	0.375	0.659	0.284	0.509	1

Table 4.44 RCA: 1977 EC Import Market L Products Group Correlation

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.361	0.548	0.248	0.324
HKG	0.361	1	0.584	0.395	0.556
KOR	0.548	0.584	1	0.166	0.488
SNP	0.248	0.395	0.166	1	0.063
TWN	0.324	0.556	0.488	0.063	1

Table 4.45 RCA: 1982 EC Import Market L Products Group Correlation

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.489	0.365	0.554	0.206
HKG	0.489	1	0.459	0.499	0.39
KOR	0.365	0.459	1	0.285	0.46
SNP	0.554	0.499	0.285	1	0.245
TWN	0.206	0.39	0.46	0.245	1

Table 4.46 RCA: 1987 EC Import Market L Products Group Correlation

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.492	0.345	0.413	0.273
HKG	0.492	1	0.485	0.304	0.289
KOR	0.345	0.485	1	0.512	0.54
SNP	0.413	0.304	0.512	1	0.435
TWN	0.273	0.289	0.54	0.435	1

All Asian NIEs had higher RCA correlation coefficient in this products group than in K group. This reflects that Asian NIEs had global comparative advantage in L group products. But in terms of import revealed comparative advantage, Asian NIEs were still fall behind Japan. Before 1982, Korea had a relatively higher coefficient than other Asian NIEs.

4.4.2 US Import Market

Capital Intensive Products Group

Table 4.47 RCA: 1967 US Import Market K Products Group Correlation

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.046	0.293	-0.088	0.022
HKG	0.046	1	-0.036	-0.026	0.798
KOR	0.293	-0.036	1	-0.051	-0.036
SNP	-0.088	-0.026	-0.051	1	0.055
TWN	0.022	0.798	-0.036	0.055	1

Table 4.48 RCA: 1972 US Import Market K Products Group Correlation

	JPN	HKG	KOR	SNP	TWN
JPN	1	-0.031	-0.026	-0.031	1
HKG	-0.031	1	-0.028	0.695	-0.032
KOR	-0.026	-0.028	1	-0.025	-0.032
SNP	-0.031	0.695	-0.025	1	-0.031
TWN	1	-0.032	-0.032	-0.031	1

Table 4.49 RCA: 1977 US Import Market K Products Group Correlation

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.05	0.309	0.023	0.158
HKG	0.05	1	0.635	0.435	0.878
KOR	0.309	0.635	1	-0.021	0.735
SNP	0.023	0.435	-0.021	1	0.416
TWN	0.158	0.878	0.735	0.416	1

Table 4.50 RCA: 1982 US Import Market K Products Group Correlation

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.005	0.098	-0.066	0.278
HKG	0.005	1	0.395	0.361	0.556
KOR	0.098	0.395	1	0.248	0.063
SNP	-0.066	0.361	0.248	1	0.324
TWN	0.278	0.556	0.063	0.324	1

Table 4.51 RCA: 1987 US Import Market K Products Group Correlation

	JPN	HKG	KOR	SNP	TWN
JPN	1	-0.044	0.602	-0.086	0.342
HKG	-0.044	1	0.249	0.105	0.244
KOR	0.602	0.249	1	-0.083	0.809
SNP	-0.086	0.105	-0.083	1	0.183
TWN	0.342	0.244	0.809	0.183	1

In this products group, all Asian NIEs were still far below Japan in terms of revealed comparative advantage according to above tables. Korea still had highest correlation coefficient among Asian NIEs. Especially in 1987, Korea led other Asian NIEs by a larger margin. This implies that Korea was improving its revealed comparative advantage in the US import market of K group products thanks to its industrial policy favoring K group products.

Labor Intensive Products Group

Table 4.52 RCA: 1967 US Import Market L Products Group Correlation

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.45	0.156	0.39	0.412
HKG	0.45	1	0.232	0.188	0.284
KOR	0.156	0.232	1	0.462	0.472
SNP	0.39	0.188	0.462	1	0.839
TWN	0.412	0.284	0.472	0.839	1

Table 4.53 RCA: 1972 US Import Market L Products Group Correlation

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.542	0.575	0.768	0.021
HKG	0.542	1	0.798	0.534	-0.014
KOR	0.575	0.798	1	0.542	0.01
SNP	0.768	0.534	0.542	1	-0.003
TWN	0.021	-0.014	0.01	-0.003	1

Table 4.54 RCA: 1977 US Import Market L Products Group Correlation

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.664	0.321	0.475	0.594
HKG	0.664	1	0.367	0.333	0.457
KOR	0.321	0.367	1	0.16	0.25
SNP	0.475	0.333	0.16	1	0.438
TWN	0.594	0.457	0.25	0.438	1

Table 4.55 RCA: 1982 US Import Market L Products Group Correlation

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.304	0.028	0.223	0.753
HKG	0.304	1	0.027	-0.035	0.298
KOR	0.028	0.027	1	-0.08	0.161
SNP	0.223	-0.035	-0.08	1	0.209
TWN	0.753	0.298	0.161	0.209	1

Table 4.56 RCA: 1987 US Import Market L Products Group Correlation

	JPN	HKG	KOR	SNP	TWN
JPN	1	0.984	0.057	-0.075	0.24
HKG	0.984	1	0.034	-0.091	0.189
KOR	0.057	0.034	1	0.19	0.756
SNP	-0.075	-0.091	0.19	1	0.074
TWN	0.24	0.189	0.756	0.074	1

All Asian NIEs had smaller gap between them and Japan in the US import market of L group products according to above tables. All correlation coefficients of the US import market indicate that Asian NIEs had higher revealed comparative advantage than in the EC import market. This means that Asian NIEs were performing better in the US market than in EC market. Particularly in 1987, Hong Kong's revealed comparative advantage was very close to Japanese one. Korea, over time, had the trend of decreasing in its revealed comparative advantage. This matches the Korean industrialization policy which encouraged capital intensive industry. Singapore also had the same trend as Korea since 1972.

Chapter 5

Intra-Industry Trade Analysis

5.1 Intra-Industry Trade

A large and growing portion of international trade consists of the simultaneous exports and imports of the same products, which is called intra-industry trade. This phenomenon is particularly found in trade among industrialized countries. In this section we would like to investigate the Asian NIEs IIT.

The measure of IIT has been introduced in Chapter 2. The major IIT indices we utilize in this analysis are Grubel-Lloyd unadjusted index, Grubel-Lloyd aggregate index, Grubel-Lloyd adjusted for trade imbalance index, and Aquino index. The definition of industry here is at the 3-digit level SITC which is generally considered by trade theorist as an industry. All the 3-digit level SITC, 183 industries, are examined for this study. To understand better about the changing pattern of trade for the Asian NIEs, we also utilize Kojima's method to classify these 183 SITC product groups into four groups: agricultural products, natural resources based products, labor intensive products, and capital intensive products. We first examine degree of IIT for all 183 SITC product groups, then each individual product group according to Kojima's classfications. The Grubel-Lloyd

aggregate indices (AGL), Grubel-Lloyd adjusted indices (AdGL) for trade imbalance, and Aquino (AQ) indices for all products has been computed for each Asian NIE, with its major trading partners and listed in the following sections.

5.1.1 All SITC Products

Table 5.1 Hong Kong IIT Indices for All Products

	AGL				AdGL				AQ			
	1972	1977	1982	1987	1972	1977	1982	1987	1972	1977	1982	1987
TWN	0.0235	0.2603	0.1880	0.1839	0.8220	0.5519	0.5755	0.6366	0.5675	0.3443	0.3772	0.5070
KOR	0.3088	0.2051	0.2895	0.4704	0.5069	0.4162	0.4833	0.6399	0.3737	0.3469	0.4160	0.5158
SNP	0.3152	0.3034	0.3331	0.4893	0.3432	0.3744	0.4686	0.5840	0.3272	0.2796	0.2827	0.5093
JPN	0.1401	0.1716	0.1851	0.2316	0.3390	0.4494	0.6005	0.5501	0.1877	0.2609	0.3518	0.3538
US	0.2534	0.2201	0.2654	0.2287	0.4440	0.3707	0.4497	0.4854	0.2549	0.2321	0.2852	0.2655
EC	0.2692	0.2783	0.2989	0.3232	0.3260	0.3553	0.3456	0.3970	0.2742	0.3078	0.3121	0.3503
World	0.4468	0.4727	0.5773	0.7020	0.4736	0.4932	0.6116	0.7020	0.4499	0.4749	0.5794	0.7037

Table 5.2 Korea IIT Indices for All Products

	AGL				AdGL				AQ			
	1972	1977	1982	1987	1972	1977	1982	1987	1972	1977	1982	1987
TWN	0.0558	0.2035	0.2174	0.5207	0.1194	0.2153	0.2420	0.5738	0.0415	0.2048	0.2246	0.5143
HKG	0.2514	0.1351	0.3717	0.4704	0.3788	0.7132	0.8701	0.6399	0.3148	0.3842	0.4771	0.5158
SNP	0.1014	0.2508	0.2839	0.3599	0.1382	0.3669	0.4697	0.5202	0.0851	0.2565	0.2580	0.4151
JPN	0.1831	0.2613	0.3443	0.3105	0.3227	0.3723	0.4406	0.4100	0.2406	0.2941	0.3596	0.3608
US	0.1383	0.1811	0.2715	0.1911	0.1502	0.2064	0.2785	0.3497	0.1397	0.1782	0.2695	0.3301
EC	0.1781	0.1591	0.2467	0.2148	0.2242	0.2221	0.3295	0.2915	0.1326	0.1731	0.2842	0.2443
World	0.2566	0.2791	0.3130	0.3574	0.3275	0.2900	0.3301	0.3864	0.2486	0.2770	0.3114	0.4024

Table 5.3 Singapore IIT Indices for All Products

	AGL				AdGL				AQ			
	1972	1977	1982	1987	1972	1977	1982	1987	1972	1977	1982	1987
TWN	0.0612	0.1655	0.2028	0.3681	0.1485	0.2971	0.4914	0.6632	0.1003	0.2291	0.3007	0.3699
HK	0.3205	0.2621	0.2970	0.3634	0.4067	0.4282	0.5888	0.5752	0.3212	0.2769	0.3084	0.4341
KOR	0.1047	0.1754	0.1556	0.3599	0.1259	0.1933	0.1631	0.5202	0.0939	0.1799	0.1560	0.4151
JPN	0.0637	0.0905	0.0994	0.1774	0.1839	0.1507	0.1605	0.3275	0.1021	0.1345	0.1360	0.3061
US	0.2383	0.4288	0.4544	0.4989	0.2874	0.4362	0.5431	0.6173	0.2509	0.4236	0.4824	0.5071
EC	0.2044	0.2860	0.3190	0.3646	0.2565	0.2942	0.3942	0.3878	0.2279	0.2903	0.3168	0.4017
World	0.5167	0.5576	0.4882	0.6678	0.6591	0.6330	0.5748	0.7147	0.5491	0.5555	0.5098	0.6896

Table 5.4 Taiwan IIT Indices for All Products

	AGL				AdGL				AQ			
	1972	1977	1982	1987	1972	1977	1982	1987	1972	1977	1982	1987
HK	0.3038	0.2603	0.1880	0.1839	0.7354	0.5519	0.5755	0.6366	0.5286	0.3443	0.3772	0.5070
KOR	0.0558	0.2035	0.2174	0.5207	0.1194	0.2153	0.2420	0.5738	0.0415	0.2048	0.2246	0.5143
SNP	0.0612	0.1655	0.2028	0.3681	0.1485	0.2971	0.4914	0.6632	0.1003	0.2291	0.3007	0.3699
JPN	0.1117	0.1590	0.2381	0.2597	0.2057	0.2649	0.3625	0.3512	0.1573	0.2261	0.3116	0.3214
US	0.1288	0.1713	0.1814	0.1734	0.2057	0.2473	0.2667	0.3621	0.1116	0.1771	0.1843	0.2573
EC	0.1478	0.2503	0.2096	0.2551	0.1875	0.3190	0.2391	0.3377	0.1594	0.2584	0.2115	0.2968
World	0.2628	0.2842	0.3200	0.3504	0.2842	0.2988	0.3486	0.4458	0.2734	0.2812	0.3145	0.3645

All three types of indices indicate that IIT increases with the passage of time for all Asian NIEs except the case of Singapore in 1982. This generally reflects the IIT theory, which implies that IIT will increase with the growth of domestic market and per capita income. The interesting part of the indices is that adjusted Grubel-Lloyd indices are the largest among the three indices and unadjusted Grubel-Lloyd indices are the smallest ones. This conforms with Aquino's criticism about downward bias of Grubel-Lloyd index. These tables show that there is a high degree of IIT among the Asian NIEs. Our study also implies that the degree of IIT between the Asian NIEs and industrialized countries is high as well. Our findings indicate that IIT is not a phenomenon basically occurring in international trade among high income countries. IIT also exists among low income countries. The growth rate of the degree of IIT among the Asian NIEs is also greater than the growth rate of the degree of IIT among the Asian NIEs and industrialized countries. For the period 1972 -1987, the highest degree of IIT for the each Asian NIE is not from trade with industrialized countries, but with other Asian NIEs.

5.1.2 Agricultural Products Group

Table 5.5 Hong Kong IIT Indices for Agricultural Products

	AGL				AdGL				AQ			
	1972	1977	1982	1987	1972	1977	1982	1987	1972	1977	1982	1987
TWN	0.0705	0.1167	0.1451	0.2678	0.4434	0.1235	0.1782	0.3789	0.1972	0.1182	0.1484	0.3376
KOR	0.0239	0.1238	0.2652	0.2060	0.0795	0.4034	0.2929	0.3373	0.0442	0.2794	0.2704	0.1814
SNP	0.3942	0.5053	0.3831	0.5203	0.4516	0.5392	0.4811	0.5400	0.3910	0.5249	0.4001	0.5327
JPN	0.3795	0.3524	0.5110	0.5610	0.3984	0.4859	0.5573	0.6735	0.3840	0.4032	0.4959	0.5845
US	0.1526	0.1248	0.1694	0.1843	0.6895	0.5560	0.4228	0.4301	0.2199	0.1990	0.2266	0.2590
EC	0.1191	0.2162	0.1924	0.1744	0.4448	0.5356	0.6642	0.4666	0.1412	0.1882	0.2161	0.2072
World	0.3075	0.3651	0.4819	0.6104	0.9567	0.9735	0.9944	0.9723	0.5438	0.5271	0.6250	0.6862

Table 5.6 Korea IIT Indices for Agricultural Products

KOR-A	AGL				AdGL				AQ			
	1972	1977	1982	1987	1972	1977	1982	1987	1972	1977	1982	1987
TWN	0.0213	0.1361	0.1275	0.1977	0.0728	0.1496	0.1357	0.2166	0.0147	0.1278	0.1338	0.2116
HKG	0.0991	0.0219	0.0332	0.0808	0.2203	0.4034	0.1329	0.8563	0.0964	0.3035	0.0945	0.1306
SNP	0.0789	0.0194	0.1967	0.1396	0.3789	0.0207	0.2179	0.1855	0.0451	0.0187	0.1814	0.1245
JPN	0.0895	0.0414	0.0582	0.0489	0.2033	0.2570	0.2260	0.2946	0.1166	0.1139	0.1601	0.1665
US	0.0091	0.0194	0.0456	0.0339	0.0901	0.0207	0.3263	0.1101	0.0169	0.0187	0.0307	0.0283
EC	0.3624	0.0984	0.0564	0.2567	0.4585	0.2315	0.0812	0.2784	0.4492	0.2212	0.0742	0.2443
World	0.0715	0.0957	0.1262	0.1513	0.1539	0.1293	0.2353	0.2357	0.0766	0.0916	0.1443	0.1487

Table 5.7 Singapore IIT Indices for Agricultural Products

	AGL				AdGL				AQ			
	1972	1977	1982	1987	1972	1977	1982	1987	1972	1977	1982	1987
TWN	0.0477	0.0563	0.0764	0.2173	0.0507	0.0632	0.1514	0.2348	0.0474	0.0597	0.1172	0.2136
HK	0.3635	0.3681	0.4016	0.3604	0.7580	0.7375	0.7600	0.9187	0.4850	0.4411	0.4500	0.6972
KOR	0.1241	0.0206	0.0843	0.1396	0.3120	0.0730	0.2633	0.1855	0.0775	0.0135	0.0636	0.1245
JPN	0.1619	0.1817	0.2067	0.2050	0.2257	0.3107	0.2706	0.4906	0.1726	0.2353	0.2477	0.3572
US	0.0450	0.0570	0.1104	0.2012	0.0813	0.1021	0.1110	0.2213	0.0649	0.0666	0.1103	0.2075
EC	0.0305	0.0431	0.0701	0.1159	0.0875	0.1317	0.1064	0.1526	0.0661	0.1079	0.0898	0.1231
World	0.6657	0.7375	0.4558	0.7630	0.7039	0.7502	0.4829	0.8082	0.6601	0.7319	0.4556	0.7531

Table 5.8 Taiwan IIT Indices for Agricultural Products

	AGL				AdGL				AQ			
	1972	1977	1982	1987	1972	1977	1982	1987	1972	1977	1982	1987
HK	0.0705	0.1167	0.1451	0.2678	0.4434	0.1235	0.1782	0.3789	0.1972	0.1182	0.1484	0.3376
KOR	0.0213	0.1361	0.1275	0.1977	0.0728	0.1496	0.1357	0.2166	0.0165	0.1278	0.1338	0.2116
SNP	0.0477	0.0563	0.0764	0.2173	0.0507	0.0632	0.1514	0.2348	0.0414	0.0597	0.1172	0.2136
JPN	0.0606	0.0781	0.1048	0.0807	0.2872	0.2666	0.3304	0.3443	0.1528	0.1775	0.1624	0.1609
US	0.0156	0.0481	0.0515	0.0606	0.0162	0.1205	0.1871	0.1461	0.0083	0.0383	0.0677	0.0721
EC	0.0155	0.0386	0.1438	0.2998	0.0541	0.0769	0.1838	0.5106	0.0180	0.0463	0.1470	0.2895
World	0.1023	0.1124	0.1843	0.2418	0.1135	0.1387	0.2599	0.2878	0.1069	0.1137	0.1859	0.2371

Clearly, geographical location plays an import role in agricultural group products IIT according to above tables. The interesting finding is that selection of IIT indices for agricultural products should be cautious, especially in the case of correcting trade imbalance. For example, the trade imbalance correction for agricultural products between Taiwan and Japan is significant. Therefore, this reflects an erratic changes in corrected Grubel-Lloyd indices comparing with other indices.

Hong Kong and Singapore have relatively high degree of IIT to the world in this products group and most of the sources of this high degree of IIT are from IIT between these two countries. This phenomenon can be explained by product differentiation. Singapore imports tropical raw agricultural commodities from neighboring states, for example, Malaysia, and reprocesses them, then re-export to Hong Kong and vice versa for Hong Kong. Hong Kong and Singapore also have relatively high degree of intra-industry trade to the world market within this products group. Generally speaking, the IIT among agricultural products group is low for all Asian NIEs. This implies a high degree of trade barriers for agricultural commodities bilateral trade among nations. The growth

of IIT for all the Asian NIEs indicates that demand for differential agricultural products increases with the growth in per capita income. Most of the IIT literature only focuses on manufactured goods and ignores agricultural products due to the distortion from trade barriers among agricultural products.

5.1.3 Natural Resource Based Products

Table 5.9 Hong Kong IIT Indices for Natural Resource Based Products

	AGL				AdGL				AQ			
	1972	1977	1982	1987	1972	1977	1982	1987	1972	1977	1982	1987
TWN	0.3409	0.2988	0.0670	0.1703	0.5175	0.8343	0.1363	0.1940	0.4865	0.4705	0.1200	0.1648
KOR	0.0277	0.0082	0.0276	0.0407	0.0943	0.1627	0.0960	0.1150	0.0351	0.0889	0.0960	0.0426
SNP	0.0093	0.0027	0.0213	0.0291	0.7683	0.5621	0.9635	0.4717	0.7212	0.5102	0.9528	0.3303
JPN	0.1019	0.1109	0.1804	0.0361	0.1237	0.1384	0.2159	0.1532	0.0962	0.1335	0.1739	0.0910
US	0.2005	0.1072	0.0660	0.0616	1.0000	0.8826	0.2311	0.1352	0.1840	0.2881	0.0553	0.0980
EC	0.0671	0.0372	0.0241	0.1071	0.2812	0.1045	0.0954	0.3065	0.1891	0.0763	0.0329	0.0882
World	0.1849	0.1297	0.1129	0.2822	0.5087	0.6559	0.5059	0.6181	0.3561	0.5036	0.3662	0.4713

Table 5.10 Korea IIT Indices for Natural Resource Based Products

	AGL				AdGL				AQ			
	1972	1977	1982	1987	1972	1977	1982	1987	1972	1977	1982	1987
TWN	0.0039	0.3067	0.1139	0.5509	0.0039	0.3252	0.1873	0.8060	0.0039	0.2903	0.1860	0.4770
HKG	0.1340	0.0509	0.0096	0.0893	0.1534	0.4222	0.0173	0.7036	0.1201	0.4222	0.0173	0.1787
SNP	0.0296	0.4711	0.4958	0.5658	0.0318	0.9691	0.9997	0.9886	0.0276	0.9397	0.9640	0.9078
JPN	0.3462	0.4277	0.4295	0.6411	0.3824	0.5006	0.4700	0.9108	0.3809	0.4978	0.3989	0.7900
US	0.0045	0.0255	0.1538	0.1341	0.0691	0.9997	0.9098	0.9976	0.0657	0.0327	0.4010	0.3916
EC	0.0124	0.0258	0.0544	0.0928	0.0201	0.0352	0.0944	0.7366	0.0089	0.0204	0.0539	0.0804
World	0.1501	0.1206	0.0784	0.1942	0.5061	0.8640	0.9271	0.9682	0.1177	0.0930	0.1397	0.1793

Table 5.11 Singapore IIT Indices for Natural Resource Based Products

	AGL				AdGL				AQ			
	1972	1977	1982	1987	1972	1977	1982	1987	1972	1977	1982	1987
TWN	0.0600	0.0559	0.1729	0.8714	0.3333	0.7620	0.8551	0.9052	0.3254	0.6840	0.6939	0.9048
HK	0.0005	0.0001	0.0211	0.0033	0.3871	0.2407	0.9573	1.0000	0.1657	0.1126	0.9376	0.8083
KOR	0.0638	0.4015	0.2111	0.5658	0.3276	0.9535	0.9627	0.9886	0.1891	0.8738	0.9603	0.9078
JPN	0.0609	0.0227	0.0227	0.1098	0.8585	0.6953	0.5511	0.9546	0.8480	0.5706	0.2824	0.9036
US	0.1714	0.0907	0.7788	0.5256	0.3155	0.7546	0.9959	0.9529	0.3129	0.5585	0.9076	0.9411
EC	0.0806	0.2029	0.2858	0.7027	0.6255	0.7839	0.4062	0.8846	0.6221	0.7817	0.4036	0.7420
World	0.3309	0.1882	0.2672	0.3680	0.3450	0.1930	0.3531	0.4198	0.3444	0.1844	0.2207	0.3298

Table 5.12 Taiwan IIT Indices for Natural Resource Based Products

	AGL				AdGL				AQ			
	1972	1977	1982	1987	1972	1977	1982	1987	1972	1977	1982	1987
HK	0.3409	0.2988	0.0670	0.1703	0.5175	0.8343	0.1363	0.1940	0.4865	0.4705	0.1200	0.1648
KOR	0.0039	0.3067	0.1139	0.5509	0.0039	0.3252	0.1873	0.8060	0.0039	0.2903	0.1860	0.4770
SNP	0.0600	0.0559	0.1729	0.8714	0.3333	0.7620	0.8551	0.9052	0.3254	0.6840	0.6939	0.9048
JPN	0.6276	0.5326	0.6004	0.5267	0.6441	0.8160	0.7031	0.5710	0.6208	0.4718	0.6365	0.5476
US	0.0121	0.1050	0.3727	0.0811	0.9279	1.0000	1.0000	0.9256	0.6122	0.5201	0.2329	0.4203
EC	0.0177	0.0065	0.1163	0.0736	0.6923	1.0000	0.5392	0.9674	0.0746	0.0469	0.1735	0.4968
World	0.1536	0.1684	0.1038	0.1768	0.9306	0.9998	0.5704	0.8477	0.2842	0.2230	0.0821	0.1897

Hong Kong, Singapore, and Taiwan lack of natural resources. Therefore, the degree of IIT within the natural resource based products for these three countries with the world is high. A dramatic difference in corrected Grubel-Lloyd indices from other indices is observed as well. In Taiwan's IIT with the US in 1977 and 1982, the Grubel-Lloyd IIT indices are 1 after adjusting for trade imbalance. But the indices for the other two indices are not even close to 1. This is why numerous trade theorists criticized the correction for trade imbalance in calculating IIT index.

The interesting part of our investigation is that the higher degree of IIT among the Asian NIEs since most of them lack natural resource The distance among Asian NIEs is

the only explanation for the increase of IIT in this products group. Taiwan and Korea are two closest Asian NIEs to Japan; therefore, the IIT between two countries and Japan are much higher than other countries in our investigation.

5.1.4 Labor Intensive Products

Table 5.13 Hong Kong IIT Indices for Labor Intensive Products

	AGL				AdGL				AQ			
	1972	1977	1982	1987	1972	1977	1982	1987	1972	1977	1982	1987
TWN	0.2546	0.1948	0.1390	0.1326	0.9110	0.8441	0.8704	0.9237	0.5817	0.4263	0.4377	0.6132
KOR	0.3403	0.1857	0.3026	0.5218	0.7032	0.5436	0.7374	0.8850	0.4719	0.3415	0.5694	0.6438
SNP	0.3654	0.4123	0.5059	0.4993	0.8780	0.8991	0.8605	0.7417	0.7208	0.6477	0.6319	0.5595
JPN	0.1545	0.2178	0.2424	0.3099	0.3085	0.4777	0.5859	0.4781	0.1896	0.2932	0.3909	0.3709
US	0.1664	0.1374	0.1691	0.1223	0.5601	0.5699	0.6699	0.7075	0.2527	0.2755	0.3169	0.2900
EC	0.2711	0.2883	0.3151	0.3378	0.6075	0.5989	0.6060	0.6313	0.3050	0.3714	0.3905	0.4273
World	0.4511	0.4807	0.6048	0.6929	0.5957	0.6574	0.7528	0.8103	0.4494	0.4737	0.6269	0.7123

Table 5.14 Korea IIT Indices for Labor Intensive Products

	AGL				AdGL				AQ			
	1972	1977	1982	1987	1972	1977	1982	1987	1972	1977	1982	1987
TWN	0.2658	0.3894	0.2606	0.5187	0.4138	0.3988	0.3931	0.7420	0.3265	0.3923	0.2920	0.5443
HKG	0.2108	0.1149	0.1807	0.1408	0.5831	0.6221	0.9000	0.7444	0.4769	0.2644	0.5501	0.5963
SNP	0.0537	0.0745	0.0572	0.1614	0.6740	0.9948	0.5661	0.7115	0.1306	0.2214	0.1842	0.2510
JPN	0.3248	0.4649	0.3706	0.3422	0.3612	0.4924	0.3968	0.4590	0.3384	0.4648	0.3640	0.2993
US	0.0346	0.0588	0.1353	0.0893	0.4675	0.6183	0.5975	0.8085	0.1133	0.1852	0.2471	0.2914
EC	0.2601	0.0944	0.1298	0.1498	0.4819	0.5653	0.5044	0.5933	0.4243	0.2475	0.2463	0.2682
World	0.3134	0.2467	0.2465	0.3016	0.7041	0.7754	0.7240	0.7354	0.3239	0.3465	0.3913	0.4154

Table 5.15 Singapore IIT Indices for Labor Intensive Products

	AGL				AdGL				AQ			
	1972	1977	1982	1987	1972	1977	1982	1987	1972	1977	1982	1987
TWN	0.0309	0.0776	0.0794	0.0926	0.7865	0.7886	0.9522	0.6079	0.2560	0.2762	0.2740	0.2787
HK	0.4300	0.0776	0.5217	0.4436	0.7350	0.7886	0.7217	0.5331	0.5969	0.2762	0.5322	0.4584
KOR	0.0369	0.0788	0.0663	0.1614	0.2524	0.6523	0.4802	0.7115	0.0415	0.2123	0.2166	0.2510
JPN	0.0545	0.1157	0.0809	0.1773	0.8029	0.4175	0.4743	0.6949	0.2181	0.3161	0.3491	0.4734
US	0.2385	0.3773	0.2773	0.4811	0.2801	0.3922	0.2933	0.6286	0.2344	0.3771	0.2788	0.4150
EC	0.3179	0.3823	0.3292	0.4250	0.4704	0.3955	0.4329	0.4576	0.3707	0.3807	0.3439	0.4408
World	0.5039	0.6359	0.6423	0.7208	0.7724	0.7953	0.8468	0.8453	0.6551	0.7076	0.7229	0.7705

Table 5.16 Taiwan IIT Indices for Labor Intensive Products

	AGL				AdGL				AQ			
	1972	1977	1982	1987	1972	1977	1982	1987	1972	1977	1982	1987
HK	0.1895	0.1948	0.1390	0.1326	0.6076	0.8441	0.8704	0.9237	0.2882	0.4263	0.4377	0.6132
KOR	0.2658	0.3894	0.2568	0.3179	0.4138	0.3988	0.2640	0.3970	0.3265	0.3923	0.2574	0.2935
SNP	0.0309	0.0776	0.2593	0.5187	0.7865	0.7886	0.3931	0.7420	0.2560	0.2762	0.2906	0.5443
JPN	0.1538	0.2600	0.0794	0.0926	0.2090	0.2920	0.9522	0.6079	0.1738	0.2767	0.2740	0.2787
US	0.0467	0.0648	0.0648	0.0485	0.5933	0.5847	0.8350	0.7468	0.2294	0.1842	0.2647	0.2841
EC	0.1187	0.1458	0.1387	0.1665	0.5254	0.6322	0.5977	0.7201	0.2137	0.2387	0.2539	0.3905
World	0.1895	0.2085	0.1950	0.1951	0.6076	0.8249	0.8885	0.8856	0.2882	0.3154	0.3591	0.4211

In this products group, the difference in the degree of IIT is significant. Taiwan has the lowest indices of IIT to the world market. Taiwan's IIT indices with other Asian NIEs are also relatively low. This implies that Taiwan exports much more of its labor intensive products than imports due to its economic policy encouraging small entrepreneur engaging in exporting business. Singapore has relatively low IIT indices with its Asian NIE trading partners except for Hong Kong. But Singapore has the highest IIT indices, followed by Hong Kong, with world market. These high IIT indices reflect the trade nature of both countries which concentrate on re-exporting business.

5.1.5 Capital Intensive Products

Table 5.17 Hong Kong IIT Indices for Capital Intensive Products

	AGL				AdGL				AQ			
	1972	1977	1982	1987	1972	1977	1982	1987	1972	1977	1982	1987
TWN	0.4371	0.4231	0.2763	0.2376	0.7021	0.6765	0.8152	0.8806	0.5516	0.5011	0.4819	0.5602
KOR	0.3624	0.2945	0.3108	0.4645	0.3787	0.3550	0.3832	0.5862	0.3766	0.3434	0.3666	0.5123
SNP	0.4682	0.6650	0.7843	0.7223	0.5417	0.6779	0.8358	0.8342	0.4659	0.6661	0.7807	0.7618
JPN	0.0589	0.0818	0.0778	0.1203	0.7352	0.9045	0.8886	0.9645	0.2371	0.3813	0.4840	0.6738
US	0.4945	0.4447	0.4923	0.4684	0.5527	0.4907	0.5172	0.5429	0.5414	0.4862	0.4947	0.4918
EC	0.2998	0.2664	0.2891	0.3261	0.7427	0.4136	0.5140	0.3875	0.2592	0.2350	0.2545	0.3182
World	0.5537	0.5650	0.6390	0.7655	0.8374	0.7737	0.8184	0.8716	0.5498	0.5827	0.6956	0.7875

Table 5.18 Korea IIT Indices for Capital Intensive Products

	AGL				AdGL				AQ			
	1972	1977	1982	1987	1972	1977	1982	1987	1972	1977	1982	1987
TWN	0.0831	0.1928	0.2723	0.5616	0.1425	0.2353	0.4125	0.5802	0.0856	0.1830	0.3414	0.5567
HKG	0.3540	0.2257	0.5723	0.0574	0.4066	0.8651	0.9598	0.8308	0.3316	0.7081	0.6479	0.4685
SNP	0.2619	0.3701	0.3755	0.4558	0.3162	0.8562	0.7957	0.6811	0.2822	0.4930	0.3507	0.5262
JPN	0.1209	0.1923	0.3761	0.3058	0.9965	0.9423	0.8143	0.8307	0.4204	0.4575	0.5501	0.5197
US	0.4627	0.4706	0.5017	0.3097	0.4968	0.5117	0.5617	0.4980	0.4487	0.4549	0.4884	0.3614
EC	0.1126	0.2528	0.3535	0.2622	0.6063	0.4564	0.4061	0.2696	0.2406	0.2711	0.3353	0.2636
World	0.3323	0.4530	0.5238	0.4625	0.8130	0.6527	0.5336	0.4657	0.3949	0.4454	0.5235	0.4623

Table 5.19 Singapore IIT Indices for Capital Intensive Products

	AGL				AdGL				AQ			
	1972	1977	1982	1987	1972	1977	1982	1987	1972	1977	1982	1987
TWN	0.1421	0.3351	0.3386	0.5190	0.3833	0.8486	0.6517	0.7158	0.2353	0.5440	0.4420	0.5050
HK	0.3983	0.6419	0.6347	0.5339	0.5477	0.7576	0.8778	0.7596	0.4443	0.6773	0.7478	0.6331
KOR	0.1071	0.3341	0.2892	0.4558	0.1591	0.6329	0.4113	0.6811	0.1215	0.4636	0.3268	0.5262
JPN	0.0454	0.0900	0.0927	0.1910	0.8174	0.9797	0.1884	0.8220	0.2254	0.4453	0.1817	0.6830
US	0.2683	0.5588	0.4964	0.5195	0.4599	0.7406	0.6274	0.6389	0.3336	0.4730	0.5160	0.5220
EC	0.2258	0.3609	0.3692	0.3782	0.9306	0.5686	0.6170	0.4427	0.3022	0.3403	0.3800	0.3739
World	0.4897	0.7078	0.6481	0.7346	0.8427	0.9155	0.7775	0.7773	0.6760	0.7290	0.7199	0.7509

Table 5.20 Taiwan IIT Indices for Capital Intensive Products

	AGL				AdGL				AQ			
	1972	1977	1982	1987	1972	1977	1982	1987	1972	1977	1982	1987
HK	0.4371	0.4231	0.2763	0.2376	0.7021	0.6765	0.8152	0.8806	0.5516	0.5011	0.4819	0.5602
KOR	0.0831	0.1928	0.2723	0.5616	0.1425	0.2353	0.4125	0.5802	0.0856	0.1830	0.3414	0.5567
SNP	0.1421	0.3351	0.3386	0.5190	0.3833	0.8486	0.6517	0.7158	0.2353	0.5440	0.4420	0.5050
JPN	0.0938	0.1400	0.2539	0.2722	0.8908	0.8205	0.9836	0.9658	0.5059	0.5257	0.5768	0.6351
US	0.3079	0.3711	0.3623	0.3658	0.3933	0.3815	0.3851	0.5759	0.3390	0.3673	0.3554	0.4386
EC	0.2401	0.3985	0.2953	0.3169	0.6154	0.5988	0.4818	0.3206	0.2738	0.3659	0.3307	0.3164
World	0.4258	0.4767	0.5694	0.5375	0.5920	0.6309	0.6388	0.5494	0.4618	0.5219	0.6016	0.5418

The IIT indices for all Aisan NIEs in capital intensive products group are the highest ones, compared with ones from other products group. Singapore leads other Asian NIEs in IIT for this products group. From our investigation, we found that even all four Asian NIEs have global comparative advantage in labor intensive products, but they also enjoyed high degree of IIT with the world in this product group. Especially, there are also high degrees of IIT among Asian NIEs themselves. This result contradicts most traditional IIT literature, which argued that IIT happens only among high income countries, especially in manufactured goods. Our investigation shows that IIT even exists for high-tech products, which has been considered as the IIT phenomena only happening among high incomes countries, among Asian NIEs which then have been considered as low income countries.

The increasing degree of IIT of Asian NIEs with industrialized countries support IIT theory that the smaller difference in per capita income the greater degree of IIT between two trading partners. The high degree of IIT between Hong Kong and Singapore

probably can be explained by their similar country size and development level. On the other hand, the degree of IIT of Hong Kong and Singapore in bilateral trade with Taiwan and Korea is not that high as the IIT between Hong Kong and Singapore.

5.2 General Intra-Industry Trade Patterns

Table 5.21 Asian NIEs Distribution of IIT Indices to World Market in All Products

	HKG		KOR		SNP		TWN	
	> 0.50	> 0.75	> 0.50	> 0.75	> 0.50	> 0.75	> 0.50	> 0.75
1972	60	28	42	22	77	30	44	23
1977	74	30	50	26	103	53	44	14
1982	96	96	57	25	107	50	50	31
1987	117	69	55	22	116	58	46	28

The distribution of indices table, Table 5.21, for all SITC three-digit level products indicates that there is a general increasing tendency of IIT from 1972 to 1987 for all the Asian NIEs. This trend can be explained by the economic growth of Asian NIEs which made income distribution more evenly among Asian NIEs. This even income distribution means that each Asian NIE demand structure is becoming more similar with the passage of time according to the hypothesis of determinants of IIT. The number of IIT indices greater than 0.75 grew much faster for Hong Kong and Singapore than Korea and Taiwan. This reflects that Hong Kong and Singapore are entrepots for re-exports, especially after the Mainland China economic reform in the late 1970s giving Hong Kong new opportunity to resume its re-export business with China. Hong Kong and Singapore have more IIT indices greater than 0.50 than do Korea and Taiwan. This means that the

IIT of Korea and Taiwan with their trading partners concentrated more on a few products than do Hong Kong and Singapore. This also reflects the trading nature of Hong Kong and Singapore on re-exporting business.

Table 5.22 Asian NIEs Distribution of IIT Indices to World Market in Agricultural Products

	HKG		KOR		SNP		TWN	
	> 0.50	> 0.75	> 0.50	> 0.75	> 0.50	> 0.75	> 0.50	> 0.75
1972	18	10	10	3	32	14	6	1
1977	19	6	10	7	38	22	10	1
1982	25	13	9	5	33	19	14	6
1987	29	16	9	3	37	22	13	7

Table 5.23 Asian NIEs Distribution of IIT Indices to World Market in Capital Intensive Products

	HKG		KOR		SNP		TWN	
	> 0.50	> 0.75	> 0.50	> 0.75	> 0.50	> 0.75	> 0.50	> 0.75
1972	13	4	13	8	18	5	18	11
1977	18	6	19	9	27	12	18	8
1982	27	15	26	11	35	17	21	16
1987	38	24	23	7	33	17	17	12

Table 5.24 Asian NIEs Distribution of IIT Indices to World Market in Labor Intensive Products

	HKG		KOR		SNP		TWN	
	> 0.50	> 0.75	> 0.50	> 0.75	> 0.50	> 0.75	> 0.50	> 0.75
1972	23	13	15	10	22	7	16	9
1977	30	14	18	7	32	15	14	5
1982	39	22	21	9	31	9	13	8
1987	45	27	21	10	40	16	14	8

Table 5.25 Asian NIEs Distribution of IIT Indices to World Market in Natural Resource Based Products

	HKG		KOR		SNP		TWN	
	> 0.50	> 0.75	> 0.50	> 0.75	> 0.50	> 0.75	> 0.50	> 0.75
1972	4	0	3	1	3	2	4	2
1977	3	1	3	3	4	2	2	0
1982	4	1	2	0	7	4	2	1
1987	5	2	1	1	7	3	1	1

We are not only interested in the general pattern of IIT for all products but for each products group as well. By doing so, we can identify the source where the increase in degree of IIT for all products are from which products group. Except for the IIT of Korea with its trading partners, other Asian NIEs have general pattern of increasing number of agricultural products group in gaining the degree of IIT. Especially for Hong Kong, there is a significant jump from 1977 to 1982. The implication for this could be explained by China's economic reform and open policy in late 1970s which increased the degree of IIT for Hong Kong.

In the distribution of IIT indices for capital intensive products, both Hong Kong and Singapore have same pattern of increases in the degree of IIT. This is also indicated by the high degree of IIT in the bilateral trade between Hong Kong and Singapore. Korea and Taiwan followed similar pattern which the number of high degree of IIT indices declined from 1982 to 1987.

For the labor intensive products group, Hong Kong and Korea have a similar pattern, in which there is a tendency to increase number of IIT over 0.5 and 0.75 of the distribution of IIT indices over time, except that Korea had a decline in IIT over 0.75 from 1972 to 1977. Singapore's number of IIT over 0.75 and 0.5 declined from 1977 to 1982. Taiwan has a surprising pattern in which the distribution of IIT indices almost stay the same over time, with only marginal decreases or increases.

Hong Kong and Singapore have the tendency of increasing in number of IIT indices over 0.5 and 0.75, except for Hong Kong in 1977. Korea and Taiwan also share the similar pattern in decreasing number of IIT indices over 0.5 and 0.75.

5.3 Concentration Degree of IIT Indices

In our studies, we also investigate the coefficient of variation of each Asian NIEs with its major trading partners for the four products groups classification. A high coefficient of variation of IIT over different products indicates that IIT is concentrated on a few products. Generally speaking, by examining IIT in bilateral trade for each Asian NIE, IIT of concentration on a few products is common, but there is a tendency that the degree of concentration is becoming less with the passage of time. This generally supports the IIT theory, which interprets the IIT phenomena by differential demand structure between countries. As the difference in per capita income is becoming smaller, the demand structure between two trading partners will become similar. Therefore, the degree of IIT will increase. If two nations have exactly same demand structure, then IIT

phenomena will be common for every products in bilateral trade. This implies that the coefficient of variation of IIT indices should approach to zero. The trend of decreasing in IIT concentrated in a few products for Asian NIEs illustrates that the consumer preference among each Asian NIE and its trading partners is becoming similar.

Table 5.26 Asian NIEs IIT Coefficient of Variation for All Products

	1972	1977	1982	1987
HKG	0.776	0.724	0.601	0.521
KOR	1.075	1.031	0.940	0.832
SNP	0.552	0.522	0.536	0.474
TWN	1.033	0.976	0.973	0.924

Singapore has the lowest coefficient of variation for all products in the world market, followed by Hong Kong, among the four Asian tigers over time, according to Table 5.26. Taiwan and Korea have higher coefficient of variation than Hong Kong and Singapore. The implication behind these numbers is that IIT for Hong Kong and Singapore are more spreading evenly across industries due to their re-exporting trade nature. On the other hand, the industry policy of Taiwan and Korea favored one sector in the economy; hence, IIT would be concentrated on a few industries.

Table 5.27 Hong Kong IIT Coefficient of Variation

		HK-TWN	HK-JPN	HK-KOR	HK-SNP	HK-US	HK-EC	HK-W
A Group	72	2.018	1.450	5.017	1.039	1.634	1.640	0.769
	77	1.682	1.288	3.429	1.086	1.540	1.504	0.793
	82	1.687	1.309	1.933	1.249	1.283	1.391	0.648
	87	1.362	1.172	1.874	1.132	1.387	1.334	0.621
N Group	72	1.811	1.728	3.852	2.350	1.748	2.091	1.240
	77	1.520	2.489	2.629	3.512	1.981	2.475	1.291
	82	2.050	2.062	3.320	2.010	2.176	2.584	1.315
	87	1.614	2.117	2.875	1.554	2.498	1.725	1.024
L Group	72	1.161	1.054	1.089	0.712	1.045	0.892	0.488
	77	1.022	0.981	1.067	0.687	0.987	0.720	0.460
	82	1.131	0.849	0.763	0.606	0.789	0.651	0.363
	87	1.131	0.800	0.793	0.616	0.821	0.546	0.235
K Group	72	1.028	2.258	2.181	0.989	2.447	2.089	0.923
	77	0.964	1.844	1.610	0.873	1.822	1.941	0.784
	82	1.444	1.609	1.435	0.782	1.344	1.835	0.581
	87	1.218	1.195	1.293	0.656	1.071	1.276	0.440

Table 5.28 Korea IIT Coefficient of Variation

		KOR-TWN	KOR-HK	KOR-JPN	KOR-SNP	KOR-US	KOR-EC	KOR-W
A Group	72	3.153	2.496	1.657	7.344	2.228	2.465	1.315
	77	2.313	3.712	1.793	4.117	4.117	2.311	1.319
	82	3.274	2.934	1.603	3.440	1.598	2.332	1.389
	87	1.858	3.017	1.636	2.211	1.612	1.458	1.216
N Group	72	2.822	3.721	1.810	2.647	3.218	3.357	1.790
	77	3.848	2.786	1.896	3.873	2.199	3.843	1.845
	82	2.683	3.873	1.763	2.656	2.341	2.648	1.705
	87	3.473	2.838	1.185	2.086	2.243	2.007	1.497
L Group	72	2.644	1.020	0.881	1.461	1.064	1.348	0.765
	77	1.400	1.051	0.747	1.784	1.113	1.095	0.800
	82	1.226	0.898	0.730	1.424	0.928	0.900	0.701
	87	0.704	1.450	0.666	1.032	0.862	0.798	0.676
K Group	72	2.354	1.797	1.349	1.881	1.465	2.213	1.070
	77	1.745	1.601	1.141	1.975	1.096	1.286	0.808
	82	1.191	1.627	1.040	1.641	0.952	1.134	0.629
	87	0.923	3.092	0.910	1.001	0.952	1.096	0.619

Table 5.29 Singapore IIT Coefficient of Variation

		SNP-TWN	SNP-HK	SNP-JPN	SNP-KOR	SNP-US	SNP-EC	SNP-W
A Group	72	2.770	1.372	1.691	4.267	2.992	1.825	0.485
	77	2.861	1.338	1.489	3.888	2.328	1.471	0.468
	82	2.723	1.292	1.369	2.455	2.094	1.500	0.589
	87	1.964	1.156	1.343	2.211	1.463	1.504	0.476
N Group	72	2.266	3.859	3.531	3.073	2.009	3.042	1.209
	77	2.331	2.597	1.981	3.873	1.807	1.795	1.190
	82	2.229	1.645	1.994	2.263	1.985	1.807	1.135
	87	1.957	1.695	1.539	2.086	1.930	1.900	0.986
L Group	72	2.548	0.610	1.729	2.171	1.155	1.246	0.400
	77	1.690	0.725	1.493	2.088	1.021	1.108	0.391
	82	1.643	0.638	1.377	1.530	0.931	0.946	0.361
	87	1.316	0.612	0.905	1.032	0.743	0.818	0.244
K Group	72	2.079	1.005	2.376	2.632	2.356	1.894	0.581
	77	1.254	0.808	1.644	1.661	1.870	1.646	0.505
	82	1.399	0.654	1.603	1.382	1.560	1.637	0.457
	87	1.087	0.699	1.290	1.001	1.112	1.423	0.465

Table 5.30 Taiwan IIT Coefficient of Variation

		TWN-HK	TWN-JPN	TWN-KOR	TWN-SNP	TWN-US	TWN-EC	TWN-W
A Group	72	2.018	1.958	3.153	2.770	2.431	2.854	1.268
	77	1.682	1.725	2.313	2.861	1.584	1.830	1.078
	82	1.687	1.225	3.274	2.723	1.690	1.543	1.090
	87	1.362	1.329	1.858	1.964	1.474	1.392	1.077
N Group	72	1.811	1.957	2.822	2.266	3.463	3.148	1.299
	77	1.520	1.753	3.848	2.331	2.384	2.832	1.501
	82	2.050	1.527	2.683	2.229	2.242	1.925	1.493
	87	1.614	1.373	3.473	1.957	1.949	1.804	1.617
L Group	72	1.161	1.174	2.644	2.548	1.122	1.126	0.886
	77	1.022	0.939	1.400	1.690	1.118	1.113	0.909
	82	1.131	0.829	1.226	1.643	1.066	0.979	0.964
	87	1.131	0.764	0.704	1.316	1.199	0.835	0.860
K Group	72	1.028	1.419	2.354	2.079	1.346	2.112	0.836
	77	0.964	1.309	1.745	1.254	1.154	1.282	0.763
	82	1.444	1.071	1.191	1.399	1.017	1.213	0.723
	87	1.218	0.921	0.923	1.087	0.911	0.985	0.692

Hong Kong and Singapore have the lowest coefficient of variation within the agricultural products group trading with the world, according to above tables. This means that Hong Kong and Singapore have IIT with the world evenly spread over different products within the products group. The IIT of Korea and Taiwan with the world are more concentrated on a few industries in the A group. The IIT concentration on a few products became less with the passage of time, except for Korea. But Hong Kong and Singapore have significant relatively higher coefficient of variation in IIT indices in the agricultural products group with bilateral trade with Korea in 1972 and 1977 than with other countries. The coefficient of variation of IIT indices between Taiwan and Korea and Singapore in A group products are relatively high through the years we investigate. The implication of this is that demand structure in A group products between Taiwan and Korea and Singapore varies more than that of Taiwan and other countries in our studies.

The degree of concentration on a few products of IIT indices within N group products for the Asian NIEs is the highest among the four group products due to the nature of products inside this group. Generally speaking, the IIT of those Aisan NIEs lacking natural resources with those natural resource abundant countries concentrated on a few products within the N products group.

In the L group products, Hong Kong and Singapore have a relatively lower coefficient of variation of IIT indices with each other, but higher ones with Korea and Taiwan over the time period we investigated. This indicates that Hong Kong and Singapore also have similar demand structures in L group products. Surprisingly, Taiwan

and Korea have relatively higher coefficients of variation of IIT indices in bilateral trade with each other until 1987. This can be explained by both country's adoption of imports substitution policy. Hence, this industrialization policy resulted in IIT concentrated on a few products. The lower one between these two nations in 1987 is result of new industrialization policies which focus on capital intensive products.

Among the Asian NIEs' bilateral trade in L group products with industrialized countries over the time period 1972-1987, Hong Kong has relatively lower coefficient of variation of IIT indices with EC and Singapore has relatively lower one with US, but Taiwan and Korea have relatively lower ones with Japan. Colonial relics could be the factor to explain this. This supports the hypothesis of IIT theory which culture plays an important role in IIT. Singapore was a British colony before, and Hong Kong is a British colony[6]. Therefore, both countries are easily to adapt western culture, especially English are official language in both countries. Taiwan and Korea were Japanese colonies before. Hence both countries still have Japanese relics on their culture which, in turn, influence their demand structure.

In the capital intensive products group, Hong Kong, Korea, and Singapore have a pattern in decreasing in coefficient of variation in much faster rate than Taiwan in bilateral trade with industrialized countries. Especially Korea after initialized its industrialization policy in favor of heavy chemical industry, its coefficient of variation of

[6] When this analysis is written, Hong Kong is still British colony. But it will be reverted to Mainland China soon.

IIT in bilateral trade with these industrialized nations and Taiwan has dropped at dramatic rate from 1972 to 1977. This means that Korea's IIT with those industrialized countries and Taiwan became less concentrated on a few products. After 1977, Korea's coefficient of variation of IIT with industrialized countries has become smoother in K products group. But the rate of decreasing in Korea's coefficient of variation of IIT with other Asian NIEs is lesser than those with industrialized countries in this group of products. Korea also has a higher coefficient of variation of IIT with Hong Kong and Singapore. In other words, Korea's IIT with Hong Kong and Singapore are more concentrated on a few products than those of Taiwan and industrialized countries in the K group products.

The implication of this Korea's case in K group products is quite interesting. The IIT theory argues that the degree of IIT will increase as the similarity in demand structure increases. But the theory cannot explain why the Korea's coefficients of variation with Hong Kong and Singapore are higher than those of Taiwan and industrialized countries. These Asian NIEs have similar demand structure. The plausible explanation for this is the Korea government policy strongly influenced the direction of IIT.

The coefficient of variation of IIT indices is relatively lower between Hong Kong and Singapore within the period of our study. This indicates that IIT spreading evenly over K products group over time. The coefficient of variation of IIT fluctuated between Taiwan and Hong Kong bilateral trade. Hong Kong bilateral trade with Korea has relatively higher coefficient of variation. This reflects the difference in industrialization policy between two nations. Hong Kong almost had no industrialization policy, but Korea

had policy which favored capital intensive industry. That explains the coefficient of variation of IIT of Hong Kong in bilateral trade with Korea in 1987 had risen in much higher increasing rate. After 1977, Taiwan has lower coefficient of variation with Korea and higher coefficient of variation with Singapore and Hong Kong. Again, this indicates that similarity in economic development between Taiwan and Korea.

5.4 The Determinants of IIT: An Empirical Test

We conduct an econometric investigation of the determinants of IIT for Asian NIEs. A pooled regressions are conducted across Asian NIEs for 1972, 1977, 1982, and 1987. The dependent variable is IITij index between two economies i and j. The IIT index we use as dependent variable is Aquino index. The reason we use the Aquino index instead of the Grubel and Lloyd index is that the Aquino index avoids the problem of correcting trade imbalance. We have shown that adjusted Grubel and Lloyd index is seriously biased if trade is not in balance. The model is

$$IIT_{ij} = f(APCI_{ij}, INPCI_{ij}, AGDP_{ij}, INGDP_{ij}, SD_{ij}, INOP_{ij}, Culture)$$

$APCI_{ij}$: Average of per capita income between two economies i and j.

$INPCI_{ij}$: The relative inequality of per capita income between two economies i and j.

$AGDP_{ij}$: Average of GDP between two economies i and j.

$INGDP_{ij}$: The relative inequality of GDP between two economies i and j.

SD_{ij}: Square root of distance between two economies i and j.

$INOP_{ij}$: The relative inequality of degree in openness between two economies i and j.

Culture: A dummy variable of similar cultural background.

We also conduct a weighted logit transformation regression to avoid bias. The details regarding this regression model are in previous chapter.

The IIT index is computed by SITC three-digit level industry data. All independent variables are tested for all products group, K group products and L group products at three-digit SITC. Major trading partners of Asian NIEs are included in the study sample.

5.4.1 Test Results for All Products Group

Table 5.31 Results of Regression Analysis on the Determinants of IIT for the Asian NIEs: All Products Group

	IIT				Logit IIT			
	1972	1977	1982	1987	1972	1977	1982	1987
Constant	0.8162***	0.6178**	0.8546***	0.7107**	0.1598	-0.9619***	-1.1337**	-0.65
	(5.86)	(2.66)	(3.43)	(2.69)	(0.6)	(-2.95)	(-2.49)	(-1.21)
APCI	0.0005***	0.00004	0.00004**	-0.00002*	0.00234***	0.0003***	0.0002***	-0.00002
+	(8.54)	(1.37)	(2.17)	(-1.96)	(7.59)	(3.64)	(2.94)	(-0.44)
INPCI	0.4433***	0.035	0.3171*	-0.356*	1.675***	1.024*	1.252*	-0.793
-	(4.45)	(0.23)	(2.02)	(-2.02)	(3.72)	(2.02)	(1.90)	(-0.98)
AGDP	-0.0006*	-0.00005	-0.00004	0.0001	-0.0027***	-0.0003	-0.0002	0.0003*
+	(-7.13)	(-0.82)	(-0.76)	(1.66)	(-6.01)	(-1.55)	(-0.63)	(1.88)
INGDP	-0.664***	-0.293*	-0.362**	-0.0718	-2.774***	-1.303**	-0.882	-1.6642
-	(-7.05)	(-1.86)	(-2.39)	(0.32)	(-6.65)	(-2.42)	(-1.32)	(-1.68)
SD	-0.013***	-0.0045*	-0.008***	-0.002	-0.046***	0.0043	0.008	0.01212
-	(-8.39)	(-2.03)	(-3.10)	(-0.81)	(-4.57)	(0.55)	(0.66)	(1.15)
INOP	0.7935***	0.5377*	0.71**	0.18	3.286***	0.926	0.199	0.8616
-	(5.76)	(1.98)	(2.73)	(0.88)	(4.35)	(0.90)	(0.16)	(1.01)
Culture	-0.493***	-0.2605*	-0.4125**	-0.007	-0.6602***	0.1454	0.21	0.4788*
+	(-5.88)	(-1.95)	(-2.83)	(-0.06)	(-3.41)	(0.72)	(0.69)	(1.90)
R^2	89.3	38.4	51.9	57.3	83.5	52.9	48.3	52.9
F	19.03	1.4	2.47	3.07	11.56	2.57	2.14	2.57

Note: + and - sign are expected sign. *t*-values are in parentheses. ***, ** and * indicate significance at the 1, 5 and 10 percent levels, respectively.

The explanatory power of those regression varies through years. In 1972, both equations had the highest explanatory power of the regression. Then the explanatory power decreased dramatically in 1977. Since then it was slowly gaining back its power.

The variable APCI has positive sign as expected by IIT theory except an opposite sign for 1987. In weighted logit transformation model, the negative APCI in 1987 is insignificant but the negative APCI of ordinary model is significant at 10% level. The significant positive sign of APCI in 1972, 1977 and 1982 support that development stage

plays an important role in determining IIT for Asian NIEs. The negative sign of APCI could be explained by the increase of IIT among Asian NIEs at faster rate than with industrialized countries.

The variable INPCI of both model has same sign, but the one of 1972, 1977 and 1982 has the opposite sign to that which the IIT theory predicted. All the INPCI variable of weighted logit model in 1972, 1977 and 1987 is significant at 1%, 10%, and 10%, respectively, but the ordinary model is significant for the same level but in different years, 1972, 1982 and 1987. The reason could be due to higher degree of IIT within Asian NIEs than with industrialized countries, especially when the difference in per capita income was not significant among Asian NIEs in the early years, 1972 to 1977. The high degree of IIT inside Asian NIEs outweighs the difference in development level in determining IIT in the early years. In 1987, the per capita income of Hong Kong and Singapore leads the other two little tigers with a larger gap and moves closer to the industrialized country level. This results in a negative INPCI in 1987. Basically, IIT theory is based on observation of industrialized countries experience. Consequently it may not be able to explain IIT well for Asian NIEs.

The variable AGDP also has the opposite sign in 1972 and 1977 and it is significant only in 1972. AGDP has the correct sign in 1987, but it is insignificant. Our results contradict most traditional IIT literature results. This is probably the weakness of IIT theory. All Asian NIEs have smaller size of economies compared with industrialized countries. The IIT theory also does not catch the unique characteristics of the four tigers'

economies. This result also contradicts Kim's (1992) study about Korea's manufactures IIT and Lee's (1992) research about Pacific Basin IIT.

The INGDP variable has all the correct sign as expected in both equations. The variable is not significant in weighted logit equation in 1982 and 1987, but only insignificant in the ordinary equation in 1987. It is significant at 1%, 10%, and 5%, respectively for 1972, 1977, and 1982 in ordinary equation, but it is significant at 1% and 5% for 1972 and 1977 in weighted logit equation. These results support IIT hypothesis about that difference in market size is an determinant for IIT. The difference in market size among Asian NIEs is small. This explains the high degree IIT among Asian NIEs themselves.

The variable SD has all expected sign in IIT equation, but in 1987, it is insignificant. For the logit IIT equation, only in 1972 it has the expected sign and is significant. In other three years, 1977, 1982, and 1987, it has the opposite sign as the IIT model predicted. The distance could be not that important in determining IIT for Asian NIEs since all the industrial policies of four tigers are export oriented. Exports are the engine to move their economies forward.

The variable INOP has opposite sign in both equations In 1972, 1977, and 1987 it is significant in IIT equation but it is only significant in logit equation in 1972. This means, if we consider all products group IIT, the bigger difference in the degree of openness between two economies, the higher degree of IIT will be. It contradicts with

the prediction of IIT theory in determining IIT. The variable Culture in IIT equation in all year also has opposite sign as predicted. It is significant at 1%, 10%, and 5% in the IIT equation, respectively, for 1972, 1977, and 1982. But in login IIT equation, it has the expected positive sign in 1977, 1982 and 1987 and it is insignificant. The opposite sign in logit equation for 1972 is significant at 1%. The implication of the mixed signs is that it is not clear about cultural role in predicting IIT when all products group have been included.

5.4.2 Test Results For Capital Intensive Products Group

Table 5.32 Results of Regression Analysis on the Determinants of IIT for the Asian NIEs: Capital Intensive Products Group

	IIT				Login IIT			
	1972	1977	1982	1987	1972	1977	1982	1987
Constant	0.4885	-0.6203	-0.1739	0.0313	-0.3544	-2.18***	-2.53***	-0.674
	(2.41)	(-1.78)	(-0.47)	(0.21)	(-1.13)	(-4.26)	(-3.37)	(-1.68)
APCI	0.0005***	0.0002***	0.0001***	0.00003***	0.002***	0.0007***	0.0005***	0.0001**
+	(5.82)	(4.16)	(3.87)	(3.71)	(6.09)	(4.32)	(4.95)	(2.18)
INPCI	0.519***	0.62**	0.2192	-0.4238***	2.055***	1.5031*	0.29	-1.77***
-	(3.58)	(2.74)	(0.93)	(-4.22)	(3.63)	(1.76)	(0.36)	(-3.53)
AGDP	-0.0005***	-0.0001	0.00004	0.00007***	-0.002***	-0.0004	-0.00002	0.0003**
+	(-3.72)	(-1.62)	(0.50)	(2.94)	(-3.66)	(-1.41)	(-0.07)	(2.32)
INGDP	-0.41***	-0.583**	-0.3005	0.0303	-1.6***	-1.832**	-0.72	0.35
-	(-2.96)	(-2.48)	(-1.33)	(0.23)	(-3.2)	(-2.11)	(-0.91)	(0.52)
SD	-0.0094***	0.005	0.0013	0.0014	-0.03***	0.026**	0.03*	0.014
-	(-4.30)	(1.47)	(0.36)	(1.01)	(-3.09)	(2.27)	(1.94)	(0.18)
INOP	0.2656	0.1966	-0.4209	-0.244	0.88	-0.686	-4.01**	-0.97*
-	(1.32)	(0.48)	(-1.08)	(-2.10)	(1.13)	(-0.44)	(-2.50)	(-1.83)
Culture	-0.229*	0.486**	0.255	0.3628***	-0.233	1.034***	1.164**	0.586***
+	(-1.88)	(2.43)	(1.17)	(4.73)	(-1.08)	(3.29)	(2.73)	(3.22)
R^2	77.2	63.9	59.7	91.9	75.9	69.6	68.9	89.7
F	7.74	4.05	3.38	25.78	7.19	5.24	5.06	19.81

The two equations have an overall better explanatory power of the model than all products group one, except in 1972 for both equations. The improvement in explanatory power is especially significant in 1987 for both equations. The variable APCI is significant at 1% level at every year we investigated. It is also significant at 1% level in 1972, 1977, and 1982, and at 5% level in 1987. These results strongly support IIT theory in predicting IIT pattern for Asian NIEs. With the economic development level close to industrialized countries, the degree of IIT of each Asian NIEs increases. Among Asian NIEs, when the average per capita income increases, the degree of IIT within K group in bilateral trade with Asian NIEs themselves also increases.

The result of the variable INPCI has a mixed sign in both equations for each year. In 1972, 1977, and 1982, it has an unexpected positive sign for both equations. It is significant at 1% and 5% level in ordinary IIT equation and at 1% and 10% level in logit equation in 1972 and 1977, respectively. In 1987, it has a negative sign at significant 1% level in both equations. This result can not be explained by IIT theory. The possible cause for this paradox is that there was less significant difference in per capita income within Asian NIEs. Therefore, the difference in per capita income among Asian NIEs has little influence on the degree of IIT among Asian NIEs. On the other hand, difference in per capita income between Asian NIEs and industrialized countries was still significant. The positive sign of INPCI in 1972, 1977, and 1982 means the bigger the difference in per capita income, the higher degree of IIT between Asian NIEs and industrialized countries. With the passage of time, when the difference in per capita income among Asian NIEs

became significant, the variable INPCI in 1987 became negative. This supports the hypothesis of IIT model in prediction of IIT.

The variable AGDP that measures average market size between two economies also has mixed signs. In IIT equation, it is significant at 1% and 10% in 1972 and 1987, respectively, but with unexpected negative sign in 1972 and expected positive sign in 1987. In the meantime, it is significant at 1% and 5% level in 1972 and 1987, respectively, with unexpected negative sign in 1972 and expected positive sign in 1987. The possible answer to this paradox is that the size of economy of Asian NIEs are relatively small in the early years. When the economy of Asian four tigers grew over time, the average market size exerted its proper direction in determining IIT. This is shown by the significant expected sign of AGDP in 1987.

The variable INGDP, difference in GDP, in both equations has expected sign in 1972, 1977, and 1982. The two equations have same significant level for 1972 and 1977. Namely, it is significant at 1% and 5% level for both equations in 1972 and 1977. In 1982 and 1987, the variable is not significant for both equations. The variable has unexpected positive sign in 1987 for both equations. Our results show in 1972 and 1977, the IIT theory can explain IIT phenomena for Asian NIEs correctly. The possible explanation for this is that in the early year the difference in GDP Asian NIEs and industrialized countries was relatively significant than later year. This results in negative sign of INGDP for the early years and positive sign of INGDP in 1987.

The variable SD, the distance between two economies, has mixed signs as well. In IIT equation, the variable is significant at 1% and has expected sign in 1972. All other three years, 1977, 1982 and 1987 has an unexpected sign but is insignificant. In the logit equation, it has the expected sign with a significant level at 1% in 1972 and unexpected sign in 1982 and 1987 with significant level at 5% and 10%, respectively. This indicates the variable SD could not explain IIT for Asian NIEs well. The reason could be that all Asian NIEs do not have large enough domestic markets to keep their economies growing faster; therefore, they all favor exports as an engine to push economy going. Hence, the distance does not play the important role in determining IIT with their trading partners.

The variable INOP, which measures trade barriers between two economies, has mixed signs without any significant level in IIT equation. In logit equation, the variable has expected negative sign in 1977, 1982 and 1987. But it is only significant at 5% and 10% level in 1982 and 1987, respectively. This result indicates that trade barriers only can explain Asian NIEs IIT in the later years. The variable Culture has an unexpected negative sign for both equations in 1972 and is significant at 10% level in IIT equation. Other than 1972, the variable has the expected sign. It is significant at 5% and 1%, respectively, for IIT equation in 1977 and 1987. For logit equation, it is significant at 1%, 5% and 1% respectively in 1977, 1982 and 1987. Therefore, the culture factor is important in explaining Asian NIEs IIT in K products group. This is contrary to the results in all products case.

5.4.3 Test Results For Labor Intensive Products Group

Table 5.33 Results of Regression Analysis on the Determinants of IIT for the Asian NIEs: Labor Intensive Products Group

	IIT				Logit IIT			
	1972	1977	1982	1987	1972	1977	1982	1987
Constant	0.41	0.73**	-0.4257	0.59	-1.09**	-0.586***	-1.287**	0.0885
	(1.58)	(2.45)	(-0.62)	(1.38)	(-2.70)	(-2.94)	(-2.74)	(0.14)
APCI	0.0004***	0.00005	0.00008	0.00005	0.002***	0.00035**	0.0004***	0.00003
+	(3.78)	(1.28)	(1.51)	(0.24)	(4.73)	(2.46)	(6.35)	(0.5)
INPCI	0.054	-0.2643	0.3192	-0.431	0.8186	-0.66	0.92	-1.792
-	(0.29)	(-1.36)	(0.74)	(-1.50)	(1.28)	(-0.73)	(1.54)	(-1.52)
AGDP	-0.0004**	-0.000005	-0.00014	0.00005	-0.002**	-0.00006	-0.0003	0.0002
+	(-2.37)	(-0.08)	(-0.91)	(0.66)	(-2.70)	(-0.16)	(-1.26)	(0.71)
INGDP	-0.6***	-0.17	-0.0164	-0.45	-2.3511***	-0.68	-1.18**	-2.024
-	(-3.42)	(-0.84)	(-0.04)	(-1.21)	(-3.89)	(-0.78)	(-2.12)	(-1.46)
SD	-0.004	-0.005*	0.004	-0.0015	0.002	-0.001	0.0073	-0.005
-	(-1.57)	(-1.77)	(0.54)	(-0.38)	(0.16)	(-0.17)	(0.65)	(-0.36)
INOP	-0.0044	0.187	-0.26	0.393	-0.6	-0.813	-1.005	1.653
-	(-0.02)	(0.54)	(-0.37)	(1.17)	(-0.61)	(0.63)	(-1.01)	(1.22)
Culture	-0.08	0.2	0.3266	-0.02	0.3591	0.136	0.354	-0.0042
+	(-0.51)	(-1.18)	(0.81)	(-0.09)	(1.36)	(0.92)	(1.26)	(-0.01)
R^2	72.8	52.6	22.4	44.4	76.7	46.4	78.5	43.4
F	6.1	2.53	0.66	1.83	7.54	1.97	8.33	1.76

The test results of labor intensive group are discouraging. Not many variables are significant. The variables INPCI, INOP, and Culture are not significant in any year we studied. The variable APCI in IIT equation is only significant at 1% level with expected sign in 1972 and in logit equation it is significant at 1%, 5%, and 1% level with the expected sign. The variable AGDP in both equations has unexpected negative sign at significant level of 5% in 1972. The INGDP variable in both equations has the expected sign at the significant level of 1%, but a positive sign at the significant level of 5% in logit equation. The distance variable SD is only significant at 10% level with expected

sign for IIT equation in 1977. The possible explanation of this poor results in L products group is that all Asian NIEs have global comparative advantage in labor intensive products group between the early '70s and early '80s. This reflects the test results in both equations for 1972 have the expected sign which IIT theory predicted. That is because in the early 1970s all Asian NIEs industrialization policy still stressed labor intensive industry. These policies have evolved into moving toward encouraging capital intensive industry in late '70s and early '80s. Other factors affected the economies: China adopted an open economic policy during late '70s and early '80s; hence, China's rising definitely affected the IIT of Asian NIEs in L group products. Consequently, IIT theory can explain Asian NIEs IIT phenomena better in 1972 than other time period this study covered.

Chapter 6

Conclusions

The outstanding performance of Asian NIEs in the past has been accompanied by dramatic changes in the structure of their production. Given the dynamic changing process of their economies since 1967, is hard to conclude what kind of patterns of international trade they might be. The dynamic economies also contribute to the successful stories of the Asian NIEs. Generally speaking, changes in their industrial structure are closely related to economic policy. Hong Kong and Singapore had similar economic development levels. But the government role in economic activities in each nation is quite different. The Hong Kong colonial government plays a very limited role in making industrial policy. On the other hand, the Singapore government plays a dictator role in directing industrial development. Therefore, in terms of global comparative advantage, Singapore was rapidly moving toward capital intensive products by government policy to gain global comparative advantage in capital intensive products, while Hong Kong accomplished this slowly by free market force. Because of the geographical location, the entrepot role of Hong Kong and Singapore results relatively symmetric blocked area in four group products in terms of global comparative advantage.

Taiwan and Korea have followed similar development strategies in the period since the World War II. In other words, in the early days, both countries adopted an import substitution policy that is export oriented with domestic production protected. Both governments play similar role, one in which government makes industrial policy, in economic activities. But it turns out that the industrial structure of both countries are quite different. The production in Taiwan is dominated by small firms, but by large conglomerates in Korea. In the early years, this difference in terms of firm size exerted little difference on both countries' performance in labor intensive products in the world market. But the difference in capital intensive products is obvious. This explains why Korea is gaining more market share in capital intensive products in the world market than Taiwan. The reason is because small size firms in Taiwan find it hard to enjoy economies of scale which is important in capital intensive industry. But the advantage of small size firm is its flexibility in adjusting itself quickly to changing market condition. This advantage strengthens Taiwan's competitiveness in capital intensive goods against Korea in the world market.

The other factor contributing to the reason that it is hard to trace a pattern for Asian NIEs in the US and EC market is that the characteristics of each market are different. The EC market is generally more conservative than US market. Therefore, the competition from the Asian NIEs against Japan in the US market is more intensive than in the EC market. The general patterns for Asian NIEs in exports are gradually moving from labor intensive products to capitai intensive products. This is clearly following the Japanese economic development path. Unfortunately, in capital intensive goods Asian

NIEs have not been able to compete effectively against Japan in US and EC markets, but they have to face stiff competition from ASEAN countries and Mainland China in the labor intensive products. That is why Asian NIEs are losing revealed comparative advantage to their rivals in both US and EC markets.

Intra-industry trade has become increasingly important in recent international trade. We analyzed four tigers' IIT situation. We found that there is a trend of increasing degree of IIT to total trade for Asian NIEs; we also found the degree of IIT among Asian NIEs was high. This indicates that IIT is not only a phenomena among high income countries but also happens in low income countries. We found that the economic development level is more important in explaining IIT than other factors in determining IIT for Asian NIEs. This particularly obvious when we investigated the IIT among Asian NIEs. Hong Kong and Singapore had similar economic development levels. Korea and Taiwan did the same. We found that the degree of IIT between Hong Kong and Singapore is higher than with other Asian NIEs and industrialized countries. Korea and Taiwan have similar but lesser degree of IIT between themselves.

Choosing a proper IIT index is also important. We showed that different IIT indices based on different methods. Some indices will be biased due to the way of computing the index. Therefore, definitely, choosing a IIT index will affect the econometric test results.

The test for the determinants of IIT for Asian NIEs are quite different from traditional IIT literature. The test results of all SITC three-digit level industries are not satisfactory. That reason is most of early IIT literature test was only applied to manufactures, especially capital intensive products, among high income countries. Therefore, the explanation of IIT was based on those test results. But we still believe that the agricultural products can represent one country's taste since food expense take large share of expenditure for consumer. It should be a factor counted into determining IIT; even critics say that it is hard to get the real picture of IIT for agricultural products due to protection in agricultural products. When test of all products applied, those explanations of IIT could not hold well. Surprisingly, the taste factor in predicting IIT just did fine even it is not completely satisfactory. But when we separated the all products into capital intensive and labor intensive products, the test results improved significantly.

The other possible reason to explain these unsatisfactory test results is that most traditional IIT literature tests focused on high income countries, which have been regarded in the mature stage of economies. When the test of the dynamic economies, like Asian NIEs, applied, we cannot explain the results well with traditional views of IIT theory. Another reason to explain this deviation from traditional IIT theory is that the size of economies of Asian NIEs is relatively much smaller than that of industrialized countries; therefore, traditional IIT theory in explaining IIT among larger size of economies may not work well with the much smaller size of economies, such as the Asian NIEs. This may contribute to the difference in our test results from other IIT studies.

Chapter 7

References

Abe, Kiyoshi, Gunther, William, and See, Harold, *Economic, Industrial and Managerial Coordination between Japan and the USA*, St. Martin's Press, Inc., 1992

Aggarwal, Raj and Agmon, Tamir, "The International Success of Developing Country firms: Role of Government-Directed Comparative Advantage," *Management International Review*, Second Quarter 1990, Vol. 30, pp.163-180

Andrikopoulos, Andreas A., "The Strong Factor Intensity Hypothesis and the Heckscher-Ohlin Theorem: A Multiregional Test," *Nebraska Journal of Economics & Business*, Spring 1978, Vol. 17, pp.17-33

Aquino, A., "Intra-Industry Trade and Inter-industry Specialization," *Weltwiutschafthiches Archiv*, 1978, 112 (2), pp. 275 - 296

Aquino, A., "Changes over in the pattern of comparative advantage in manufactured goods," *European Economic Review*, 1981a, Vol.15, pp. 41-62

Aquino, A., "The Measurement of Intra-Industry Trade When Overall Trade Is Imbalanced," *Weltwiutschafthiches Archiv*, 1981b, 117, pp. 763 - 766

Balassa, Bela, "Trade Liberalization and 'Revealed' Comparative Advantage in Manufactured Goods," *Manchester School*, 1965, 33:99-123

Balassa, Bela, "'Revealed' Comparative Advantage Revisited," *The Manchester School of Economic and Social Studies*, December 1977, No. 7, pp. 327 - 344

Balassa, Bela, "The Changing Pattern of Comparative Advantage in Manufactured Goods," *Review of Economics and Statistics*, May 1979, 61: 259-66

Balassa, Bela, *The Newly Industrializing Countries in the World Economy*, Pergamon Press, 1981

Balassa, Bela, "The Lessons of East Asian Development: An Overview," *Economic Development & Cultural Change*, April 1988, Vol. 36, s273-s290

Balassa, Bela, *Comparative Advantage Trade Policy and Economic Development*, Harvester Wheatsheaf, 1989

Balassa, Bela and Luc Bauwens, *Changing Trade Patterns in Manufactured Goods: An Econometric Investigation*, North-Holland, 1988

Ballance, Robert H.; Forstner, Helmut and Murray, Tracy, "Consistency Tests of Alternative Measures of Comparative Advantage," *Review of Economics & Statistics*, February 1987, Vol. 69, pp.157-161

Bergstrand, Jeffrey H., " Measurement and Determinants of Intra-Industry International Trade," in *Intra-Industry Trade Empirical and Methodological Aspects*, ed. by Tharakan, P. K. M., North-Holland, 1983, pp. 201 - 253

Bergstrand, Jeffrey H., "The Heckscher-Ohlin-Samuelson Model, the Linder Hypothesis and the Determinants of Bilateral Intra-Industry Trade," *The Economic Journal*, 100, December 1990, pp.1216 - 1229

Bhagwati, Jagdish N., "The Pure Theory of International Trade: A Survey," *Economic Journal*, March 1964, 74, pp. 1 - 84

Brander, J. A., and Spencer, B. J., "Tariff Protection and Imperfect Competition," in *Monopolistic Competition and International Trade*, Oxford University Press, 1984

Brander, J., "Intra-Industry Trade in Identical Commodities," *Journal of International Economics*, 1981, 11, pp. 1 - 14

Brander, J. and Krugman, P., "'Reciprocal Dumping' Model of International Trade," *Journal of International Economics*, 1983, 15, pp. 313 - 321

Brander, J. A., and Spencer, B. J., "Trade Warfare: Tariffs and Cartels," *Journal of International Economics*, 1984, 16, pp. 227 - 42

Brander, J. A., and Spencer, B. J., "Tariff Protection and Imperfect Competition," in *Monopolistic Competition and International Trade*, ed. by Kierzkowski, Oxford University Press, 1986

Branson, William, and Monoyios, Nikolaos, "Factor Inputs in the U.S. Trade," *Journal of International Economics*, May 1977, 7, pp. 111 - 131

Cassing, James H. and Hillman, Arye L., "Shifting Comparative Advantage and Senescent Industry Collapse." *American Economic Review*, June 1986, Vol.76, pp. 516-523

Chacholiades, Miltiades, *International Trade Theory and Policy*, McGraw-Hill, 1978

Changing Patterns of Trade in World Industry: an Empirical Study on Revealed Comparative Advantage, United Nations, 1982

Chipman, John S., "A Survey of the Theory of International Trade," *Econometrica*, July 1965, pp. 477 - 519; October 1965, pp. 685 - 760; January 1966, pp. 18 - 76

Chou, Tein-chen, "Concentration, Profitability and Trade in a Simultaneous Equation Analysis: The Case of Taiwan", *Journal of Industrial Economics*, June 1986, Vol. 34, pp. 429-443

Chowdhury, Anis and Islam, Iyanatul, *The Newly Industrialising Economies of East Asia, Routledge*, 1993

Chowdhury, A and Kirkpatrick, C. H., "Human Resources, Factor Intensity and Comparative Advantage of ASEAN," *Journal of Economic Studies*, 1990, Vol. 17, pp. 14-26

Christodoulou, Maria, "Intra-Industry Trade in Agrofood Sectors: the Case of the EEC Market," *Applied Economics*, 1992, 24, pp. 875 - 884

Corden, W. M., 'Comment', in *Studies in International Economics*, eds. McDougall, I. A. and Snape, R. H., North-Holland, 1970 .

Crafts, N. F. R. and Thomas, Mark, "Comparative Advantage in UK.. Manufacturing Trade, 1910-1935." *Economic Journal*, September 1986, Vol. 96, pp. 629-645

Culem, Claudy and Lundberg, Lara, "The product Pattern of Intra-Industry Trade: Stability among Countries and over Time," *Weltwirtschaftliches Archiv*, 1986, 122 (1), pp. 113 - 30

Dalal, Ardeshir J. and Williams, Martin, "An Empirical Investigation of Interregional Production Relations and Comparative Advantage in U.S. Manufacturing, 1960-70," *Applied Economics*, June 1990, Vol. 22, pp. 823-838

Deardorff, Alan V., "Weak Links in the Chain of Comparative Advantage," *Journal of International Economics*, May 1979, 9 (2), pp. 197 - 209

Deardorff, Alan V., "The General Validity of the Law of Comparative Advantage," *Journal of Political Economy*, October 1980, Vol. 88, pp. 941-957

Deardorff, Alan V., " Testing Trade Theories and Predicting Trade Flows," in *Handbook of International Economics*, vol. 1, 1984

Dixit and Stighitz, "Monopolistic Competitions and Optimum Product Diversity," *American Economic Review*, June 1977, pp. 297 - 308

Dollar, David, "Technological Differences as a Source of Comparative Advantage," *American Economic Review*, May 1993, Vol. 83, pp. 431-435

Dornbusch, R.; Fisher, S. and Samuelson, P. A., "Comparative Advantage, Trade, and Payments in a Ricardian Model with a Continuum of Goods," *American Economic Review*, December 1977, Vol. 67, pp. 823-839

Dreze, J., "Quelques Reflexions sereines sur l'adaptation de l'industrie Belge au Marche Commun," *Comptes rendus des Travaux de la Societe Royale d'Economie Politique de Belgique*, 1960, No. 275

Dreze, J., "Les Exportations Intra-CEE en 1958 et la Position Belge," *Researches Economiques de Louvain*, 1961, 27, pp. 717 - 738

Ethier, W. J., "High Dimensional Issues in Trade Theory," in Jones, R. W. and Kenen, P. B. (eds), *Handbook of International Economics*, North-Holland, 1984

El-Agraa, Ali M., *International Trade*, MacMillan, 1989

Eswaran, Mukesh and Kotwal, Ashok, "Export Led Development: Primary vs. Industrial Exports," *Journal of Development Economics*, June 1993, Vol. 41, pp. 163-172

Falvey, Rodney E., "Comparative Advantage in a Multi-Factor World," *International Economic Review*, June 1981, Vol. 22, pp. 401-413

Findlat, Ronald, "The Roots of Divergence: Western Economic History in Comparative Perspective," *American Economic Review*, May 1992, Vol. 82, pp. 158-161

Gray, H. P., "Two-Way International Trade in Manufactures: A theoretical Underpinning," *Weltwirtschaftliches Archiv*, 1973, 109, pp. 19 - 39

Greenaway, David and Milner, Chris, *The Economics of Intra-Industry Trade*, Basil Blackwell Inc., 1986

Greenaway, David and Milner, Chris, "Trade Imbalance Effects in the Measurement of Intra-Industry Trade," *Weltwirtschaftliches Archiv*, 1981, 117 (4), pp. 756 - 62

Greenaway, David and Tharakan, P. K. M., *Imperfect Competition and International Trade the Policy Aspects of Intra-Industry Trade*, Humanities Press, 1986

Grossman, Gene M and Helpman, Elhanan, "Trade, Innovation, and Growth," *American Economic Review*, May 1990, Vol. 80, pp. 86-91

Grossman, Gene M and Helpman, Elhanan, "Product Development and International Trade," *Journal of Political Economy*, December 1989, Vol. 97, pp.1261-1283

Grossman, Gene M and Helpman, Elhanan, "Comparative Advantage and Long-Run Growth," *American Economic Review*, September 1990, Vol. 80, pp. 796-815

Grubel, Herbert G. and Lloyd, P.J., *Intra-Industry Trade the Theory and Measurement of International Trade in Differentiated Products*, John Wiley and Sons, 1975

Harkness, Jon, "Factor Abundance and Comparative Advantage," *American Economic Review*, December 1978, Vol. 68, pp.784-800

Heckscher, E., (1919) "The Effect of Foreign Trade on the Distribution of Income," reprinted in H.S. Ellis and L.A. Metzler (eds.), *Readings in the Theory of International Trade*, Blakistan, 1950

Helpman, Elhanan, "International Trade in the Presence of Product Differentiation, Economies of Scale and Monopolistic Competition," *Journal of International Economics*, 1981, 11, pp. 305-40

Helpmand, E. and Krugman, P. R., *Market Structure and Foreign Trade*. MIT Press, Cambridge, 1985.

Heron, Richard Le and Park, Sam Ock, *The Asian Pacific Rim and Globalization Enterprise, Governance and Territoriality*, Avebury, 1995

Hickok, Susan and Orr, James, "Shifting Patterns of U.S. Trade with Selected Developing Asian Economies," *Federal Reserve Bank of New York Quarterly Review*, Winter 1989/1990, Vol. 14, pp.36-47

Hickok, Susan, "The Shifting Composition of U.S. Manufactured Goods Trade," *Federal Reserve Bank of New York Quarterly Review*, Spring 1991, Vol. 16, pp. 27-37

Hillman, Arye L., "Observations on the Relation Between 'Revealed Comparative advantage' and Comparative Advantage as Indicated by Pre-Trade Relative Prices," *Weltwirtschaftliches Archiv*, 1980, Vol. 116, pp. 315 - 321

Hillman, Arye L. and Bullard, Clark W. III, "Energy, the Heckscher-Ohlin Theorem, and U.S. International Trade," *American Economic Review*, March 1978, Vol. 68, pp. 96-106

Hindley, Brian and Smith, Alasdair, "Comparative Advantage and Trade in Services," *World Economy*, December 1984, Vol. 7, pp. 369-389

Hirsch, Seev, *Location of Industry and International Competitiveness*, Clarendon Press, 1967

Horiba, Y. and Moroney, J. R., "On the Structure of Comparative Advantage in a Multifactor Trade Model," *International Economic Review*, June 1979, Vol. 20, pp. 551-554

Horiba, Yutaka, "Testing the Demand Side of Comparative Advantage Models," *American Economic Review*, September 1979, Vol. 69, pp. 650-661

Hoy, Harold J. and Shaw, John J., "The United States' Comparative Advantage and Its Relationship to the Product Life Cycle Theory and the World Gross National Product Market Share," *Columbia Journal of World Business*, Spring 1981, Vol. 16, pp. 40-50

Hufbauer, G. C., "The Impact of National Characteristics and Technology on the Commodity Composition of Trade in Manufactured Goods," *The Technology Factor in International Trade*, NBER, 1970

Hughes, H., "'Singapore', in Asian Development Bank", *Southeast Asia's Economy in the 1970s*," Longman, 1971

Hummels, David and Levinsohn, James, "Product Differentiation as a Source of Competitive Advantage?," *American Economic Review*, May 1993, Vol. 83, pp. 445-449

International Comparative Advantage In Manufacturing: Changing Profiles of Resources and Trade. United Nations Industrial Development Organization, Vienna, 1986.

Katz, Jorge M., "Domestic Technological Innovations and Dynamic Comparative Advantage," *Journal of Development Economics*, Sep/Oct 1984, Vol. 16, 13-37

Koekkoek, K. A. and Mennes, L. B. M., "Revealed Comparative Advantage in Manufacturing Industry: The Case of the Netherlands," *Economist-Leiden*, 1984, Vol. 132, pp. 30-48

Kohli, Ulrich and Edward R. Morey, "U.S. Imports by Origin: A Characteristics Approach," *Kyklos*. Vol. 41, 1988, Fasc. 1, pp. 51-74.

Kojima, K., "The pattern of International Trade among Advanced Countries," *Hitotsubashi Journal of Economics*, June 1964, 5, pp. 14 - 36

Kol, Jacob, "Exports from Developing Countries: Some Facts and Scope," *European Economic Review*, Feb/Mar 1987, Vol. 31, pp. 466-474

Kol, Jacob and Mennes, Loet B. M., "Intra-Industry Specialization: Some Observations on Concepts and Measurement." *Journal of International Economics*, August 1986, Vol. 21, pp. 173-181

Kraar, Louis, "The Rising Power of the Pacific," *Fortune*, Fall 1990, Vol. 122, pp. 8-12

Kravis, I. B., "'Availability' and Other Influences on the Commodity Composition of Trade," *Journal of Political Economy*, April 1956, pp. 143 - 155

Krugman, Paul R., "Increasing Returns, Monopolistic Competition and International Trade," *Journal of International Economics*, 1979, vol. 9, pp. 469 - 479

Krugman, Paul R., "Intra-Industry Specialization and the Gains from Trade," *Journal of Political Economy*, Vol. 89, October 1981, pp. 959-973

Krugman, Paul, "Rethinking International Trade," *Business Economics*, April 1988, Vol. 23, pp. 7 - 12

Kwon, Tecksung, "Is the Observed Intra-Industry Trade a Statistical Artifact?," *International Economic Journal*, Spring 1988, Vol. 2, No. 1, pp. 69 - 84

Lancaster, K., *Variety, Equity and Efficiency*, Columbia University Press, 1979

Lancaster, K., "Intra-Industry Trade Under Perfect Monopolistic Competition," *Journal of International Economics*, 1980, 10, pp. 151 - 75

Leamer, Edward E., *Source of International Comparative Advantage: Theory and Evidence*, The MIT Press, 1984.

Leamer, Edward E., "Factor-Supply Differences as a Source of Comparative Advantage," *American Economic Review*, May 1993, Vol. 83, pp. 436 - 439

Lee, Keun, *New East Asian Economic Development – Interacting Capitalism and Socialism*, An East Gate Book, 1993

Lee, Hyun-Hoon and Lee, "Young-Youn, Intra-Industry Trade in Manfactures: The Case of Korea," *Weltwirtschaftliches Archiv*, 1993, 129 (1), pp. 159 - 71

Lee, Young Sun, " A Study of the Determinants of Intra-Industry Trade among the Pacific Basin Countries," *Weltwirtschaftliches Archiv*, 125 (2), 1989, pp. 346 - 58

Leipziger, Danny M. Leipziger, *Lessons from East Asia*, The University of Michigan Press, 1997

Leontief, W. W., "Domestic Production and Foreign Trade: The American Capital Position Re-examined," *Proceedings of the American Philosophical Society*, September 1953, pp. 332 - 349

Linder, Staffan B., *An Essay on Trade and Transformation*, New York: John Wiley, 1961.

Loertscher, Rudolf and Wolter, Frank, "Determinants of Intra-Industry Trade: Among Countries and across Industries," *Weltwirtschaftliches Archiv*, 1980, Vol. 116 No. 2, pp. 280-93.

Lowinger, Thomas C., "Human Capital and Technological Determinants of U.S. Industries' Revealed Comparative Advantage," *Quarterly Review of Economics & Business*, Winter 1977, Vol. 17, pp. 91-102

Lundberg, Lars, "Economic Integration, Inter- and Intra-Industry Trade: The Case of Sweden and the EC," *Scandinavian Journal of Economics*, 1992, Vol. 94, pp. 393-408

Lutz, James M and Kihl, Young Whan, "The NICs, Shifting Comparative Advantage, and the Product Life Cycle," *Journal of World Trade*, February 1990, Vol. 24, pp. 113-134

MacDonald, Glenn M and Markusen, James R., "A Rehabilitation of Absolute Advantage," *Journal of Political Economy*, April 1985, Vol. 93, pp. 277-297

MacDougall, G. D. A., "British and American Exports: A study Suggested by the Theory of Comparative Costs," *Economic Journal*, December 1951, LXI, pp. 697 - 724

Melvin, James R., "Production and Trade with Two Factors and Three Goods," *American Economic Review*, 1968, 58, pp. 1249 - 1268

Michaely, M., *Concentration in International Trade*, North-Holland, 1962a

Michaely, M., "Multilateral Balancing in International Trade," *American Economic Review*, September 1962b, LII, pp. 685 - 702

Mullor-Sebastian, Alicia, "A New Approach to the Relationship Between Export Instability and Economic Development," *Economic Development & Cultural Change*, January 1988, Vol. 36, pp. 217-236

Myint, H., "International Trade and Developing Countries (1969)," reprinted in *Economic Theory and the Underdeveloped Countries*, Oxford University Press, 1971

Nishimizu, Mieko and Page, John M., Jr., "Productivity Change and Dynamic Comparative Advantage," *Review of Economics & Statistics*, May 1986, Vol. 68, pp. 241-247

Nolle, Daniel E., " The Determinants of Intra-Industry Trade for Developing Economies," *Rivista Internazionale di Scienze Economiche e Commerciali*, 1990, Vol. 37, N. 4 - 5, pp. 409 - 42

Ohlin, B., *Inter-Regional and International Trade*, Harvard University Press, 1933

Peterson, John, "Export Shares and Revealed Comparative Advantage. A Study of International Travel," *Applied Economics*, March 1988, Vol. 20, pp. 351-365

Posner, M. V., "International Trade and Technical Change," *Oxford Economic Papers*, October 1961, pp. 323 - 341

Rauch, James E, "Comparative Advantage, Geographic Advantage, and the Volume of Trade," *Economic Journal*, September 1991, Vol. 101, pp. 1230-1244

Rodrick, D., "Industrial Organization and Product Quality: Evidence from South Korean and Taiwanese Exports." *Working Paper, No. 2722*, 1988, National Bureau of Economic Research

Roskamp, K. W., "Factor Proportions and Foreign Trade: The Case of West Germany," *Weltwirtschaftliches Archiv*, 1963, pp. 319 - 326

Roskamp, K. W. and McMeekin, G. C., "Factor Proportions, Human Capital and Foreign Trade: The Case of West Germany Reconsidered," *Quarterly Journal of Economics*, February 1968, pp. 152 - 160

Ruffin, Roy J, "The Missing Link: The Ricardian Approach to the Factor Endowments Theory of Trade," *American Economic Review*, September 1988, Vol. 78, pp. 759-772

Sattinger, Michael, "Comparative Advantage Individuals," *Review of Economics and Statistics*, May 1978, Vol. 60, pp. 259-267

Shannon, Russell, "A Simple Mathematical Demonstration of the Heckscher-Ohlin Theorem," *Studies in Economic Analysis*, Spring 1985, Vol. 9, pp. 57-63

Tatemota, M., and Ichimura, S., "Factor Proportions and Foreign Trade: The Case of Japan," *Review of Economics and Statistics*, 1959, 41, pp. 442 - 446

Tharakan, P. K. M., *Intra-Industry Trade Empirical and Methodological Aspects*, North-Holland, 1983

Tharakan, P. K. M., "The Intra-Industry Trade of Benelux with the Developing World," *Weltwirtschaftliches Archiv*, 1986, 122 (1), pp. 131 -49

Tybout, James R., "Internal Returns to Scale as a Source of Comparative Advantage: The evidence," *American Economic Review*, May 1993, Vol. 83, pp. 440-444

Tyers, Rodney and Phillips, Prue, "ASEAN in Pacific Basin Trade: Export Composition and Performance," *Journal of Business Administration*, 1986, Vol. 16, pp.74-116

Vanek, Jaroslay, "The Factor Proportions Theory: The N-Factor Case," *Kyklos*, October 1968, 21 (4), pp. 749 - 756

Verdoorn, P. J., "The Intra-Bloc Trade of Benelux," in *Economic Consequences of the Size of Nations*, ed. by Robinson, E. A. G., Macmillan, 1960

Vernon, Raymond, " International Investment and International Trade in the Product Cycle," *Quarterly Journal of Economics*, May 1966, 80, pp. 190 - 207

Vernon, Raymond, *The Technology Factor in International Trade*, NBER, 1970

Vogel, Ezra F., *The Four Little Dragons the Spread of Industrialization in East Asia*, Harvard University Press, 1991

Vona, Stefano, "On the Measurement of Intra-Industry Trade: Some Future Thoughts," *Weltwirtschaftliches Archiv*, 1991, 127 (4), pp. 678 - 700

Webster, Allan, "Some Issues in the Measurement of Comparative Advantage," *Applied Economics*, May 1991, Vol. 23, pp. 937-948

Wells, Louis T., Jr., "Test of a Product Cycle Model of International Trade: U.S. Exports of Consumer Durables," *Quarterly Journal of Economics*, February 1969, 82, pp. 152 - 162

Wester, Allan, "Comparative Advantage: Assessing Appropriate Measurement Techniques," *Bulletin of Economic Research*, October 1990, Vol. 42, pp. 299-310

Woronoff, Jon, *Asia's 'Miracle Economies'*, M.E. Sharpe, Inc., 1986

Xu, Yingfeng, "A General Model of Comparative Advantage with Two Factors and a Continuum of Goods," *International Economic Review*, May 1993, Vol. 34, pp. 365-380

Appendix A

International Trade Tables

Table 1 Share of International Trade

	1965		1970		1975		1980		1985		1989	
	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import
North America	20.70	17.50	20.60	18.70	17.30	17.00	15.20	16.40	16.90	23.40	16.60	20.40
United States	15.90	12.80	14.90	14.00	13.10	12.60	11.70	13.20	11.80	19.10	12.50	16.40
Canada	4.90	4.70	5.80	4.70	4.10	4.30	3.60	3.20	5.10	4.30	4.10	4.00
Japan	4.90	4.50	6.60	6.20	6.80	6.90	6.90	7.30	9.80	6.90	9.40	7.00
Asian NIEs	1.60	2.10	2.20	2.90	2.60	3.40	4.00	4.50	6.30	5.70	8.40	7.80
South Korea	0.10	0.30	0.30	0.70	0.60	0.90	0.90	1.10	1.10	1.60	2.10	2.00
Taiwan	0.30	0.30	0.50	0.50	0.60	0.70	1.00	1.00	1.70	1.10	2.30	1.80
Singapore	0.60	0.70	0.50	0.80	0.70	1.00	1.00	1.20	1.30	1.40	1.50	1.60
Hong Kong	0.70	0.90	0.90	1.00	0.70	0.80	1.00	1.20	1.70	1.60	2.50	2.40
EEC	38.60	41.00	36.20	41.10	37.30	39.60	36.40	39.70	35.80	34.80	39.10	38.90
W Germany	10.40	9.70	11.80	9.90	10.90	9.00	10.20	9.70	10.20	8.40	11.70	9.00
France	5.80	5.70	6.20	6.30	6.40	6.50	6.10	6.90	5.60	5.60	6.20	6.40
U.K.	8.00	8.90	6.70	7.20	5.20	6.50	5.80	5.90	4.20	5.60	5.20	6.60
Italy	4.20	4.10	4.60	4.90	4.20	4.90	4.10	5.20	5.60	4.70	4.80	6.60
ASEAN	1.90	1.90	1.60	1.60	1.90	1.80	2.50	2.00	2.50	2.00	2.40	2.10
China	1.50	1.20	0.80	0.70	0.90	0.90	1.00	1.00	1.50	2.20	1.80	2.00
Oceania	2.30	2.60	2.10	2.10	1.70	1.70	1.40	1.40	1.60	1.70	1.60	1.60
World Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Note 1 The figures are component ratios of nominal values (dollars) to be global total.
Note 2: World Total excludes the Communist bloc.
Source: International Financial Statistics, IMF, Monthly Statistics of Exports and Imports, Ministry of Finance, the Republic of China.

Table 2 International Trade Flow Matrix 1980
(Units: $ million, %)

	Importer																	
	North America				Asian NIEs	South Korea	Taiwan	Singapore	Hong Kong	EEC	West Germany	France	U.K.	Italy	ASEAN	China	Oceania	Other	Total
		United States	Canada	Japan															
North America	81,399	41,068	40,331	24,541	13,600	5,000	4,591	3,204	2,855	69,304	15,861	11,777	17,422	7,952	6,576	4,497	5,360	30,695	293,452
	(27.70)	(14.05)	(13.70)	(8.40)	(5.30)	(1.70)	(1.60)	(1.10)	(1.00)	(23.60)	(5.40)	(4.00)	(5.90)	(12.70)	(2.20)	(1.50)	(1.80)	(29.50)	(100.00)
United States	40,331		40,331	20,790	14,741	4,685	4,337	3,813	2,686	68,799	14,896	10,736	14,136	6,936	6,144	3,755	4,600	74,474	225,722
	(17.90)		(17.90)	(9.20)	(6.50)	(2.10)	(1.90)	(1.70)	(1.20)	(26.90)	(6.20)	(4.80)	(6.30)	(3.10)	(2.70)	(1.70)	(2.10)	(33.00)	(100.00)
Canada	41,068	41,068		3,751	969	285	254	171	169	8,505	1,005	1,043	3,286	1,016	432	742	672	11,531	67,736
	(60.60)	(60.60)		(5.50)	(1.40)	(0.50)	(0.40)	(0.30)	(0.30)	(12.70)	(2.70)	(1.50)	(4.90)	(1.50)	(0.60)	(1.10)	(1.00)	(17.00)	(100.00)
Japan	33,386	31,367	2,437		19,187	5,360	5,140	3,912	4,761	18,574	5,730	2,771	3,983	1,382	9,119	5,878	4,865	10,980	129,887
	(26.00)	(24.20)	(1.90)		(14.80)	(4.10)	(4.00)	(3.00)	(3.70)	(14.30)	(4.40)	(2.10)	(3.10)	(1.00)	(7.00)	(3.90)	(3.70)	(30.00)	(100.00)
Asian NIEs	28,320	18,965	1,355	7,601	7,400	783	2,160	1,675	3,870	13,626	4,661	1,693	4,330	1,057	8,182	1,936	2,502	14,972	76,347
	(36.60)	(24.80)	(1.80)	(10.10)	(9.80)	(1.00)	(2.80)	(2.20)	(5.10)	(17.80)	(5.80)	(2.20)	(5.70)	(1.40)	(10.70)	(2.50)	(3.30)	(19.30)	(100.00)
South Korea	4,969	4,624	345	3,839	1,386		216	267	823	2,810	1,087	379	969	278	860	—	250	4,169	17,439
	(28.50)	(26.50)	(2.00)	(17.60)	(7.90)		(1.20)	(1.50)	(4.70)	(16.10)	(5.80)	(2.20)	(5.50)	(1.60)	(5.00)	(—)	(1.50)	(24.00)	(100.00)
Taiwan	7,220	6,769	460	2,173	2,363	267		505	1,551	3,883	1,193	600	944	347	1,919	—	573	3,570	19,811
	(36.40)	(34.10)	(2.30)	(11.00)	(11.90)	(1.30)		(2.50)	(7.80)	(15.60)	(6.00)	(2.80)	(2.70)	(1.80)	(5.10)	(—)	(2.90)	(17.10)	(100.00)
Singapore	2,980	2,424	156	1,360	2,113	259	328		1,486	2,683	980	330	1,247	144	4,961	307	1,131	4,122	19,377
	(13.30)	(12.50)	(0.80)	(0.10)	(10.90)	(1.30)	(1.70)		(7.70)	(13.80)	(2.80)	(1.70)	(6.40)	(0.70)	(25.60)	(1.60)	(5.80)	(21.30)	(100.00)
Hong Kong	5,551	5,157	394	909	1,706	227	616	863		5,130	1,711	384	1,978	388	1,356	1,249	530	3,303	19,720
	(28.10)	(26.30)	(2.00)	(4.60)	(8.70)	(1.20)	(3.10)	(4.40)		(26.00)	(8.70)	(1.90)	(10.00)	(1.50)	(6.80)	(6.30)	(2.70)	(16.70)	(100.00)
EEC	61,991	57,255	4,736	6,385	7,911	1,358	1,218	2,381	2,972	351,374	88,016	62,434	68,725	44,142	5,695	2,412	5,253	144,525	664,856
	(6.30)	(15.60)	(0.70)	(1.00)	(1.20)	(0.20)	(0.20)	(0.40)	(0.40)	(52.80)	(13.20)	(9.40)	(7.30)	(6.60)	(0.80)	(0.40)	(0.80)	(36.00)	(100.00)
W. Germany	12,972	11,779	1,196	2,184	2,383	529	566	786	952	88,620		22,819	13,261	16,554	1,693	1,145	1,311	31,407	191,688
	(6.70)	(6.10)	(0.60)	(1.10)	(1.20)	(0.30)	(0.30)	(0.40)	(0.50)	(44.60)		(11.60)	(6.90)	(8.60)	(0.90)	(0.60)	(0.70)	(42.50)	(100.00)
France	5,661	4,921	680	1,000	833	153	108	116	276	60,631	20,142		9,071	13,843	619	304	360	41,885	111,311
	(5.00)	(4.40)	(0.60)	(1.10)	(0.70)	(0.10)	(0.10)	(0.30)	(0.30)	(54.50)	(18.10)		(8.10)	(12.40)	(0.60)	(0.30)	(0.30)	(37.60)	(100.00)
U.K.	12,664	10,980	1,764	1,300	2,514	235	215	763	1,301	66,709	12,527	7,285		4,418	1,214	395	2,687	69,723	115,176
	(11.00)	(9.50)	(1.50)	(1.10)	(2.20)	(0.20)	(0.20)	(0.70)	(1.10)	(58.00)	(10.90)	(6.30)		(3.80)	(1.10)	(0.30)	(2.30)	(43.20)	(100.00)
Italy	4,624	4,138	486	707	788	102	124	205	260	39,677	14,938	12,666	5,376		642	257	514	30,981	77,982
	(5.90)	(5.30)	(0.60)	(0.90)	(0.90)	(10.10)	(0.20)	(0.30)	(0.30)	(50.90)	(19.20)	(16.30)	(6.90)		(0.60)	(0.30)	(0.70)	(39.80)	(100.00)
ASEAN	9,018	8,839	179	16,273	8,371	868	965	5,980	978	7,013	2,192	1,236	919	685	1,513	366	855	1,828	67,157
	(19.10)	(18.70)	(0.40)	(34.50)	(17.70)	(1.70)	(2.00)	(12.70)	(1.90)	(14.90)	(4.60)	(2.60)	(1.90)	(1.70)	(3.20)	(0.80)	(1.80)	(8.10)	(100.00)
China	1,120	983	137	4,932	4,774	—	—	421	4,353	2,634	894	668	356	438	775		254	4,556	18,139
	(6.10)	(5.40)	(0.80)	(22.30)	(26.30)	(—)	(—)	(2.30)	(24.00)	(14.50)	(4.40)	(2.60)	(2.00)	(2.40)	(4.30)		(1.40)	(25.10)	(100.00)
Oceania	3,879	3,291	588	6,551	1,980	543	487	621	609	6,418	858	752	2,197	699	1,683	957	1,755	6,415	27,438
	(14.10)	(12.00)	(2.10)	(23.90)	(7.20)	(2.00)	(1.80)	(2.30)	(1.90)	(16.10)	(3.10)	(2.70)	(7.70)	(2.50)	(5.40)	(3.50)	(6.40)	(23.40)	(100.00)
Other	126,457	115,216	11,241	75,065	22,911	9,201	6,346	6,223	2,261	263,194	67,932	53,931	42,302	43,307	6,513	6,619	5,763	133,782	638,304
	(19.80)	(18.10)	(1.80)	(11.80)	(3.60)	(1.40)	(1.00)	(1.00)	(0.40)	(41.20)	(10.60)	(8.40)	(6.60)	(6.80)	(1.00)	(0.70)	(0.90)	(21.00)	(100.00)
Total	117,988	256,984	61,004	168,520	88,312	22,863	19,733	24,817	22,399	738,217	185,854	34,852	128,152	90,702	39,166	19,565	25,807	534,877	1,895,500
	(16.80)	(13.60)	(3.20)	(7.40)	(4.70)	(1.20)	(1.00)	(1.30)	(1.20)	(38.90)	(9.80)	(7.10)	(6.30)	(5.30)	(2.10)	(1.00)	(1.40)	(28.20)	(100.00)

Note: Parentheses indicate the component ratios to the exporter's total.
Source: Direction of Trade Statistics, IMF and various countries' statistics.

Table 3 International Trade Flow Matrix 1988
(Unit: $ million, %)

	Importer																		
	North America	United States	Canada	Japan	Asian NIEs	South Korea	Taiwan	Singapore	Hong Kong	EEC	West Germany	France	U.K.	Italy	ASEAN	China	Oceania	Other	Total
North America	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
United States	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Canada	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Japan	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Asian NIEs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
South Korea	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Taiwan	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Singapore	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hong Kong	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
EEC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
W. Germany	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
France	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
U.K.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Italy	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ASEAN	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
China	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
Oceania	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Note/Source: same as 1980

Table 4 The Trade Balance Matrix 1988
(Unit: $ millions)

	Trading Partners													
	North America	United States	Canada	Japan	Asian NIEs	South Korea	Taiwan	Singapore	Hong Kong	EEC	West Germany	France	U.K.	Italy
North America		11,128	(11,128)	(51,314)	(37,151)	(10,941)	(12,059)	(3,720)	(10,431)	(6,864)	10,128	1,080	492	(4,152)
United States	(11,128)		(11,128)	(51,902)	(35,087)	(10,188)	(11,300)	(3,600)	(9,999)	(5,136)	(9,432)	1,812	492	(3,684)
Canada	11,128	11,128		588	(2,064)	(753)	(759)	(120)	(432)	(1,728)	(696)	(732)	0	(468)
Japan	51,314	51,902	(588)		21,955	3,437	5,592	4,916	8,010	30,132	8,688	4,620	8,484	1,068
Asian NIEs	37,151	35,087	2,064	(21,955)		(2,512)	(3,859)	481	5,890	9,276	2,364	1,174	3,888	(240)
South Korea	10,941	10,188	753	(3,437)	2,512		37	584	1,891	3,648	720	516	1,212	276
Taiwan	12,059	11,300	759	(5,592)	3,859	(37)		569	3,327	4,584	1,044	900	1,416	360
Singapore	3,720	3,600	120	(4,916)	(481)	(584)	(569)		672	(828)	(384)	(12)	(84)	(168)
Hong Kong	10,431	9,999	432	(8,010)	(5,890)	(1,891)	(3,327)	(672)		1,872	984	(228)	1,344	(708)
EEC	6,864	5,136	1,728	(30,132)	9,276	(3,648)	(4,584)	828			38,148	4,236	32,568	7,848
W. Germany	10,128	9,432	696	(8,688)	(2,364)	(720)	(1,044)	384	(984)	38,148		4,656	14,076	7,356
France	(1,080)	(1,812)	732	(4,620)	(1,174)	(516)	(900)	12	228	(4,236)	(4,656)		3,792	60
U.K.	(492)	(492)	0	(8,484)	3,888	1,212	(1,416)	84	(1,344)	(32,568)	(14,076)	(3,792)		(3,264)
Italy	4,152	3,684	468	(1,068)	240	(276)	(360)	168	708	(7,848)	(7,356)	(60)	3,264	
ASEAN	5,407	5,474	(72)	2,610	(1,681)	588	(844)	(1,709)	284	3,684	348	768	708	444
China	(3,348)	(1,640)	1,708	(1,430)	1,526	—	—	317	1,289	912	(324)	516	60	120
Oceania	(3,282)	(3,208)	(74)	2,724	914	743	(292)	(53)	516	(1,164)	(888)	396	(864)	60
Other	36,953	34,517	2,436	21,934	8,314	2,588	5,117	3,487	(4,750)	(13,788)	(34,728)	2,342	(984)	4,788

Note/Source: same as 1980

Table 5 International Trade Matrix 1980

Unit: $Mil, %

	1980 Trade Data	Importer							
		U.S.	Japan	Asian NIE	S. Korea	Taiwan	Hong Kong	Singapore	Total
	U.S	***	20,790	14,741	4,685	4,337	2,686	3,033	225,722
			9.21%	6.53%	2.08%	1.92%	1.19%	1.34%	100.00%
	Japan	31,367	***	19,187	5,368	5,146	4,761	3,912	129,807
E		24.16%		14.78%	4.14%	3.96%	3.67%	3.01%	100.00%
x	Asian NIE	18,965	7,681	7,488	783	1,160	3,870	1,675	76,347
o		24.84%	10.06%	9.81%	1.03%	1.52%	5.07%	2.19%	100.00%
r	S. Korea	4,624	3,093	1,308	***	216	823	267	17,439
t		26.52%	17.74%	7.50%		1.24%	4.72%	1.53%	100.00%
e	Taiwan	6,760	2,173	2,363	267	***	1,551	545	19,811
r		34.12%	10.97%	11.93%	1.35%		7.83%	2.75%	100.00%
	Hong Kong	5,157	909	1,706	227	616	***	863	19,720
		26.15%	4.61%	8.65%	1.15%	3.12%		4.38%	100.00%
	Singapore	2,424	1,560	2,113	289	328	1,496	***	19,377
		12.51%	8.05%	10.90%	1.49%	1.69%	7.72%		100.00%
	Total	256,984	140,528	88,212	22,063	19,733	22,399	24,017	1,895,500
		13.56%	7.41%	4.65%	1.16%	1.04%	1.18%	1.27%	100.00%

Source: Director of Trade Statistics, IMF and Taiwan Statistical Data Book

Table 6 International Trade Matrix 1990

Unit: $Mil, %

	1990 Trade Data	Importer							
		U.S.	Japan	Asian NIE	S. Korea	Taiwan	Hong Kong	Singapore	Total
	U.S.	***	48,585	40,819	14,399	11,560	6,841	8,019	393,592
			12.34%	10.37%	3.66%	2.94%	1.74%	2.04%	100.00%
	Japan	91,121	***	56,805	17,499	15,461	13,106	10,739	287,581
		31.69%		19.75%	6.08%	5.38%	4.56%	3.73%	100.00%
E	Asian	74,131	30,428	32,146	4,476	6,659	14,272	6,739	266,947
x	NIE	23.90%	11.40%	12.04%	1.68%	2.49%	5.35%	2.52%	100.00%
p	S. Korea	19,182	12,626	6,218	***	1,297	3,387	1,534	64,956
o		29.53%	19.44%	9.57%		2.00%	5.21%	2.36%	100.00%
r	Taiwan	23,917	8,506	11,442	1,396	***	7,456	2,590	67,079
t		35.65%	12.68%	17.06%	2.08%		11.12%	3.86%	100.00%
e	Hong Kong	19,817	4,680	7,984	1,907	3,462	***	2,615	82,160
r		24.12%	5.70%	9.72%	2.32%	4.21%		3.18%	100.00%
	Singapore	11,215	4,616	6,502	1,173	1,900	3,429	***	52,752
		21.26%	8.75%	12.33%	2.22%	3.60%	6.50%		100.00%
	Total	516,987	235,368	267,843	69,640	54,830	82,474	60,899	3,455,000
		14.96%	6.81%	7.75%	2.02%	1.59%	2.39%	1.76%	100.00%

Source: Director of Trade Statistics, IMF and Taiwan Statistical Data Book

Table 7 International Trade Balance Matrix 1990

	1990 Trade Data	Importer							
		U.S.	Japan	Asian NIE	S. Korea	Taiwan	Hong Kong	Singapore	Total
E	U.S.	***	-42,536	-33,312	-4,783	-12,357	-12,976	-3,196	-123,395
x	Japan	42,536	***	26,377	4,873	6,955	8,426	6,123	52,217
p	Asian								
o	NIEs	33,312	-26,377	0	-1,742	-4,783	6,288	237	-896
r	S. Korea	4,783	-4,873	1,742	***	-99	1,480	361	4,684
t	Taiwan	12,357	-6,955	4,783	99	***	3,994	690	12,249
e	Hong Kong	12,976	-8,426	-6,288	-1,480	-3,994	***	-814	-314
r	Singapore	3,196	-6,123	-237	-361	-690	814	***	-8,147

Source: Director of Trade Statistics, IMF and Taiwan Statistical book

APPENDIX B

Kojima's Four Grouping Classifications

Natural Products Group	
SITC	Title
271	Fertilizers, crude
273	Stone, sand and gravel
274	Sulfur, iron pyrites unroasted
275	Natural abrasives
276	Other crude minerals
281	Iron ore and concentrates
282	Iron and steel scrap
283	Ores, concentrates of non-ferrous metals
284	Non-ferrous metal scrap
285	Silver and platinum ores
286	Uranium, thorium ores and concentrates
321	Coal, coke and briquettes
331	Petroleum crude, partly refined
332	Petroleum products
341	Gas, natural and manufactured
351	Electric energy

Agricultural Products Group	
SITC	Title
001	Live animals
011	Meat, fresh, chilled or frozen
012	Meat, dried, salted or smoked
013	Meat in airtight container N.E.S.
022	Milk and cream
023	Butter
024	Cheese and curd
025	Eggs
031	Fish fresh, simply preserved
032	Fish etc. in airtight container
041	Wheat and meslin, unmilled
042	Rice
043	Barley, unmilled

044	Maize (corn), unmilled
045	Cereals N.E.S., unmilled
046	Meal and flour of wheat etc.
047	Meal and flour of non-wheat
048	Cereal etc. preparations
051	Fresh fruit and nut fresh, dried
052	Dried fruit
053	Fruit preserved and fruit preparations
054	Vegetables fresh, frozen or preserved
055	Vegetable roots and tubers preserved prepared
061	Sugar and honey
062	Sugar preparations excluding chocolate
071	Coffee
072	Cocoa
073	Chocolate and products, N.E.S.
074	Tea and mate
075	Spices
081	Feeding-stuff for animals
091	Margarine and shortening
099	Food preparations, N.E.S.
111	Non-alcoholic beverages, N.E.S.
112	Alcoholic beverages
121	Tobacco, unmanufactured
122	Tobacco manufactures
211	Hides and skins undressed
212	Fur skins, undressed
221	Oil seeds, nuts and kernels
231	Crude rubber, including synthetic
241	Fuel wood and charcoal
242	Wood in rough or roughly squared
243	Wood shaped or simply worked
244	Cork, raw and waste
261	Silk
262	Wool and other animal hair
263	Cotton
264	Jute
265	Other vegetable fibers
291	Crude animal materials, N.E.S.
292	Crude vegetable materials, N.E.S.
411	Animal oils and fats
421	Fixed vegetable oils, soft
422	Other fixed vegetable oils
431	Processed animal vegetable oil, fat, wax
941	Zoo animals, pets

Labor-intensive Products Group	
SITC	Title
267	Waste of textile fabrics
541	Pharmaceutical products
611	Leather
612	Manufactures of leather
613	Fur skins, tanned or dressed
621	Materials of rubber
629	Rubber articles, N.E.S.
631	Veneers, plywood boards, etc.
632	Wood manufactures, N.E.S.
633	Cork manufactures
641	Paper and paperboard
642	Articles of paper, paperboard
651	Textile yarn and thread
652	Cotton fabrics, woven
653	Textile fabrics, woven
654	Lace, ribbons, tulle, etc.
655	Special textile fabrics
656	Made-up articles of textile
657	Floor coverings, tapestries
665	Glassware
666	Pottery
667	Pearls and precious stones
691	Structures, parts of iron, steel
692	Metal containers for storage etc.
693	Wire products excluding electric
694	Iron, steel, copper nails, etc.
695	Hand tools and tools for machines
696	Cutlery
697	Household equipment of base metal
698	Manufactures of metal, N.E.S.
733	Road vehicles excluding motor vehicles
812	Sanitary, heating, lighting equipment
821	Furniture
831	Travel goods, handbags, etc.
841	Clothing
842	Fur etc. clothing and products
851	Footwear
861	Scientific, optical etc. instruments
862	Photographic, cinema supplies
863	Developed cinema film
864	Watches and clocks
891	Musical instruments, sound recorders etc.
892	Printed matter

893	Articles of plastic material, N.E.S.
894	Perambulators, toy, sport goods
895	Office, stationery supplies
896	Works of art, antiques etc.
897	Jewelry, gold, silver wares
899	Manufactured articles, N.E.S.

Capital-intensive Products Group	
SITC	Title
251	Pulp and waste paper
266	Synthetic and regenerated fibers
512	Organic chemicals
513	Inorganic chemicals
514	Other inorganic chemicals
515	Radioactive materials
521	Chemicals from tar, petroleum, etc.
531	Synthetic dye, natural indigo, lakes
532	Dyeing, tanning extracts, etc.
533	Pigments, paints, varnish, etc.
551	Essential oils, perfume, etc.
553	Perfumes, cosmetics, etc.
554	Soaps, polishing preparations
561	Fertilizers manufactured
571	Explosives, pyrotech products
581	Plastic materials, etc.
599	Chemical materials, N.E.S.
661	Lime, cement for building
662	Clay construction materials
663	Mineral manufactures, N.E.S.
664	Glass
671	Pig iron, spiegleisen, etc.
672	Iron, steel ingots etc.
673	Iron, steel bar, rod, section
674	Iron, steel plate, sheet, etc.
675	Iron, steel hoop and strip
676	Railway rails of iron, steel
677	Iron, steel wire excluding wire rod
678	Tubes, pipes etc.. of iron, steel
679	Iron, steel castings etc. unworked
681	Silver, platinum, etc.
682	Copper
683	Nickel
684	Aluminum
685	Lead
686	Zinc

687	Tin
688	Uranium, thorium and alloys
689	Miscellaneous non-ferrous base metals
711	Power generating machinery non-electric
712	Agricultural machinery, etc.
714	Office machines
715	Metalworking machinery
717	Textile, leather machinery
718	Machines for special industries
719	Machinery, machine parts, N.E.S.
722	Electricity power machinery, switchgear
723	Electricity distributing equipment
724	Telecommunications apparatus
725	Domestic electrical equipment
726	Electric medical apparatus
729	Other electric machinery, apparatus
731	Railway vehicles
732	Road motor vehicles
734	Aircraft
735	Ships and boats

APPENDIX C

Sample Table of SITC Code Converter R2 => R1

The following conversion examples are from Japan AIDXT table.

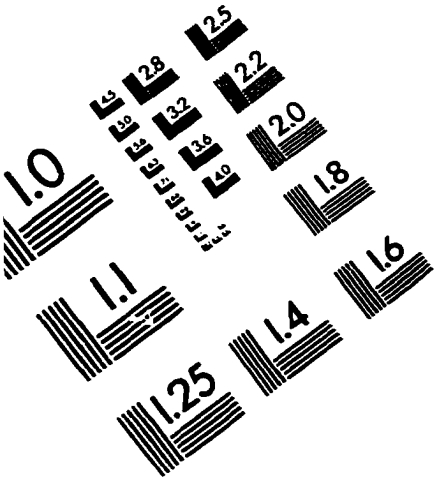
266 266 + 267

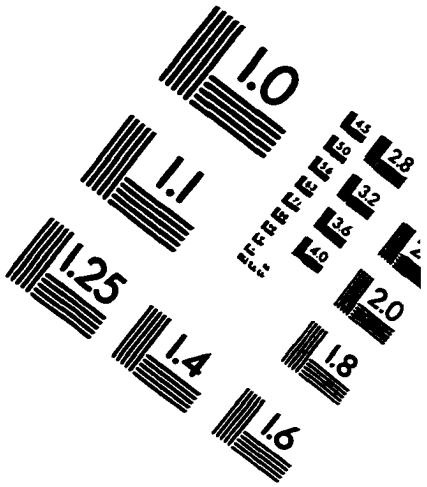
332 334 + 3351 + 3353 + 3354

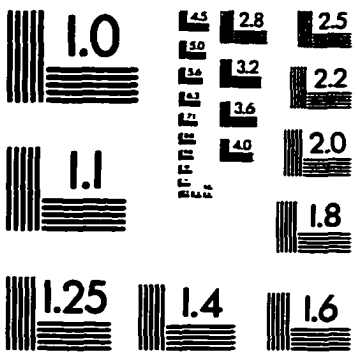
571 572 + 89463

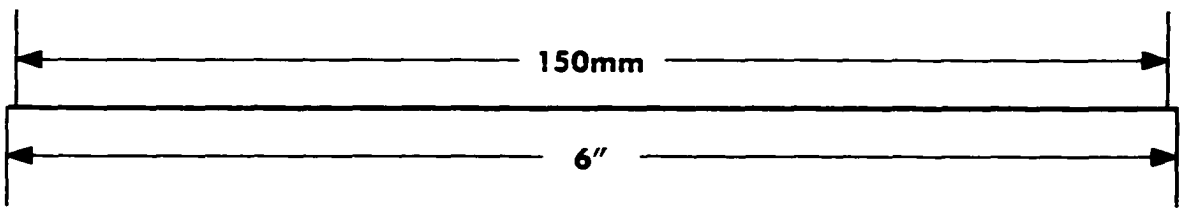
653 653 + 653 + 654 + 6551 + 6552

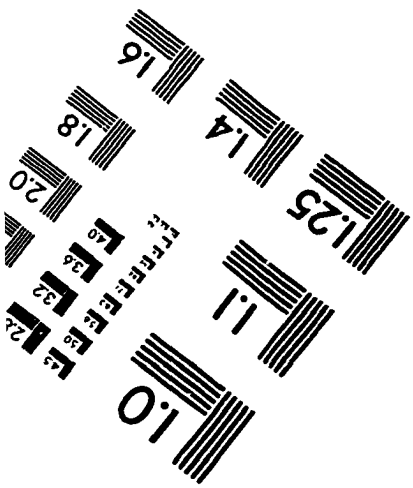
IMAGE EVALUATION TEST TARGET (QA-3)

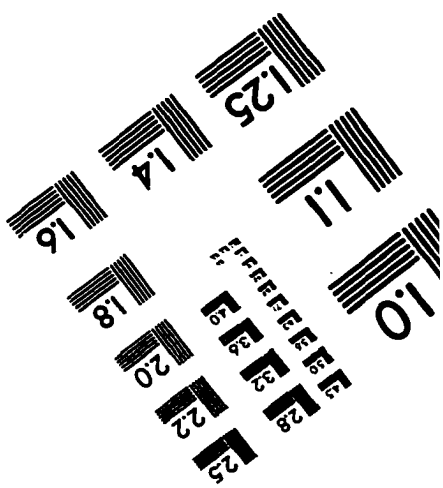












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