Determinants of China's Intra-Industry Trade in Manufactures (1984-1994): A Tobit cum Fixed Effect Panel Data Model Application[1]

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1 Introduction

Intra-industry trade (IIT), the simultaneous export and import of goods from the same industry category, has been found to be a significant phenomenon in the trade between developed market economies (Balassa, 1966; Grubel and Lloyd, 1975; Aquino, 1979), centrally planned economies (Pelzman, 1975; Drabek and Greenaway, 1984), and less developed countries (Willmore, 1972; Balassa, 1979; Laird, 1981; Havryly and Civan, 1985). New theoretical approaches to the analysis of IIT were developed in the late 1970s (Krugman, 1979, 1981; Lancaster, 1980; Helpman, 1981). The determinants of IIT for the developed market economies have been extensively analysed (Havrylyshyn and Civan, 1983; Tharakan, 1984; Loertscher and Wolter, 1980; Balassa, 1986a;). However, until now less attention has been devoted to the empirical study of the determinants of IIT for developing economies, especially when they are experiencing a transition period.

Most "traditional" international trade theories view international exchange as arising from differences in comparative advantages, which essentially reflect the variations in the level of economic development. The standard factor proportion theory of Heckscher-Ohlin predicts that a country with large amounts of capital relative to labour will tend to export relatively capital intensive goods and import relatively labour intensive goods. Since countries endowed with relatively large amounts of capital, which may be understood to include human as well as physical capital, tend to be relatively rich, and

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countries with relatively large amounts of labour tend to be poor, the factor proportions theorem is essentially an account of trade between countries at different levels of development. The implication is that international trade is likely to be more intense between countries that differ in income per head. Thus, this theoretical tradition neglects the fact that a large volume of trade in manufactures takes place between countries at similar levels of industrialisation and income per head.

The actual development of international trade in manufactured goods since the World War II has been quite different from earlier expectations. Large amounts of international trade took place between countries in the developed world and most of it took the form of IIT in manufactured products.

In the face of high unemployment and rapid development of labour-saving technologies, some industrial countries have been concerned about the effect of international trade on the domestic economy (United Nations, 1988). Consequently, protective measures have been adopted, which attempt to counter-act the structural adjustments required by the changing comparative advantage. This creates barriers between the developed and developing worlds, which may lead to increased trade between developed economies alone.

For example, the demand for agricultural products and metals has been sluggish or declining, while supply has continued to rise. This calls for structural adjustments, primarily in countries that do not possess comparative advantage in the production of these goods. However, fearing that such changes would exacerbate the unemployment problem and offend vested interests, the industrial nations have tended to opt for support programmes and protectionist policies. These interventions not only affect the developing countries, but are also a source of friction among industrial nations. To defend domestic infant industries, many developing countries have followed suit and set up trade barriers or organised themselves in trading blocs.

Others argue that the diffusion of manufacturing technology to less developed countries would lead to the decline of international trade in manufactures. According to this view

the exchange of manufactures for primary products would increasingly take place within rather than between nations (Rayment, 1983).

However, evidence shows that the spread of industrialisation has not diminished international trade in manufactures: the underlying relationship between the growth of world output and trade has proved to be positive, not negative. The rapid development in Japan and newly industrialised countries has contributed to the expansion of trade in manufactures. The proportion of manufactures in world trade has risen from 45 per cent in 1955 to more than 60 per cent in 1985, and world trade in manufactures has continued to be dominated by the developed market economies.

The ever-growing international exchange of products in manufactures between developed countries has received more and more attention from economists. In the early 1960s, trying to explain the trade among the industrial market economies in manufactured goods, Linder (1961) argued that for a good to be exported it must first be consumed in the exporting country. The country will export products with the most advantageous cost functions, which will tend to be those catering to “representative demand” (roughly, equivalent to majority tastes in the exporting country). The demand pattern, in turn, is determined by the country’s level of income; for consumer goods it depends on the tastes of the “majority”; for capital goods it depends on the existing capital stock, hence, on the income level as well. Trade between two countries will take place when they are at relatively similar levels of development: their demand patterns are such that a product which meets the “majority” demand in one country is able to meet the “minority” taste in another. Through the exchanges between them, the overlapping demands provide an expanded market to the producers by almost unlimited scope for product differentiation, which could in combination with seemingly unrestricted buyer idiosyncrasies, make possible flourishing trade in what is virtually homogenous products.

In IIT, commodities may be classified into vertically and horizontally differentiated products by the end of use. An essential and innovative element in the vertical IIT models (Flam and Helpman 1987; Falvey and Kierzkowski 1987) is the postulation of vertical product differentiation by quality as the crucial determinant in the North-South

IIT. The essential elements of these models are that capital intensity or human capital intensity creates quality differences in the varieties being produced within an industry. Given the scope for vertical product differentiation, the high-income countries with high endowment of capital or human capital will tend to produce high 'quality' products and the low income countries will tend to produce low quality products. But income distribution patterns in the North and the South could lead to a situation in which low income groups in the former will generate demand for low quality varieties and high income groups in the latter for high quality varieties, which in turn will lead to intra-industry trade between the two types of countries. An interesting feature of such models is that they do not rely on economies of scale and imperfect competition to explain IIT.

In contrast, the models of horizontal IIT explicitly introduce economies of scale and imperfect competition in the analysis. Most of the basic ingredients of horizontal IIT can be found in so-called 'neo-Chamberlinian' and 'neo-Hotelling' models (Krugman 1979, 1980; Lancaster1980; Helpman 1981). In the former, the consumers endeavour to consume as many different varieties as possible and more than one firm will produce the same variety. In the latter, different consumers have different preferences for alternative varieties of given commodities. The varieties are distinguished in terms of their actual or perceived characteristics, i.e. they are horizontally differentiated. The producer of each variety is subject to decreasing costs. Essentially it is the interaction, between economies of scale and horizontal product differentiation that leads to IIT.

In surveying the empirical work on testing the hypotheses concerning IIT, Greenavway and Milner (1989) suggest that the hypotheses may usefully be grouped under three headings: country-specific, industry-specific and policy-specific. In this paper, we concentrate on the country specific variation. That is, we aim at identifying the characteristics of the trade partners that influence China's IIT. Based on this analysis, we hope to link the pattern of IIT of different industries to different types of economies. Thereupon, we could identify which factor is more important in the IIT, for different types of economies in the long run.[2]

[2] To investigate the economic development effect on IIT, the selected countries are classified into four type of economies: Developed Market Economies (DMEs), Newly Industrialised Economies (NICs), Newly Export Economies (NECs) and Least Developed Economies. The detail about the classification see the following Section 2.

The motive of this analysis lies in the following facts: In 1979, to quadruple national income and to achieve modernisation, China initiated its economic reform. Since then, China's economy has been experiencing a transition process, moving from a centrally planned economy to a market-oriented one. The Open-Door policy, as an important component of the reform program, has brought about a rapid export expansion. In turn, export expansion, as an engine of economic development, has integrated China into the world economy. During almost two decades of economic reform, the national economy has been mirrored by a fast economic growth and improving 'per capita income. As a consequence, the market has moved out of the stage where most consumption was in short supply to a situation where consumers' decisions became more and more important. No doubt, this integration process will give consumers more scope for choice of differentiated goods, which, in turn, improves the national welfare. In the meantime, the integration process also provides wider markets for both domestic and foreign producers, which give them the opportunities to realise the economies of scale and scope. We, therefore, believe that the integration process will generate more intensive IIT, at least in trade of manufacturing products.

The rest of the paper is divided into five parts. Section 2 discusses the methodology for measuring IIT; Section 3 presents our hypotheses on the determinants of IIT. Section 4 describes the data and models, which will be used in the regressions analysis; Section 5 provides GL indices (Grubel and Lloyd indices) distributions which shows China's IIT development with the selected countries between 1984 and 1994; Section 6 presents the results of our regressions; and Section 7 provides some conclusions.

2 Extent of IIT and Methodology

An industry is usually classified according to one of two criteria. The first states that two different products are the outputs of a single industry, if the two production processes could be easily substituted, or that they have the same capital intensity. The second one defines the industry by product substitutability in consumption.

To some degree IIT is primarily a problem of statistical aggregation, arising from the necessity of placing a large variety of goods into a manageable number of statistical categories. Thus, in general, the more detailed the product classification, the smaller is the amount of measured IIT. However, it has been shown that the phenomenon persists even when very fine product classifications are used and that, for a given classification, IIT has tended to increase over time (Grubel and Lloyd, 1975; Rayment, 1983; and Greenaway and Milner, 1986). There is now widespread agreement among trade analysts that IIT is a reflection of real economic processes and is not a mere statistical curiosity. The most commonly used classification of 'categories' is the Standard International Trade Classification (SITC) system. Under this system, the products are grouped by the numerical code according to their substitutability in both production and consumption.

Currently, the most widely used measure of IIT is the one suggested by Grubel and Lloyd (1975). Their index of IIT measures the extent, in relation to total trade, to which exports of a given product (or products category) are matched or offset by imports of the same product. Put another way, it measures the degree to which trade is balanced within the individual product groups. The value of the index, ranges between zero, i.e. no IIT, and unity, if trade is completely IIT. The index will approach to unity as the extent of IIT increases.

The basic Grubel-Lloyd index for a given commodity may be written as

$$GL_j = \frac{\left(X_j + M_j\right) - \left|X_j - M_j\right|}{\left(X_j + M_j\right)} \qquad (2\text{-}1)$$

where X_j stands for the export value of certain commodity by country j, and M_j is the value of the 'matching' imports in the identical category for the same country. This index may be rewritten in another form

$$GL_j = 1 - \frac{\left|X_j - M_j\right|}{\left(X_j + M_j\right)} \qquad (2\text{-}2)$$

This transformed index links the method created by Grubel-Lloyd to their successor (Balassa, 1966) by emphasising the extent of overlapped trade in the index.[3] The higher the intensity of IIT, the larger the extent of overlapping trade and the higher the index will be. However, there is no causal relationship between the index intensity and trade development in that industry.

In measuring the extent of China's IIT, the GL index is modified to match the statistics of exports and imports reported by China with its trade partners in each industry.

$$GL_j^i = 1 - \frac{\left| X_j^i - M_j^i \right|}{\left(X_j^i + M_j^i \right)} \qquad (2\text{-}3)$$

where the super and subscripts i and j stand for industry i and the China's trade partner j, respectively. For instance, X_j^i stand for the export value of industry i that China exported to country j; and similarly M_j^i indicates the import value of commodity i that China imported from country j, respectively. The index GL_j^i shows the intensity of IIT between China and its trade partner j in industry i over a given time period.

3 Hypotheses

As noted above, factor proportions theory suggests that trade volumes between two countries are high if the differences between their national endowments of production factors are significant. In contrast to this notion, Linder (1961) observed an inverse relationship; subsequent research, notably by Linnemann (l966) and Balassa (1966), corroborated this finding. Various efforts have been made to provide a rationale for trade in the absence of differences in endowments. In the literature on IIT, the variation of intensity of IIT in certain industry is frequently explained by the characteristics of the trading partners. The hypotheses, in this paper, will investigate their effects on the intensity of IIT, through a country-specific model.

[3] They changed the Balassa index and made it more intuitively. For more detail, see Chapter Three, footnote 2.

The hypotheses of this study are as follows:

(a) IIT between China and its trade partners is likely to be intensive, when their average per capita income is high. On the supply side, a country with high per capita income has a high capital-labour ratio and, hence the capability to innovate and produce differentiated products. Based on this assumption, Dixit and Norman (1980), Helpman (1981) and Helpman and Krugman (1985) predicted that IIT would be positively correlated with capital endowments and, hence, per capita incomes. On the demand side, high per capita incomes are associated with more differentiated demand, which allows for a country to exploit the economies of scale in the production of a wide variety of individual commodities. In the present study, the average per capita income of China and the selected trade partner j in the corresponding year t is denoted as $AGDP_{jt}$, and is measured in terms of US dollars at constant 1990 prices.

(b) IIT between China and its trade partners is likely to be intensive, when the difference in per capita income between them is relatively small. In models with horizontally differentiated products, Dixit and Norman (1980), Helpman (1981) and Krugman (1981) showed that the similarity of capital-labour ratios between two trade partners is positively correlated with their intensity of IIT. Per capita incomes are taken to reflect the relative factor endowments. Similar factor proportions would lead to similar production structures, which provides the possibility for production of horizontally differentiated products. On the demand side, Linder (1961) showed that demand structures depend on per capita income. And thus, the more similar the incomes, the more similar the demand structures and the larger the demand for varieties produced in the other country. In this paper, the absolute value of the difference in per capita income between China and trade partners j in the year t is denoted as $DAGDP_{jt}$, and is measured in terms of US dollars at constant 1990 prices.

(c) IIT between China and its trade partners is likely to be intensive, when their average market sizes is large. In large markets, more differentiated goods can be produced

under conditions of economies of scale. At the same time, the expanded demand for foreign differentiate goods provides the potential market for IIT. The supply-induced effect is especially important if one follows Larson (1978) who maintains that economies of scale are available to any product that is produced in large volume. In this paper, the averaged market size of China and the selected trade partners j in the corresponding year t, which is proxied by their averaged GDP levels in the corresponding year t, is denoted as $SIZE_{jt}$ **.** The averaged market size is measured in US dollars at constant 1990 prices.

(d) IIT between China and its trade partners is likely to be intensive, when the difference in their market sizes is small. Dixit and Norman (1980) and Helpman (1981) argues that the smaller the difference in market size between trade partners, the more similar their abilities to produce differentiated goods, and hence the more IIT there is likely to be. Obviously, if the markets of both countries are large, there is more scope for IIT than in cases where the markets are of very different in size. Furthermore, use of this variable could reduce the bias from just using average market size, such that, one country may have a rather small market size and the other a very large market size, so that their average market size is rather large (Loertscher and Wolter, 1980). Therefore, this determinant corrects for the influence of determinant (c), in the same way (b) corrects for (a). In the current study, the absolute value of difference in market size between China and the selected trade partners j in the corresponding year t is denoted as $SIZED_{jt}$, and is measured in US dollars at constant 1990 prices.

(e) IIT between China and the selected trade partners is intensive if they are close geographically. The negative distance impacts on the share of IIT is discussed in Balassa (1986c), who assumes that consumption of differentiated goods requires more information than consumption of homogeneous goods. In addition, Loertscher and Wolter (1980) point out that there is a correlation between geographical proximity and preference similarities for countries. In the imperfect competition world, the cost due to distance is an important factor in the decisions of producers when choosing markets. In the current study, the geographical distance between China and its selected trade partners j is denoted as DIS_j , in terms of kilometres.

(f) Foreign investment and international trade generally are mutually supportive, and both play a central role in the ongoing integration of the world economy. Through investment and trade, firms in each country will not only be able to specialise in producing what they can produce most efficiently, but also be able to intensify the extent of IIT in multinational activities. Foreign investment facilitates this process by increasing the international mobility of - and thus the efficient use of - the world's supplies of capital and technology, including organisational, managerial and marketing skills (Hoekman and Djankov, 1996). Therefore, we hypothesise that the intensity of China's IIT is positively correlated with investment level from the selected trade partners. And in the study, the investment level from the selected trade partner j in the corresponding year t is denoted as FI_{jt}, and is measured in terms of US dollars at current price.

(g) Finally, various aspects of commercial policy and a natural trade barrier are expected to influence IIT. Theoretically, Falvey (1981) claimed that the share of IIT is negatively correlated with the level of trade restrictions. The restrictive tariff measures will shift the demand toward domestic supplies due to an increase in the domestic price of foreign varieties. Trade in differentiated products will decline as a result of more expensive foreign goods. Here, we assume that the tariff rates are closely associated with the differentiation between domestic products and imported ones. Therefore, we hypothesise that the intensity of China's IIT is negatively correlated with the average tariff rates between China's and the selected trade partners. And in the study, the average tariff rate in sector i between China and the trade partner j in the corresponding year t is denoted as TRF_{ijt}.

4 Data and Model

The data on exports and imports used in this study, covering 1984 to 1994, are from the United Nations, Commodity Trade Statistics, and are classified by SITC in version 1. The value of imports and exports are reported at f.o.b. (free on board) and c.i.f. (cost, insurance and freight), in terms of US dollars, respectively. There are 61 sectors at the 2-digit level of SITC. In the study, the GL indexes, which are at the 2-digit level, are

transformed into one-digit level of SITC by their trade share in the total trade for that commodity.

At that one-digit level, the commodities are classified into 10 different categories (0-9) by their SITC code.[4] Within the 10 categories, the commodity SITC5-8, except sector SITC68, are classified as manufactures, while the rest belong to non-manufactures. (For detail about the GL index distribution for the selected countries and regions, see Appendix 1).

For the trade partners, 12 countries and regions were selected, namely, the United States, Japan, European Community (EC),[5] Hong Kong, Korea, Singapore, Indonesia, Malaysia, Thailand, Philippines, India, and Pakistan. Their trade shares account for over 80 percent of China's trade over the whole period. Therefore, the exports and imports between China and these countries and regions basically reflect the pattern of China's foreign trade. In fact, Hong Kong, Japan, and the United States are China's three principal trade partners. Thus, the GL indexes (see Appendix1) reflect China's intra-industry trade development.

In the current study, we focus on the long-run relationship between economic development levels and the IIT. The selected countries and regions are classified into four groups according to their economic development levels, represented by their GDP and per capita income levels.[6] The four groups are denoted as Developed Market Economies (DMEs), which includes the United States, Japan and EC; Newly Industrialised Countries (NICs), which includes Hong Kong, S. Korea, and Singapore; Newly Exporting Countries (NECs), which includes Indonesia, Malaysia, and Thailand; and Least Developed Countries (LDCs), which includes the Philippines, India, and Pakistan. The rapid economic development of the NICs since the 1980s have made their

[4] The ten category commodities are Food and Live Animal (SITC0), Beverages and Tobacco (SITC1), Crude Matls Excl. Fuels (SITC2), Mineral Fuels (SITC3), Animal, Vegetable Oil (SITC4), Chemicals (SITC5), Basic Manufactures (SITC6), Machines and Transport Equipment (SITC7), Miscellaneous Manufactured Goods (SITC8, and Goods not Classified by Kind (SITC9), respectively.

[5] It includes all member countries before 1994. They are Austria, Belgium-Luxembourg, Denmark, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, United Kingdom.

per capita income approach to that of the DMEs. During examining the effects of economic development levels on the IIT, all member countries in each group are assumed homogeneously distributed.

In estimating the determinants of China's IIT, a tobit cum panel data fixed effect model is set up. To determine the specific effect of each industry on the IIT, we introduce ten industry dummy variables for the ten different industries (SITC0-9). The different effects on industrial dummy variables reflect the different industrial characteristics, embedded in these industries. For instance, each industry has a different production structure, resulting in different extent of value-added contents in their outputs. The different industrial structures, in turn, might reflect either the different production conditions, or variations in the industrial policies, technology progress, economic improvement, and etc. Since the model dwells on the analysis of long run relationship between determinants and its explanatory variables, the individual effects are assumed constant during the time span.

The dependent variable, in our regressions, is the index of IIT defined in equation (2-3), while the explanatory variables are the country variables referred to in the hypotheses. Since the dependent variable lies within the range of [0, 1], a tobit model is used.

$$GL_{ijt} = \beta_1 \ln AGDP_{jt} + \beta_2 \ln DAGDP_{jt} + \beta_3 \ln SIZE_{jt} + \beta_4 \ln SIZED_{jt}$$
$$+ \beta_5 \ln FI_{jt} + \beta_6 \ln DIS_j + \beta_7 \ln TRF_{ijt} + \sum_i^n \alpha_i SITCi + \varepsilon_{ijt} \qquad (3\text{-}1)$$

The data for the variables used in the model are reported from IMF (various issues) and China State Statistics Bureau (1996), except for the figures for Hong Kong, which are taken from Euromonitor (various issues). They all measured in terms of US dollars at 1990 constant price. In the regression, all the explanatory variables are transformed into logarithm form, except for the industry dummy variables.

5 GL Index Distributions in Manufactures

[6] The GDP levels are taken as the proxy of market size, and per capital income levels are taken as substitute of demand levels.

This section surveys the development of China's manufactures IIT with different types of economies. By doing this, we could answer the question: which type of economy is more important for China's IIT of a certain category. We can also answer the question on which product China has a relative comparative advantage in trade. After these examinations, we will investigate what factors are the most important in different type of economies to IIT.

As noted above in Section 2, the volume of imports and exports are the basic elements in determining the intensity of IIT. The unbalanced trade between China and its trade partner in an industry, which could be either in trade surplus or deficit, reflects both comparative advantage and the government policy orientations.

Appendix 1 shows that, in Miscellaneous Manufactured Goods (SITC8), the GL indices are low in trade with all type of economies, except for the trade with Korea and occasionally Hong Kong, Indonesia and Thailand. China's trade accounts shows a surplus over most time periods with these economies in this industry. This indicates that China has a competitive advantage relative to them. It is noteworthy that most products in this category are labour intensive products. In fact, the low labour cost of China made it competitive in this market and led to its expansion.

In Chemical Goods (SITC5), the GL indices are higher in trade with Japan, EC, Hong Kong and Malaysia. In the meantime, China's trade account is found to have a trade deficit with all DMEs and most NICs. But in trade with NECs and LDCs, China's trade account mostly shows a trade surplus. This suggests that DMEs' products have a comparative advantage relative to China in this sector. (Except for the sector SITC56 and SITC7, which includes Fertilisers manufactured and Explosives pyrotech products, respectively. The export expansion from them has helped to improve the sector trade balance since 1992). In trade with the NICs, the trade pattern with Korea is quite similar to that with the developed world; while China's principal import products from Hong Kong and Singapore were Plastic materials etc (SITC58). In trade with NECs and LDCs, China imported more than its exports in trade with Indonesia and Philippines before 1992. However, *visá-vis* the rest of NECs and LDCs, China mostly showed a

trade surplus. Generally, the trade pattern shows that China imported more than its exports in trade with the DMEs and NICs, while in trade with the NECs and LDCs, the pattern was opposite.

In Basic Manufactures (SITC6), the trade pattern is not clear-cut. For example, the GL indices increased and were relatively higher in trade with the USA, Japan, Hong Kong and Korea. However, China imported more than its exports in trade with Japan, while the opposite was the case for the USA, Hong Kong and Korea. In trade with DMEs, the trade deficit with Japan was mainly due to the increasing imports in the sectors SITC61, SITC62, SITC64, SITC66, SITC67, and SITC69 respectively.[7] The changes in GL indices reflect that China's export capacity was improving in this category. In trade with the EC, the imports of Iron and steel, and metal manufactures are significant and a trade surplus has shown up since 1990. In trade with the USA, China's exports exceeded imports and has kept the GL indices between 40 to 50 percent since 1988. In trade with the NICs, the indices are relatively high in trade with Hong Kong and Korea, while the low intensity in trade with Singapore reflects the fact that China exports significantly more than it imports. In trade with the NECs, China imports more than it exports in trade with Indonesia,[8] while it was opposite case for the trade with Malaysia and Thailand. The volume of trade with LDCs is small. In trade with Philippines, the low intensity and the trade surplus indicate China's a comparative advantage.

In Machines and Transport Equipment (SITC7), products are generally capital and technology intensive. All DMEs apparently have a comparative advantage in trade with China. However, the GL indices increased upwards with China's export expansion. This maybe due to either the industry structure adjustment in DMEs, which results in declining in some industries, or the fact that China's export capacity has been improved by upgrading its technology. In trade with NICs, a similar pattern in trade with the DMEs indicates that the NICs also had a comparative advantage to China over this period. However, China's exports have expanded since 1990. China's exports in

[7] These sectors are leather, dressed fur, etc, rubber manufactures, paper, paperboard and manufactures, non-metal mineral manufactures, iron and steel, and metal manufactures, respectively.

[8] The main import products are ranged in SITC 63, 64, 66 and 67, namely, wood, cork manufactures, paper, paperboard and manufactures, iron and steel, respectively.

category SITC72-3, including Electric machinery and Transport equipment products, surpassed its imports in trade with Hong Kong and Singapore. In trade with NECs and LDCs, China appears to have comparative advantage relative to all of them, except for some occasions in trade with Indonesia, Malaysia and Philippines in 1980s, and Thailand in 1994.

For the whole manufacturing industry, the GL indices changed with a different pattern for different type of economies. Generally, the GL indices for NICs are the highest one among all types of economies. In trade with DMEs, the GL indices shift upward. In trade with the NECs, the GL indices in most case have shifted upwards. In trade with the LDCs, the GL indices fluctuated up and down. This pattern of trade is similar to the findings by other investigations in this literature.

Comparing with the non-manufactures, the manufacturing industry could develop and produce more differentiated products, since more value contents could be added in further production processes. The diversified manufactures, in turn, provide more possibilities for intra-industry trade. Therefore, manufactures usually have relatively higher IIT than that of non-manufactures. This pattern is consistent with that of China's foreign trade.

Evidences from Other Analyses

Theoretically, it is postulated that IIT is closely related to income levels (Greenaway and Milner, 1989). This implies that the extent of IIT should be relatively small in South-South trade compared to that of among industrial countries. Comparing the importance of IIT in manufactured goods among different levels of economies in 1985, Ballance and Forstner (1990) show that the share of IIT among DMEs (developed market economies, which include 22 developed economies) is the most significant among all type of economies, and accounting for more than 47 percent of total trade. In both South-North trade and South-South trade, the shares of IIT of LDCs are positively correlated with their economic development levels. However, the share of IIT in South-South trade is mostly higher than that in that of share in South-North trade. For

example, the share of intra-industry trade within second generation NICs (which includes Indonesia, Malaysia, Philippines, Thailand, Colombia, Peru, Tunisia, Uruguay and Sri Lanka) and within other developing countries (which includes India, Pakistan, Chile, Dominican Republic, Egypt, Guatemala, Panama, Turkey, Venezuela and Yugoslavia) are 17.5 percent and 12.8 percent, respectively; while their corresponding shares with DMEs are 11.3 percent and 9.6 percent, respectively. Similar results are found also from other studies.[9]

6 Results

In surveying the determinants of China's IIT, we ran a set of regressions. First, to examine the hypotheses in the trade of different types of commodities, namely total commodities, non-manufactures and manufactures, three regressions were made. Second, to investigate the effect of economic development levels on the hypotheses, another four regressions were run for the four types of economies, namely DMEs, NICs, NECs, and LDCs, respectively.

The results are reported in Table 1-5, respectively. Since the time span of the regressions covers from 1984 to 1994, the models above focus on a long run relationship between the IIT and those explanatory variables. The heteroscedasticity are corrected by heteroscedasticity test in regressions. In the meantime, to verify the model efficiency by introducing industry dummy variables, null hypothesis tests were undertaken in the form of maximum log-likelihood ratio test in the regression.

In the regression for all commodities, Table 1 shows that all seven hypothesised variables have the expected signs and five of them are statistically significant, namely, average market size, average per capita income, foreign investment, geographic distance and average tariff rate. Among the five variables, the level of significant for all of them is above 1 percent, except for average per capita income at 5 per cent. For the industry

[9] For example, in analysing intra-industry trade in the Pacific Basin, Lee (1987) found that the share of intra-industry trade among developed economies is the highest, 34 percent; followed by the share among NICs, 29 percent, which is higher than trade with developed economies; and the lowest one is among developing countries, which account for 14 percent.

dummy variables, most of them are statistically significant, where all manufacture dummy variables have a positive sign, while the non-manufacture industry variables have a negative sign. These results indicate that an increase in average market size, average per capita income or the foreign investment would have a positive effect on China's IIT, while a widening of geographic distance or an increasing in average tariff rates would have a negative effect. The different signs for industry dummy variables between the two industries indicate that the two industries have different impact on the IIT. This might be due to the existence of differences in value-added content between the two industry products. The more value-added content, the more intensive IIT will be. In this model, the induction of industry dummy variables improves the model efficiencies, with 1 percent of significant levels in null hypothesis test.

In the regression for the non-manufactures, all coefficients have the expected sign, except for the two market size variables. Among the five variables with expected signs, three of them are statistically significant, namely, the average per capita income, the foreign investment, and the averaged tariff rate, respectively. This indicates that in trade of non-manufactures between China and the rest of the world, both increments of the average per capita income and foreign investment could have a positive effect on the IIT, while a higher tariff rate would reduce this type of trade. All industry dummies in this regression are insignificant, except for Food and Live Animals (SITC0), with a negative sign. However, the model efficiency is significantly improved by introduction of dummy variables, with supporting from its null hypothesis test.

In the regression for the manufactures, all coefficients have the expected sign and six of them are statistically significant, namely, the average market size, the difference in market size, the difference in per capita income, the foreign investment, the geographic distance, and the averaged tariff rate, respectively.

Table 1: Regression Results for All Commodities, Non-Manufactures, and Manufactures

Explanatory Variables Industry Dummy Variables	Expected Signs	Total Trade Coefficient t-value	Non-Manufacture Trade Coefficient t-value	Manufacture Trad Coefficient t-value
Constant		None	None	0.3263

Log country size	+	**0.0485 (***)**	-0.0133	**0.16 (***)**
Log Difference in Country size	-	**-0.0253**	0.0236	**-0.1378 (***)**
Log Average per capita GDP	+	**0.0264 (**)**	**0.05 (***)**	**0.0079**
Log Difference in per capita GDP	-	**-0.0002**	**-0.0003**	**-0.0001 (**)**
Log Foreign Investment	+	**0.0001 (***)**	**0.0001 (***)**	**0.0002 (***)**
Log Geographic Distance	-	**-0.031 (***)**	**-0.0043**	**-0.0554 (***)**
Log Average Tariff Rates	-	**-0.0432 (***)**	**-0.0663 (***)**	**-0.0338 (***)**
Food and Live Animal (SITC0)		-0.0988 (***)	-0.0499 (***)	
Beverages and Tobacco (SITC1)		-0.0666 (***)	0.0248	
Crude Matls Excl. Fuel (SITC2)		-0.0281	0.0283	
Mineral Fuels (SITC3)		-0.059 (***)	-0.0163	
Animal & Vegetable Oil (SITC4)		-0.066 (***)	0.0123	
Goods not Classified by Kind (SITC9)		-0.0362 (***)	0.0112	
Chemicals (SITC5)		0.1114 (***)		0.0117
Basic Manufactures (SITC6)		0.1058 (***)		0.0364 (*)
Machines &Transport Equipment (SITC7)		0.1238 (***)		
Miscellaneous Manufactures (SITC8)		0.0383 (**)		-0.0535 (**)
Number of Observations		1246	730	516
Log-Likelihood Function Unrestricted Maximum Likelihood Test Ratio		87.1825 148.002 (***)	-1.5887 214.8916 (***)	172.1244 25.0128 (***)

Note:

1. The signs ***, **, * represent the significance of t value 1%, 5% and 10%, respectively.
2. The bold figures indicate that the sign of coefficient is consistent with that of theoretical expectations in the corresponding regression.
3. Among the ten industrial dummy variables (SITC0-9), SITC5, SITC6, SITC7, and SITC8 are manufacturing industries, while the rest are non-manufacturing industries.

All the six variables were at 1 percent of significant level, except for the difference in per capita income, at 5 percent. This result suggests that both enlarging the average market size and absorbing foreign investment would increase IIT in manufactures, while widening the difference in market size, per capita income, geographic distance, or increasing the average tariff rate would have a negative effect on IIT of manufactures. The average per capita income is not significant in the regression, although its sign

follows the hypothesis prediction. Among the four manufactures, sector SITC7 was taken as the reference to other sectors. But the trade character from regression in sector is not clear. Compared with SITC7, the sector SITC8 has a negative sing and statistically significant, indicating that the trade in this sector is relatively net trade oriented instead of IIT oriented; while sector SITC6 has a positive sign and statistically significant, indicating that sector is more inclined to IIT. However, sector SITC5 is not clear in the regression. The null hypothesis test, with 1 percent of significant level, suggests that the introduction of industry dummy variable improves model efficiency.

In summary, the statistical results indicate that the robustness of hypotheses exists for the trade in all commodities and manufactures, while it is weak for the trade of non-manufactures. The value-added differences between the two industries might be the reason for the weak explanation from non-manufactures. In the national total IIT, average market size, average per capita income, foreign investment, geographic distance, and average tariff rates are important factors; while in the national manufactures IIT, average market size, difference in market size, difference in per capita, foreign investment, geographic distance, and average tariff rate are important factors.

In the regression for the DMEs (see Table 2), five hypothesised variables are included, namely average market size, difference in market size, foreign investment, geographic distance, and average tariff rates, respectively.[10] The regression result shows that all the five variables have the expected signs, except for the foreign investment, and they are all statistically significant, except for the average tariff rates. Those results suggest that an increase in the average market size of China and its trade partner will have a positive contribution to the IIT of manufactures, while an increase in the difference of market size, the foreign capital investment, and the geographic distance, will have a negative effects on that type of trade. The negative effect of foreign investment might infer that most investments from the DMEs are inter-industry trade oriented. Among the four manufactures, sector SITC7 was taken as the reference to other sectors in the regression.

[10] Note that, the income variables are not included into the regression. In fact, due to the big income disparity between China and the DMEs, the trades between the two markets are mostly in the form of inter-industry trade. That is, the trade between them should follow the pattern predicted by Ricardo and H-O theorem, where China exports labour intensive products and imports capita intensive ones.

The result shows that it has a negative sign and statistically significant, indicating that the trade in this sector is mostly inter-industry trade in character. Compared to sector SITC7, both SITC5 and SITC6 incline to the IIT, while that for SITC8 is not clear. The null hypothesis test, with 1 percent of statistical significant level, supports the introduction of industrial dummy variables in the regression.

Table 2: Regression Results for the Developed Market Economies (DMEs)

Determinants of IIT	Expected Signs	Coefficients / t-Ratio Test
Constant (SITC7) Machine and Transport Equipment		-11.298 (***)
Log Average Market Size	+	1.4704 (***)
Log Difference in Market Size	-	-0.8345 (*)
Log Foreign Investment	+	-0.0417 (*)
Log Geographic Distance	-	-0.2066 (*)
Log Average Tariff Rates	-	-0.0242
Chemicals (SITC5)		0.3166 (***)
Basic Manufactures (SITC6)		0.229 (***)
Miscellaneous Manufactures (SITC8)		-0.0044
Number of Observations		132
Log-Likelihood Function Unrestricted Maximum Likelihood Test Ratio		46.4824 124.2294 (***)

Note: The interpretations are same as Table 1.

In the regression for the NICs (see Table 3), four hypothesised variables are included, namely difference in market size, average per capita income, difference in per capita income, and foreign investment, respectively. The regression result shows that all of them have the expected signs and statistically significant above one percent. This result suggests that, *ceteris paribus*, an increase in the average per capita income and foreign capital inflow have a positive effect on the IIT, while the widening of either difference in average market size or per capita income will have a negative effect. Among the four manufactures, sector SITC7 was taken as a reference to other sectors in the regression. The result shows that it has a positive sign and statistically significant, indicating that the trade between China and the NICs in this sector is characterised by intra-industry

trade. Compared to the SITC7, all other sectors have a negative sign and statistically significant, indicating that the trades in those sectors are relatively inter-industry trade in character. The null hypothesis test, with 1 percent of statistical significant level, supports the introduction of industrial dummy variables in the regression.

Table 3: Regression Results for the Newly Industrialised Countries (NICs)

Determinants of IIT	Expected Signs	Coefficients / t-Ratio Test
Constant (SITC7) Machine and Transport Equipment		30.064 (***)
Log Difference in Market Size	-	-1.3572 (***)
Log Average Per Capita GDP	+	14.946 (***)
Log Difference in Per Capita GDP	-	-12.546 (***)
Log Foreign Investment	+	0.002 (***)
Chemicals (SITC5)		-0.2193 (***)
Basic Manufactures (SITC6)		-0.1022 (***)
Miscellaneous Manufactures (SITC8)		-0.3021 (***)
Number of Observations		120
Log-Likelihood Function Unrestricted Maximum Likelihood Test Ratio		21.878 24.9404 (***)

Note: The interpretations are same as Table 1.

In the regression for the NECs (see Table 4), six hypothesised variables are included, namely average market size, average per capita income, difference in per capita income, foreign investment, geographic distance, and average tariff rates, respectively. The regression result shows that all of them have the expected signs, but only three of them are statistically significant, namely average market size, average in per capita income, and the difference in per capita income, respectively. This result suggests that, *ceteris paribus*, an increase in the average market size, and average per capita income of China and the trade partners in NECs would positively contribute to their IIT of manufactures, while an widening in difference of per capita income between them would have a negative effect to that type of trade. Among the four manufactures, sector SITC7 was taken as the reference to other sectors in the regression. The result shows that it has a negative sign and statistically significant, indicating that the trade in this sector between

China and the NECs in this sector are characterised by inter-industry trade. Compared to the SITC7, the patterns of trade for other sectors are not clear from their statistic inferences. The null hypothesis test, with 1 percent of statistical significant level, supports the introduction of industrial dummy variables in the regression.

Table 4: Regression Results for the Newly Exporting Countries (NECs)

Determinants of IIT	Expected Signs	Coefficients / t-Ratio Test
Constant (SITC7) Machine and Transport Equipment		-4.127 (***)
Log Average Market Size	+	0.2413 (***)
Log Average Per Capita GDP	+	0.1588 (*)
Log Difference in Per Capita GDP	-	-0.286 (***)
Log Foreign Investment	+	-0.0045
Log Geographic Distance	-	-0.0031
Log Average Tariff Rates	-	-0.0128
Chemicals (SITC5)		0.012
Basic Manufactures (SITC6)		-0.073
Miscellaneous Manufactures (SITC8)		-0.1511 (***)
Number of Observations		132
Log-Likelihood Function Unrestricted Maximum Likelihood Test Ratio		52.3032 27.31 (***)

Note: The interpretations are same as Table 1.

In the regression for the LDCs (see Table 5), we used another six hypothesised variables in the regression, namely average market size, difference in market size, average per capita income, difference in per capita income, geographic distance, and average tariff rates, respectively.

Table 5: Regression Results for the Least Developed Countries (LDCs)

Determinants of IIT	Expected Signs	Coefficients / t-Ratio Test
Constant (SITC7) Machine and Transport Equipment		0.3033 (**)
Log Average Market Size	+	0.1715

		(**)
Log Difference in Market Size	-	-0.969 (*)
Log Average Per Capita GDP	+	0.1532
Log Difference in Per Capita GDP	-	-0.0001
Log Geographic Distance	-	-0.2452 (***)
Log Average Tariff Rates	-	-0.0058
Chemicals (SITC5)		0.0114
Basic Manufactures (SITC6)		-0.0637 (***)
Miscellaneous Manufactures (SITC8)		-0.0273
Number of Observations		132
Log-Likelihood Function Unrestricted Maximum Likelihood Test Ratio		103.62 19.58 (***)

Note: The interpretations are same as Table 1.

The regression result shows that all of them have the expected signs, but only average market size, difference in market size, and geographic distance are statistically significant. This suggests that, *ceteris paribus*, an increase in average market size of China and the LDCs has a positive effect on the IIT of manufactures, while a widening in difference of market size or geographic distance between them would have a negative effect on that type of trade between them. Among the four manufactures, sector SITC7 was taken as the reference to other sectors in the regression. The result shows that this sector is characterised by intra-industry trade, with a significant positive sign. Compared with sector SITC7, sector Basic Manufactures (SITC6) is more inclined to the IIT. However, the pattern of two other sectors are not clear from their statistical inference. The null hypothesis test, with 1 percent of statistical significant level, supports the introduction of industrial dummy variables in the regression.

Generally, the patterns of trade determinants are different from each other according to the trade with different type of economies. The different patterns are due to the fact that different economies have a different level of technology, industrial structure, taste, and consumption behaviour, and so on. However, the results positively confirm the

introduction of industry dummy variables, which tend to improve the model efficiency. For comparing with other studies, see the Appendix 4.2.

7 Conclusion

There are three main conclusions from this investigation:

First, intra-industry trade is becoming important in China's foreign trade, especially for manufactures. As the foreign trade expanded, the share of IIT moved upward in the trade with its principal trade partners, namely the DMEs and NICs.

Second, among the determinants of IIT, the market size and income levels, *ceteris paribus*, are the most important ones to China, especially for the manufactures. The roles of other factors to China's IIT are usually indirect and implicit. For example, as the economy has expanded, China has gradually left the stage where commodities are in short supply so that the consumer decisions become more important. As income increase, the taste in consumption changes. More demand shifts to high quality products, which are characterised as high value-added products. On the other hand, as the foreign capital flows in, the competition becomes more intensive. More domestic producers prefer updating their technology to meet the competition. The intensified IIT in the horizontally and/or vertically differentiated goods reflect both taste changes and technology improvement.

Third, the extent of value-added in production is an important factor for IIT. The higher value-added products in manufactures apparently have a higher ratio of IIT than that of non-manufactures. The upward movement of IIT for China's manufactures reflects the changes in the income and consequently in the consumption of high value-added products. On the other hand, the technology progress under pressure of competition provides more availability of high quality products.

And fourth, the pattern of trade determinants varies between trade with different types of economies. That suggests the economic development level is an important factor to the IIT of China's manufactures.

The increment of IIT in China reflects the requirement of further economic development in the future. Although China's export expansion significantly contributed its economic development, also the import played an important role in the national economy. Most imports were used in updating production technology, which improves domestic productivity and the scale of production. The technology improvement increases the market supply and national income. On the other hand, a lot of studies takes the IIT index as an indicator of "market openness", and argue that a fair trade between countries with similar market structures should have an intensive IIT. China's economy expansion will definitely bring about the changes in market structure, which, in turn, will increase the IIT. Therefore, the IIT will become more important in the way that China integrates itself into the world market.

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Appendix 1

Intra-Industry Trade Index (GL Index) for China's Foreign Trade (1984-1994)

SITC0 (Food and Live Animal Category) (%)

Year	USA	Japan	EC	H.K.	Korea	Singapor	Indonesi	Malaysia	Thailand	Philippine	India	Pakistan
84	***0.8***	9.3	5.1	5.1	0.0	3.5	13.5	4.1	5.2	1.8	65.5	0.1
85	***3.1***	7.3	11.5	4.9	0.0	3.1	8.9	12.8	2.3	4.9	7.8	0.1
86	***13.3***	6.3	7.2	4.7	0.0	3.4	7.2	9.3	4.9	7.5	10.8	0.4
87	***7.5***	9.6	7.6	7.9	0.0	3.3	4.0	12.4	4.5	10.2	1.1	0.0
88	***3.3***	7.3	15.3	8.4	1.2	8.2	15.0	17.8	8.1	14.3	1.5	2.7
89	***2.7***	7.6	12.1	8.6	6.7	8.6	13.8	18.6	16.4	8.3	1.2	0.1
90	***4.4***	7.4	9.0	10.3	1.5	6.1	28.5	21.8	47.7	6.3	2.8	0.1
91	***8.6***	7.5	13.1	12.9	0.8	7.8	33.7	14.0	42.6	11.7	8.7	0.5
92	***14.4***	5.9	11.0	13.2	1.6	10.7	39.5	8.8	46.1	17.2	***11.1***	0.4
93	***18.2***	6.4	16.8	14.8	2.4	18.3	30.0	13.9	24.9	34.5	***11.0***	1.7
94	***23.0***	9.3	16.5	11.1	6.1	13.0	15.1	16.0	***11.2***	29.8	0.7	1.1

SITC1 (Beverages and Tobacco Category) (%)

Year	USA	Japan	EC	H.K.	Korea	Singapor	Indonesi	Malaysia	Thailand	Philippine	India	Pakistan
84	***8.1***	26.8	***83.9***	32.7	0.0	2.5	0.0	0.0	***0.0***	***1.5***	***0.0***	***0.0***
85	***2.6***	48.1	***19.6***	42.2	0.0	4.1	0.0	0.0	***0.0***	***0.0***	***0.0***	***0.0***
86	***4.2***	27.8	***45.9***	46.8	0.0	5.6	38.7	1.5	***0.1***	***0.0***	***1.9***	***0.0***
87	***4.7***	31.0	***44.8***	41.9	***0.0***	6.7	0.0	0.3	***0.0***	***0.9***	***6.3***	***27.5***
88	***4.0***	51.4	***41.7***	56.8	***0.0***	9.4	0.0	12.4	***0.0***	***32.4***	***0.0***	***0.0***
89	***15.3***	45.5	***60.0***	47.9	***15.4***	12.1	0.0	5.9	***0.1***	72.4	***0.0***	***0.0***
90	***14.6***	29.6	***83.8***	46.6	3.5	10.8	13.5	0.0	***14.8***	***7.4***	***0.0***	0.0
91	***29.9***	18.4	72.7	41.5	0.2	14.5	1.0	1.6	11.1	***31.7***	***9.2***	0.0
92	***41.9***	21.5	78.3	38.0	4.8	9.0	1.3	5.8	***77.9***	***3.2***	***0.0***	6.3
93	***67.9***	31.3	91.8	41.2	10.4	9.2	0.6	3.3	70.1	1.5	***0.1***	***0.0***
94	***56.2***	12.5	29.9	6.4	6.0	10.7	1.4	0.7	***44.3***	0.9	***0.0***	***4.4***

SITC2 (Crude Material Exclude Fuels Category) (%)

Year	USA	Japan	EC	H.K.	Korea	Singapor	Indonesi	Malaysia	Thailand	Philippine	India	Pakistan
84	***12.8***	33.1	35.6	6.7	0.0	***1.3***	0.0	***1.6***	23.1	9.4	5.7	8.4
85	***8.3***	44.8	60.9	10.4	0.0	***2.2***	3.5	***3.8***	18.2	***4.4***	1.8	***3.6***
86	***13.5***	38.2	54.2	5.9	0.0	5.6	1.8	***3.5***	10.6	***3.8***	0.0	***48.7***
87	***12.3***	30.4	59.5	7.6	0.0	1.5	0.1	***3.3***	6.7	***6.2***	3.1	***56.4***
88	***10.8***	31.9	66.8	17.9	83.2	5.4	3.4	***3.7***	6.6	36.0	***2.3***	***7.3***
89	***12.9***	28.2	58.7	24.0	69.3	7.7	7.1	***2.4***	27.1	***33.4***	***18.7***	***1.1***
90	***9.9***	34.3	54.0	16.7	46.9	5.8	3.3	***5.7***	26.2	***24.8***	***37.6***	***4.4***
91	***9.1***	35.0	55.0	21.9	69.3	18.6	4.9	***5.7***	25.8	***12.1***	***7.8***	***2.6***
92	***13.8***	32.7	55.8	42.6	***31.2***	26.7	5.5	***5.1***	28.7	***4.7***	***2.1***	***3.8***
93	***23.4***	32.5	32.3	33.8	***34.0***	11.9	6.8	***7.9***	26.6	***5.4***	***2.5***	***13.0***
94	***11.5***	39.9	34.4	29.6	***24.0***	12.3	20.4	***4.6***	***20.0***	7.4	***6.3***	***36.9***

SITC3 (Mineral Fuel Category) (%)

Year	USA	Japan	EC	H.K.	Korea	Singapor	Indonesi	Malaysia	Thailand	Philippine	India	Pakistan
84	2.0	0.8	11.8	5.8	0.0	3.4	3.2	0.4	***0.0***	0.0	0.0	0.0
85	3.2	0.9	14.8	6.0	0.0	0.7	0.0	0.4	***0.1***	0.0	0.0	0.0
86	13.6	1.7	18.4	15.7	0.0	50.3	***3.9***	***40.9***	***0.1***	0.7	0.0	0.0
87	10.9	2.9	16.0	16.9	0.0	44.5	***10.1***	0.2	***0.5***	0.0	0.0	0.0
88	20.2	1.6	10.6	25.6	0.0	68.9	***10.2***	8.7	0.5	2.0	0.0	0.0
89	15.9	2.2	4.6	24.8	2.7	***88.6***	***2.5***	***4.4***	0.7	5.6	0.0	***66.2***
90	12.6	4.4	7.6	19.5	3.4	67.4	***5.5***	***7.0***	5.0	3.5	0.0	***33.8***
91	28.6	6.2	10.5	24.1	1.9	86.5	***3.7***	***16.1***	0.8	12.2	0.0	***30.7***
92	67.9	11.0	26.3	***39.5***	25.4	***93.0***	***1.7***	***8.7***	0.3	16.5	35.8	***90.7***
93	***98.6***	18.2	9.0	***35.6***	72.5	***37.1***	***16.8***	***10.4***	***40.7***	***42.3***	55.4	***14.5***
94	63.1	13.2	12.7	55.5	57.4	***42.5***	***5.2***	***10.7***	***18.6***	***15.0***	2.7	***7.9***

SITC4 (Animal, Vegetable Oil and Fat Category) (%)

Year	USA	Japan	EC	H.K.	Korea	Singapor	Indonesi	Malaysia	Thailand	Philippine	India	Pakistan
84	***21.8***	3.7	11.5	11.5	0.0	***46.3***	***0.0***	***7.0***	***0.0***	***0.0***	0.0	0.7
85	***13.9***	17.4	14.0	26.0	0.0	***20.4***	***7.1***	***4.9***	***14.2***	***0.4***	0.0	0.0
86	***19.3***	27.6	97.3	28.9	0.0	***7.1***	***1.3***	***10.8***	***27.7***	***0.0***	11.6	0.0
87	***28.2***	24.2	88.1	45.6	25.1	***4.2***	***68.8***	***4.4***	***4.0***	***0.8***	0.0	4.6
88	***12.9***	23.0	58.7	59.9	0.0	***2.8***	***3.3***	***2.2***	***38.3***	***0.3***	0.0	***2.7***
89	***82.1***	39.3	***16.6***	66.3	31.2	***1.2***	***2.0***	***1.4***	***56.1***	***0.5***	0.0	***2.8***
90	***24.8***	21.8	***35.6***	47.9	34.8	***8.7***	***0.3***	***0.7***	***24.4***	***4.8***	0.0	0.0
91	***16.2***	38.2	***55.7***	32.8	0.0	***3.0***	***0.6***	***0.6***	***5.6***	***0.0***	80.0	0.0
92	***15.0***	26.4	***54.0***	64.6	2.3	***2.1***	***0.9***	***1.2***	***0.6***	***1.5***	***92.5***	0.0
93	***54.5***	38.9	***81.6***	31.0	20.6	***6.5***	***11.9***	***4.8***	***8.7***	***1.4***	0.0	0.0
94	***3.5***	38.4	***7.9***	11.8	37.2	***3.2***	***0.5***	***1.2***	***18.6***	***1.7***	***18.3***	0.0

SITCC9 (Goods not Classified by Kind Category) (%)

Year	USA	Japan	EC	H.K.	Korea	Singapor	Indonesi	Malaysia	Thailand	Philippine	India	Pakistan
84	***6.3***	18.7	***9.7***	***15.9***	0.0	17.5	***25.9***	***0.6***	0.0	***33.9***	***16.7***	***0.7***
85	***7.1***	15.0	***12.3***	***62.9***	0.0	27.0	***30.6***	***1.7***	0.0	***17.4***	***34.4***	***0.0***
86	***5.2***	***19.4***	9.6	***37.0***	0.0	28.6	***32.2***	***2.9***	0.0	***11.5***	***48.5***	***2.4***
87	***70.9***	***26.9***	78.1	***0.9***	***0.0***	22.9	***0.0***	***72.5***	***4.0***	***0.0***	***0.0***	***1.4***
88	***73.3***	6.4	39.7	***0.2***	0.0	6.7	***0.0***	***47.1***	0.0	***0.0***	***29.9***	0.0
89	***21.6***	5.2	84.9	***0.6***	***0.0***	11.3	***0.0***	***0.0***	40.9	***0.0***	***31.2***	***1.7***
90	***80.2***	3.3	42.3	***6.0***	***4.9***	14.3	***0.0***	0.0	***9.8***	***0.0***	0.0	***0.5***
91	***13.0***	3.2	26.9	***1.9***	10.1	33.2	***42.6***	12.1	6.3	0.0	***37.2***	0.0
92	***81.8***	20.6	74.0	***7.9***	4.7	***2.6***	***62.7***	10.0	0.0	0.0	0.0	0.0
93	***87.5***	8.7	***13.6***	***23.2***	46.5	***5.2***	***58.6***	***93.5***	***4.8***	60.9	***79.4***	0.0
94	***51.4***	12.4	***9.8***	***36.1***	17.6	***2.2***	***63.6***	30.7	***0.9***	4.0	0.0	0.0

Whole Non-Manufactures (%)

Year	USA	Japan	EC	H.K.	Korea	Singapor	Indonesi	Malaysia	Thailand	Philippine	India	Pakistan
84	4.9	8.0	24.8	6.8	0.0	3.3	3.0	2.4	6.5	1.4	7.5	2.0

85	5.6	10.3	44.1	8.5	0.0	1.2	0.8	6.1	6.2	1.3	2.6	1.9
86	13.0	12.8	39.5	8.4	0.0	38.8	2.7	6.3	6.0	3.5	5.0	10.9
87	10.2	11.6	39.5	11.2	0.0	30.4	1.0	5.0	5.1	2.7	2.6	6.4
88	8.8	12.5	45.0	16.2	22.0	42.5	5.3	5.8	7.1	7.9	1.8	5.8
89	8.5	11.7	34.7	18.3	25.8	59.4	6.1	4.9	19.8	9.6	11.5	4.7
90	8.6	11.9	31.8	16.7	16.4	49.1	7.4	5.4	34.0	7.4	26.4	5.8
91	14.2	13.6	36.6	19.7	19.3	65.5	6.7	6.2	31.2	11.9	7.4	5.9
92	29.4	13.6	35.9	28.6	15.8	71.9	4.7	5.6	33.5	12.7	6.7	10.3
93	44.8	16.4	29.7	26.1	39.7	32.7	15.2	8.8	28.3	33.0	8.8	10.4
94	24.1	16.6	23.7	19.0	28.6	34.6	10.7	6.2	15.7	13.7	3.8	13.4

Whole Manufactures (%)

Year	USA	Japan	EC	H.K.	Korea	Singapor	Indonesi	Malaysia	Thailanc	Philippine	India	Pakistan
84	16.2	12.9	17.9	29.3	0.0	23.0	4.4	13.0	27.2	31.8	6.6	4.1
85	16.2	8.0	13.7	46.5	0.0	19.0	3.6	17.8	25.2	17.6	14.4	3.4
86	12.8	11.1	14.6	50.3	0.0	19.6	4.1	18.4	38.1	14.1	14.7	9.6
87	14.8	20.0	21.2	74.8	7.3	26.0	3.3	17.7	37.5	19.7	23.2	7.9
88	19.1	25.0	23.9	74.3	16.6	32.4	6.7	33.9	49.2	20.7	31.2	5.0
89	23.2	25.9	25.3	68.9	40.2	35.7	8.5	29.9	42.6	27.2	43.1	3.5
90	26.2	35.0	27.6	67.8	56.4	35.6	7.8	29.1	22.1	15.9	44.0	5.2
91	24.5	39.3	27.6	66.0	56.1	33.3	6.4	33.7	23.4	16.6	47.9	2.7
92	30.7	32.1	27.3	54.3	48.2	36.1	8.9	28.4	24.3	17.8	49.6	9.0
93	35.4	32.6	31.5	54.9	41.7	50.9	20.1	42.7	48.3	20.1	30.8	2.1
94	33.6	38.4	35.1	43.4	48.3	55.0	25.4	42.2	42.6	25.4	27.1	2.3

SITC5 (Chemicals Category) (%)

Year	USA	Japan	EC	H.K.	Korea	Singapor	Indonesi	Malaysia	Thailanc	Philippine	India	Pakistan
84	***15.6***	***39.5***	***32.7***	27.3		***22.5***	***12.5***	22.3	7.2	***39.5***	9.5	***0.1***
85	***13.7***	***27.7***	***38.2***	36.1		***15.5***	***3.0***	19.3	16.7	***13.1***	12.1	***0.1***
86	***22.7***	***27.8***	***53.5***	39.9		***25.3***	***8.2***	18.1	11.2	***6.9***	12.1	0.7
87	***21.4***	***50.6***	***61.9***	42.6	***0.0***	***35.7***	***17.5***	15.3	31.2	***14.2***	32.1	18.0
88	***14.8***	***53.4***	***48.9***	45.4	***29.7***	***37.1***	***12.3***	49.7	30.0	***14.4***	***31.3***	11.2
89	***20.3***	***58.0***	***68.4***	41.3	***49.9***	***43.1***	***11.5***	58.0	26.1	***26.4***	***37.9***	0.2
90	***26.1***	***58.6***	***72.8***	41.0	***68.6***	***40.6***	***12.6***	61.5	31.9	***23.9***	26.8	0.1
91	***19.3***	***56.8***	***68.9***	41.3	***35.7***	***37.1***	***18.4***	57.7	30.8	***21.7***	58.5	0.7
92	***25.6***	***56.2***	***70.4***	***34.3***	***40.5***	***36.2***	30.1	53.1	22.5	***18.1***	45.1	2.4
93	***42.1***	***50.7***	***67.6***	***51.4***	***34.5***	***41.3***	33.5	44.9	30.7	25.7	54.4	0.7
94	***33.7***	***48.5***	***64.5***	64.4	***36.8***	***47.4***	41.0	40.4	31.1	25.2	22.0	1.2

SITC6 (Basic Manufactures Category) (%)

Year	USA	Japan	EC	H.K.	Korea	Singapor	Indonesi	Malaysia	Thailanc	Philippine	India	Pakistan
84	37.6	***17.2***	***14.2***	25.5	0.0	10.8	***3.5***	12.6	43.6	***28.4***	***5.0***	21.7
85	59.9	***15.8***	***13.0***	51.4	0.0	12.3	***3.0***	18.6	24.0	***20.1***	***10.4***	17.4
86	38.9	***18.9***	***18.1***	52.0	0.0	11.3	***2.2***	19.4	45.7	***17.7***	***62.0***	27.1

87	29.7	***31.7***	***29.9***	89.1	***25.0***	12.4	***1.8***	13.7	42.6	***23.6***	18.9	0.6
88	42.5	***40.2***	35.7	88.4	***38.0***	21.4	***5.7***	25.9	54.4	***20.9***	20.8	8.6
89	40.6	***36.7***	***33.0***	87.1	***43.0***	19.3	***4.9***	***12.2***	44.7	32.4	31.0	6.2
90	42.4	***56.9***	36.5	87.5	63.0	15.2	***3.4***	***12.8***	14.2	16.3	42.9	9.3
91	36.9	***65.9***	29.7	85.6	64.9	12.9	***2.6***	15.0	17.1	9.0	35.8	9.7
92	50.0	***57.2***	35.8	***83.2***	***53.8***	16.3	***6.0***	***16.9***	22.9	19.0	***63.1***	6.2
93	44.9	***45.5***	27.0	77.8	***46.7***	27.9	***18.1***	***27.3***	56.8	18.5	***22.7***	10.8
94	46.1	***61.2***	46.6	55.5	***59.0***	32.2	***26.2***	***33.2***	***50.4***	15.3	***35.3***	***5.5***

SITC7 (Machines and Transport Equipment Category) (%)

Year	USA	Japan	EC	H.K.	Korea	Singapor	Indonesi	Malaysia	Thailand	Philippine	India	Pakistan
84	***14.4***	***0.8***	***7.7***	***61.8***	***0.0***	37.2	10.0	15.6	18.3	43.0	8.4	0.0
85	***4.2***	***0.2***	***1.9***	***27.1***	***0.0***	***33.7***	30.6	38.9	21.9	15.2	72.8	0.3
86	***5.9***	***0.6***	***2.2***	***66.0***	***0.0***	***26.9***	***9.6***	39.6	42.9	***40.0***	48.5	1.2
87	***8.6***	***2.3***	***4.6***	***88.7***	***0.0***	***43.9***	8.9	***64.3***	30.8	49.0	14.3	1.4
88	***16.8***	***3.8***	***7.2***	***87.4***	***0.4***	***44.8***	6.4	***45.7***	49.0	54.4	42.5	0.8
89	***24.6***	***10.0***	***8.1***	***84.2***	***28.8***	***59.1***	***16.3***	***46.4***	53.6	19.7	78.6	3.6
90	***31.4***	***17.2***	***14.2***	84.9	***26.9***	65.7	***13.5***	39.0	32.7	8.6	68.9	6.1
91	***34.8***	***22.4***	***18.3***	84.7	***43.8***	61.3	6.7	50.9	28.2	17.1	39.4	0.1
92	***45.6***	***13.1***	***18.0***	73.6	***35.2***	76.2	5.1	36.0	26.7	17.2	26.3	12.3
93	***59.3***	***19.6***	***34.9***	70.6	***28.9***	***91.7***	17.4	75.5	53.1	25.7	21.1	0.2
94	***54.6***	***24.2***	***35.5***	63.2	***33.6***	***88.5***	15.3	87.0	***51.2***	51.5	19.1	0.3

SITC8 (Miscellaneous Manufactured Goods Category) (%)

Year	USA	Japan	EC	H.K.	Korea	Singapor	Indonesi	Malaysia	Thailand	Philippine	India	Pakistan
84	6.3	***18.7***	9.7	15.9	0.0	17.5	25.9	0.6	***44.7***	33.9	***16.7***	0.7
85	7.1	***15.0***	12.3	62.9	0.0	27.0	30.6	1.7	67.6	17.4	34.4	0.0
86	5.2	***19.4***	9.6	37.0	0.0	28.6	32.2	2.9	73.4	11.5	48.5	2.4
87	7.8	15.3	9.8	47.2	0.0	20.7	26.0	1.8	39.3	15.9	19.2	1.4
88	10.3	15.8	12.9	47.6	81.4	32.3	***31.0***	11.2	60.5	6.6	29.9	2.2
89	9.4	14.1	11.3	36.9	57.0	26.0	61.6	33.8	21.3	9.5	31.2	1.7
90	9.7	14.6	9.7	33.9	63.0	23.1	12.7	45.4	21.9	8.5	55.9	0.5
91	8.8	15.6	7.8	30.7	56.5	15.7	52.9	32.6	32.3	26.5	37.2	1.3
92	9.6	24.1	9.8	27.0	51.5	23.0	28.7	27.3	32.1	10.4	33.2	0.9
93	12.3	37.1	14.0	28.2	53.5	22.3	31.4	34.7	38.8	10.4	35.2	0.5
94	10.6	38.0	14.3	20.3	46.5	26.0	23.9	13.2	***15.5***	11.5	26.3	0.8

Note:

1. Manufacturing industry includes the category SITC5, SITC6, SITC7, and SITC8, respectively; while the rest are non-manufacturing industries.
2. Bold figure stands for that the volume of China's imports is more that of exports, in the trade with that trade partner for that commodity in that year.
3. Data sources are from UN published Commodity Trade Statistics, and classified by SITC in version 1.

Appendix 2

Estimates from Other Studies

Table A summarises the results of other econometric studies. which covers some of the tested hypotheses in this literature.[11] There is a broad similarity between the studies in their choice of explanatory variables. The general consistency of the signs of estimated coefficients with those expected. and the significance levels of the coefficients gives very strong support for the country-specific hypotheses. The conclusions from these studies are that there are consistent inter-country variations in average levels of IIT, related to their level of development, market size and physical / cultural proximity.

Table A: Comparison of Determinants between Studies

Explanatory variables	Expected sign	Loertscher & Wolter (1980)	Havrylyshyn & Civan (1983)	Tharakan (1984)	Balassa (1986a. 1986b)
Level of development					
1.Average per capita income	+	+	+ (***)		+ (***)
2. Per capita income differential	-	- (**)		-	- (***)
Country or market size					
1. Average GDP	+	+	+		+ (***)
Distance	-	- (**)		- (***)	

To investigate the role of IIT determinants in the developing world. Nolle (1990) made a comparison of selected developing countries to trade with both developed economies and developing countries (see Table B). In the trade with the DMEs. there are two country-specific variables. which have the unexpected signs among the following selected five explanatory variables. They are the Development Stage Differential. which is taken as a proxy of the disparity in per capital income. and the Market Size Differential. respectively. These results indicate that the greater is the disparity between a given developing country and developed countries the greater the amount of IIT. He concludes that the trade between the developing countries and DMEs. the country-specific variables are more important. In trade with developing countries. the Market Size Differential and Distance do not have the expected signs. and only the former is

statistically significant. The t tests show that in trade between developing world. most explanatory variables are not significant. However. both magnitudes of F and adjusted R^2 are so high that they suggest the overall explanatory power of the regression are significant. He concludes that this type of IIT is poorly interpreted by economic factors. and may in fact be the result of data aggregation.

Table B: Determinants in South & North. South & South Intra-Industry Trade

Exogenous Variables	Expected Sign	SLDC&DME	SLDC&LDC
1.Average Development Stage	+	+ (***)	+
2. Development Stage Differential	-	+ (***)	-
3. Average Market Size	+	+ (***)	+
4. Market Size Differential	-	+ (**)	+ (**)
5. Distance	-	- (***)	+

Note: SLDC&DC represent the IIT between the selected LDCs and DMEs; while SLDC&LDC represents the IIT between LDCs themselves.

[11] These studies consist of Loertscher and Wolter (1980), Havrylyshyn and Civan (1983), Tharakan (1984), and Balassa (1986a and b), respectively.