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An Analysis of Intra-Industry Trade between Japan, Malaysia and China*

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Abstract: This paper investigates the bilateral trade pattern between Japan, Malaysia and China (JMC) using the intra-industry trade (IIT) index analysis. Our empirical findings revealed the following. First, China shows a higher degree of IIT relation with Japan *vis-à-vis* Malaysia. Second, to the extent of whether rapid manufacturing development in China is affecting Malaysia's export to Japan, our analytical evidence demonstrates that the degree of overlapping exports to Japan by Malaysia and China has increased over time. Although this trend appears to be an indication of increasing competition from China in relation to Malaysia's products in the Japanese market, our empirical evidence – detailing the degree of product similarity between Malaysia and China using the unit value (UV) measurement – shows that both countries' exports actually comprise mainly vertically differentiated products or different segments of the market in Japan. Nevertheless, the results also reveal that, compared to Malaysia, China is rapidly increasing its export share in horizontally differentiated products or similar market segments.

Keywords: Japan, Malaysia, China, intra-industry trade (IIT), SITC Rev.2, ISIC Rev.3

JEL classifications: F14, F43, L11, L70

1. Introduction

In the past, trade patterns have been explained in terms of classical and neo-classical trade theories, incorporating comparative advantage.[1] Trade patterns were conceived mainly as inter-industry trade. However, the intensification of competition in the international market has necessitated moving beyond inter-industry explanations of trade. According to Krugman and Obstfeld (2003: 139), about one-fourth of world trade consists of intra-industry trade (IIT) which can be accounted for by the new trade theory. In line with the empirical evidence, this study sets out to investigate the pattern of trade between Japan, Malaysia and China (JMC) using the IIT index approach.

2. Literature Review

The Heckscher-Ohlin (H-O) theorem propounds that trade pattern is characterized by the homogeneity of manufactured products reflected by factor endowment and constant return to scale.[2] The assumption that production output is conditional to constant return to scale in this model implies that the relation between factor prices and commodity prices is inelastic. In other words, the H-O hypothesis ignores the productivity effects in the production process. By incorporating the effects of invention and innovation in production activities to rectify the H-O assumption on constant return to scale, Balassa (1989: 14) shows that the national comparative advantage and the pattern of inter-industry trade are highly correlated with productivity. In a later study, Neary (1985: 59-60) confirms that with trade liberalization, productivity differences also promote IIT activities between countries.

Although trade phenomenon through IIT was first observed by Balassa (1989: 41-62), the formal model was only later introduced by Grubel and Lloyd (1975). On that basis, many subsequent empirical studies have strengthened the theoretical explanation of IIT. In addition Jones (1968) and Helpman (1981) convincingly argue that the foundation to the increasing trend of IIT pattern in the global market is attributed to product differentiation being determined by monopolistic competition and the economies of scale.[3] Under the influences of these economic properties – described as "multi-behavioral" trade characteristics by Jones (1968) – it is expected that the IIT pattern is likely to become more prominent in absolute and relative terms with respect to inter-industry trade.[4]

Krugman (1996: 152) stresses that the heart of the debate on IIT is related to the factors that drive technology and technological changes. In other words, the rising trend of IIT is considered as a manifestation of a continuous process of innovation – product innovation and productivity innovation – especially by advanced countries. According to Porter (1990), innovation is a result of competition in the international market. The intensification of international competition expedites or shortens the life cycle of a particular product. The introduction of new products or the renewal of an existing product life cycle (PLC) and the relocation of the manufacturing process of a matured product to another country especially by means of FDIs have contributed to the diversity of intra-industry goods.[5]

Although the fundamental concept of IIT lies in the trade of homogenous goods, product differentiation between different countries is important in determining the pattern of IIT. There are two sets of product differentiation in the IIT concept: (i) horizontal IIT and (ii) vertical IIT.[6] The former refers to products of a similar quality with slight differences in term of characteristics, while the latter refers to products distinguished by differences in both quality and characteristics. In this regard, Fontagné *et al.* (1997) assert that product differentiation is one of the central complex features in the study of international trade.

3. Methodology

In order to obtain robust results for discussion, IIT analysis in this study is conducted using several methods as proposed by other studies. In addition, this study has also established a set of data customization procedures.

To carry out the IIT analysis, we adopt the formula proposed by Grubel and Lloyd (1975) as expressed in equation 1.

$$IIT_i = 1 - \frac{|x_i - m_i|}{x_i + m_i} \tag{1}$$

where IIT_i is the intra-industry trade index for commodity i
x_i is total export of commodity i
m_i is total import of commodity i

To measure the mean of IIT from aggregate commodity, based on Grubel and Lloyd (1975), we use the following formula:[7]

$$\overline{IIT}_i = \frac{\sum_i^n (x_i + m_i) - \sum_i^n |x_i - m_i|}{\sum_i^n (x_i + m_i) - \left|\sum_i^n x_i - \sum_i^n m_i\right|} \tag{2}$$

However, according to Aquino (1978), equation 2 contains a downward bias where the measurement is largely affected by trade imbalance, and therefore, a new model is proposed as shown in equation 3.

$$\xi = \frac{1}{n}\sum_{i=1}^{n} \frac{\log \frac{x_{ab}^i}{x_{ab}}}{\log \frac{x_{ab}^{gi}}{x_{ab}^g}} = \frac{1}{n}\sum_{i=1}^{n} \xi_i \text{ and } \mu = \frac{1}{n}\sum_{i=1}^{n} \frac{\log \frac{m_{ab}^i}{m_{ab}}}{\log \frac{m_{ab}^{gi}}{m_{ab}^g}} = \frac{1}{n}\sum_{i=1}^{n} \mu_i \tag{3}$$

where x_{ab} total exports of country a to country b
m_{ab} total imports of country a from country b
x_{ab}^i exports of country a to country b of commodity i

m^{i}_{ab} imports of country a from country b of commodity *i*

x^{gi}_{ab} total intra-industry export of country a and b for the group of commodity *i*

m^{gi}_{ab} total intra-industry import of country a and b for the group of commodity *i*

x^{g}_{ab} total a and b intra-industry export

m^{g}_{ab} total a and b intra-industry import

Technical examination of equations 2 and 3 however shows that the Grubel-Lloyd equation provides a more standardized result.[8] According to Kol and Mennes (1983), the Grubel-Lloyd method focuses on trade flow in measuring the mean of IIT of aggregate commodity. Hence, alternatively, they suggest another method, which was initially proposed by Michaely (1962)[9] as shown in equation 4, that focuses on trade pattern.[10] As such, our empirical inquiries in this study adopt the Grubel-Lloyd equation and its adjusted formula proposed by Michaely (1962).

$$F = 1 - \tfrac{1}{2} \sum \left| \frac{x_i}{\sum_{i=1}^{n} x_i} - \frac{m_i}{\sum_{i=1}^{n} m_i} \right| \tag{4}$$

Besides measuring the aggregated IIT index, our inquiry attempts to cluster trade data from IIT indices based on the following procedure. First, for the purpose of simplification, the analysis emphasizes commodities with an annual export share equal to or more than 0.1% (see equation 5). Based on this specification, our findings show that commodities with an annual export share equal or greater than 0.1% represent a significant amount of the total trade value between the countries concerned, i.e., an average of 96.03% (230 commodities) for Japan and Malaysia (JM), 94.94% (367 commodities) for Japan and China (JC), and 95.91% (343 commodities) for Malaysia and China (MC).

$$\in C_{xt} = C^{tv \geq 0.1}_{a-b1980} \cup C^{tv \geq 0.1}_{a-b1985} \cup C^{tv \geq 0.1}_{a-b1990} \cup C^{tv \geq 0.1}_{a-b1995} \cup C^{tv \geq 0.1}_{a-b2000} \cup C^{tv \geq 0.1}_{a-b2005} \tag{5}$$

where $\in C_{xt}$ is a set of commodities with pre-defined export threshold

C represents a particular commodity

$a - b$ is trade between country a and country b

$tv \geq 0.1$ indicates trade value $\geq 0.1\%$ of annual trade value

Second, under our specification, all commodities are classified into three groups according to the pre-defined IIT index range as shown in equation 6.[11] Here, we define $0 \leq IIT \leq 0.33$ as low IIT, $0.33 \leq IIT \leq 0.66$ as medium IIT, and $0.66 \leq IIT \leq 1.00$ as high IIT.

$$\text{(a)}\ 0 \leq IIT \leq 0.33 \qquad (6)$$

$$\text{(b)}\ 0.33 < IIT < 0.66$$

$$\text{(c)}\ 0.66 \leq IIT \leq 1.00$$

The third step involves the process of reflecting on the proposition of product differentiation by classifying the commodity into horizontal IIT (H-IIT) and vertical IIT (V-IIT). The gap between horizontal and vertical IIT is determined by the quality of export and import of the same commodity, which according to Stiglitz (1987) can be reflected by its relative price. In order to estimate the unit value (UV) of each commodity, this study adopts the method as discussed in Greenaway *et al*. (1995) and Fontagné *et al*. (1997) (see equation 7). In earlier studies of horizontal and vertical IIT, the price wedge in the identification of both types of IIT is 15%.[12] However, this study adopts a 25% price wedge in order to take into account the argument pointed out by Fukao *et al*. (2002).[13]

$$\text{(a)}\ 1-\alpha \leq \frac{UV_{ab}^{x}}{UV_{ab}^{m}} \leq 1+\alpha \qquad (7)$$

$$\text{(b)}\ \frac{UV_{ab}^{x}}{UV_{ab}^{m}} < 1-\alpha \quad \text{or} \quad 1+\alpha < \frac{UV_{ab}^{x}}{UV_{ab}^{m}}$$

where UV_{ab}^{x} is unit value of commodity exported by country a to country b

UV_{ab}^{m} is unit value of commodity imported by country a from country b

α is the wedge used to define the border between horizontal and vertical IIT

Equation 7(a) represents horizontal IIT, whereas equation 7(b) represents vertical IIT. The unit value of each commodity is obtained by dividing the total value of import or export of a particular commodity with the quantity traded. Where the consistency of analytical data is concerned, there are commodities where data on traded quantity in certain years between Japan and Malaysia and between Japan and China are not available. In order to obtain a comparable output of unit value for trade between these countries, we organize the commodities according to the availability of records of traded quantity. There are four categories of commodities as described by equation 6.

(a) $C_{JM}^{+tr} \cap C_{JC}^{+tr}$ (8)

(b) $C_{JM}^{+tr} \cap C_{JC}^{-tr}$

(c) $C_{JM}^{-tr} \cap C_{JC}^{+tr}$

(d) $C_{JM}^{-tr} \cap C_{JC}^{-tr}$

where C represents a particular commodity
JM trade between Japan and Malaysia
JC trade between Japan and China
$+tr$ indicates that record on traded quantity is available
$-tr$ indicates that record on traded quantity is not available

3.1 Data Sources

Our data source in this empirical inquiry is obtained from the United Nations Commodity Trade Statistics Database (UN Comtrade Database).[14] Our study employs the Standard International Trade Classification Revision Two (SITC Rev.2) (4-digit code) since the trade data cover a longer time series. The SITC classification is based on product contents and major production inputs, instead of an activity involved within a production process. As such, this classification method does not describe the corresponding industrial category of each commodity.[15] In order to mitigate this shortcoming, this study uses the commodity-industry classification correspondence list provided by the United Nations Statistics Division (UNSD) and EUROSTAT.[16] The SITC Rev.2 to ISIC Rev.3 concordance table is created based on a proxy method as illustrated in Appendix 1.

4. Output and Discussions

Table 1 tabulates the mean of aggregated IIT using the Grubel-Lloyd formula and Michaely (1962) method. The degree of IIT index is weighted by the relative value of trade, and the adjustment of trade imbalance in this model is made at the aggregated amount. Looking at the relative value across the selected years, in general the mean of aggregate IIT index for all sectors has increased toward the end of the time series. This tendency suggests that IIT between Japan and Malaysia, Japan and China, and Malaysia and China (except for SITC.2 (7) – "machinery and transport equipment") has been strengthened. With regard to SITC.2 (7), the increasing trend in IIT is observed only between Malaysia and China. The relative values of IIT indices

Table 1: Aggregate IIT of JM, JC and MC for Selected Years Based on the Grubel-Lloyd Method

	SITC Rev.2 Commodity Category	Japan-Malaysia						Japan-China						Malaysia-China					
		1980	1985	1990	1995	2000	2005	1980	1985	1990	1995	2000	2005	1980	1985	1990	1995	2000	2005
All Traded Commodity	SITC.2 (0)	0.068	0.123	0.359	0.577	0.628	0.594	0.678	0.243	0.599	0.950	0.971	0.977	0.338	0.015	0.021	0.167	0.324	0.663
	SITC.2 (1)	0	0	0.303	0.145	0.831	0.847	0.253	0.653	1	0.847	1	1	1	0	1	0.250	0.267	0.581
	SITC.2 (2)	0.077	0.116	0.121	0.112	0.055	0.084	0.004	0.023	0.061	0.094	0.112	0.064	0.000	0	0.001	0.038	0.054	0.224
	SITC.2 (3)	0.003	0.034	0.028	0.627	0.125	0.426	0.105	0.230	0.859	0.069	0.312	0.362	0	0	0	0.018	0.139	0.430
	SITC.2 (4)	0.422	0.053	0.463	0.554	0.676	0.545	0.309	0.006	0.146	0.579	0.490	0.630	0.092	0	0.163	0.240	0.368	0.048
	SITC.2 (5)	0.538	0.277	0.471	0.452	0.691	0.540	0.433	0.281	0.358	0.356	0.451	0.577	0.233	0.088	0.156	0.210	0.165	0.327
	SITC.2 (6)	0.032	0.048	0.197	0.202	0.222	0.191	0.093	0.093	0.166	0.202	0.193	0.262	0.158	0.077	0.137	0.074	0.254	0.506
	SITC.2 (7)	0.823	0.997	0.878	0.477	0.453	0.541	0.873	1	0.656	0.683	0.512	0.450	0.180	0.210	0.329	0.502	0.627	0.816
	SITC.2 (8)	0.529	0.593	0.493	0.476	0.459	0.574	0.046	0.046	0.259	0.436	0.537	0.545	1	1	0.290	0.565	0.652	0.528
	SITC.2 (9)	0.989	0.914	0.992	0.874	0.999	1.000	0.864	0.995	0.979	0.976	0.989	0.991	0.739	0.235	0.377	0.986	0.995	0.698
Commodity with 0.1% Export Threshold	SITC.2 (0)	0.076	0.207	0.458	0.585	0.702	0.635	0.863	0.285	0.638	0.985	0.995	0.991	0.338	0.016	0.018	0.160	0.320	0.837
	SITC.2 (1)	–	–	–	–	–	–	–	–	–	–	–	–	0	0	1	0.120	1	0.578
	SITC.2 (2)	0.072	0.104	0.103	0.066	0.038	0.068	0.003	0.019	0.056	0.077	0.099	0.068	0.000	0	0.001	0.037	0.047	0.214
	SITC.2 (3)	0.008	0.048	0.043	0.647	0.124	0.402	0.103	0.210	0.861	0.063	0.304	0.330	0	0	0	0.018	0.141	0.433
	SITC.2 (4)	1	1	1	1	1	1	1	1	1	1	1	1	0.093	0	0.169	0.264	0.521	0.049
	SITC.2 (5)	0.700	0.302	0.510	0.442	0.697	0.531	0.473	0.300	0.378	0.361	0.455	0.580	0.233	0.090	0.149	0.199	0.163	0.338
	SITC.2 (6)	0.024	0.040	0.165	0.194	0.205	0.167	0.090	0.087	0.160	0.190	0.174	0.244	0.157	0.067	0.140	0.064	0.235	0.487
	SITC.2 (7)	0.823	1	0.879	0.475	0.453	0.542	0.985	1	0.653	0.687	0.512	0.449	0.180	0.157	0.310	0.499	0.626	0.817
	SITC.2 (8)	0.571	0.600	0.625	0.527	0.481	0.600	0.041	0.044	0.270	0.440	0.535	0.544	1	1	0.271	0.547	0.644	0.526
	SITC.2 (9)	1	0.918	0.992	0.874	1	1	1	0.995	1	0.999	1	1	1.000	1.000	0.389	0.986	1	0.698

Notes: Calculation of the index is based on the following:
(i) Grubel-Lloyd aggregate IIT formula as expressed in equation 2.
(ii) The value of exports and imports reported by the first mentioned country in each column.

Source: Computed from UN Comtrade database (see Appendix 2 for SITC.2 – 1-digit code definitions).

across a combination of countries suggest certain peculiar characteristics of IIT, where the relative degrees of IIT indices between the three countries are consistent with several aspects highlighted by Balassa (1966), Balassa (1989: 18-30) and Gavelin and Lundberg (1983).[17]

First, the relative intensity of IIT correlates with the geographical distance of trading nations. A market that is geographically closer is more accessible and therefore gains greater advantage in terms of transportation cost. In this regard, it is also plausible that the IIT index is inclined to be higher because consumers who are geographically closer are likely to share a higher similarity in certain respects such as taste and needs that are related to culture, religion and climate. Therefore, we observe that the IIT index of SITC.2 (0), SITC.2 (1) and SITC.2 (4) (comprising mainly food-related products) between Japan and China is higher than that between Japan and Malaysia. Geographical proximity and similarity however are less pertinent to the export-oriented manufacturing sector, which in the case of developing countries is chiefly related to FDI activities. For SITC.2 (7) in particular, the underlying reason for the declining IIT index trend is the shift from horizontal integration to vertical integration strategy by the multinational corporations (MNCs). According to UNCTAD (2002: 121), such a tendency is mainly influenced by the falling barriers to international transactions since late 1980s.

Second, the relative intensity of IIT between Japan, Malaysia and China is distinguished by the relative gap in per capita income. The effects of per capita income in this respect can be observed especially in manufacturing products, which are characterized by their cross-country division of labour. As shown in Table 1, the IIT indices of SITC.2 (6), SITC.2 (7) and SITC.2 (8) between Japan and Malaysia in general are respectively slightly higher than those of Japan and China, but slightly lower than Malaysia and China's bilateral trade. However, it can be seen that Japan-China IIT is increasing and has even surpassed that of Japan and Malaysia throughout the time series.

To examine the relative degree of aggregate IIT according to sectoral division, we adopt the Michaely method. As shown in Table 2, the index of IIT is relatively higher for all combinations of economic activities that are related to SITC.2 (5), SITC.2 (7), and SITC.2 (8). In SITC.2 (4), significant differences between Japan-Malaysia and Japan-China IIT indices could be attributed to distance and culture. Meanwhile the relatively lower index of IIT in SITC.2 (6) or "manufactured goods classified chiefly by materials" as compared to the manufacturing sector classified as SITC.2 (7) and SITC.2 (8) could be largely ascribed to differences in factor endowment and regional division of labour.

The robustness of the Grubel and Lloyd (1975) and Michaely (1962) methodologies in measuring the mean of aggregate IIT have been questioned

Table 2: Aggregate IIT of JM, JC and MC for Selected Years Based on the Michaely Method

	SITC Rev.2 Commodity Category	Japan-Malaysia						Japan-China						Malaysia-China					
		1980	1985	1990	1995	2000	2005	1980	1985	1990	1995	2000	2005	1980	1985	1990	1995	2000	2005
All Traded Commodity	SITC.2 (0)	0.049	0.112	0.087	0.279	0.194	0.247	0.119	0.054	0.094	0.191	0.204	0.281	0.080	0.005	0.015	0.113	0.089	0.314
	SITC.2 (1)	1-Way	1-Way	0.028	0.005	0.616	0.698	0.135	0.416	0.554	0.390	0.475	0.587	0.028	1-Way	0.077	0.164	0.266	0.289
	SITC.2 (2)	0.014	0.013	0.011	0.025	0.020	0.030	0.027	0.021	0.031	0.062	0.073	0.070	0	0	0.001	0.030	0.039	0.098
	SITC.2 (3)	0	0.028	0.022	0.016	0.013	0.019	0.010	0.019	0.089	0.041	0.130	0.053	0	0	0	0.002	0.034	0.378
	SITC.2 (4)	0.005	0.019	0.109	0.198	0.103	0.107	0.281	0.006	0.088	0.161	0.403	0.353	0.024	0	0.084	0.006	0.084	0.037
	SITC.2 (5)	0.075	0.111	0.210	0.255	0.454	0.462	0.251	0.210	0.321	0.312	0.328	0.394	0.062	0.084	0.055	0.112	0.148	0.286
	SITC.2 (6)	0.027	0.031	0.115	0.173	0.196	0.166	0.028	0.028	0.163	0.200	0.188	0.254	0.074	0.041	0.082	0.070	0.225	0.353
	SITC.2 (7)	0.102	0.237	0.418	0.340	0.386	0.430	0.072	0.136	0.345	0.438	0.477	0.449	0.074	0.105	0.188	0.408	0.570	0.579
	SITC.2 (8)	0.241	0.252	0.419	0.412	0.456	0.505	0.035	0.041	0.112	0.169	0.168	0.230	0.019	0.018	0.107	0.310	0.311	0.427
	SITC.2 (9)	0.838	0.912	0.992	0.871	0.817	0.779	0.861	0.980	0.978	0.970	0.989	0.950	0.739	0.141	0.377	0.971	0.993	0.679
Commodity with 0.1% Export Threshold	SITC.2 (0)	0.056	0.109	0.087	0.336	0.230	0.172	0.188	0.062	0.092	0.187	0.205	0.268	0.082	0.005	0.014	0.113	0.088	0.330
	SITC.2 (1)	–	–	–	–	–	–	–	–	–	–	–	–	1-Way	1-Way	0.089	0.092	0.442	0.285
	SITC.2 (2)	0.012	0.008	0.007	0.016	0.016	0.026	0.002	0.012	0.018	0.049	0.064	0.056	0	0	0.001	0.029	0.038	0.094
	SITC.2 (3)	0	0.036	0.024	0.016	0.020	0.019	0.009	0.019	0.089	0.039	0.126	0.046	0	0	0	0.002	0.034	0.378
	SITC.2 (4)	0.032	0.133	0.094	0.184	0.095	0.108	1	1	1	1	1	1	0.024	0.000	0.085	0.007	0.088	0.041
	SITC.2 (5)	0.085	0.149	0.243	0.270	0.514	0.528	0.262	0.218	0.336	0.315	0.322	0.380	0.063	0.086	0.054	0.106	0.145	0.290
	SITC.2 (6)	0.023	0.025	0.100	0.173	0.186	0.149	0.026	0.025	0.159	0.186	0.167	0.240	0.077	0.041	0.085	0.062	0.221	0.352
	SITC.2 (7)	0.103	0.242	0.424	0.340	0.389	0.434	0.075	0.133	0.343	0.439	0.478	0.449	0.081	0.086	0.184	0.409	0.574	0.582
	SITC.2 (8)	0.306	0.277	0.504	0.429	0.475	0.526	0.033	0.038	0.118	0.171	0.165	0.226	0.021	0.019	0.106	0.287	0.319	0.435
	SITC.2 (9)	0.838	0.916	0.992	0.871	0.817	0.779	1	0.995	0.998	0.996	0.992	0.959	1	1	0.389	0.984	0.998	0.679

Notes: Calculation of the index is based on the following:
(i) Michaely (1962) aggregate IIT formula as expressed in equation 4.
(ii) The value of export and import reported by the first mentioned country in each column.

Source: Computed from UN Comtrade database (see Appendix 2 for SITC.2 – 1-digit code definitions).

by Tharakan (1983), Glejser (1983), Kol and Mennes (1983), Schumacher (1983) and Havrylyshyn and Civan (1983). One of the main problems identified by Kol and Mennes (1983) is that both models address the issues related to the value and pattern of trade separately.[18] To remedy this shortcoming, Table 3 tabulates the relative value of annual trade share according to the pre-defined range of IIT index. This approach raises several interesting points.

First, significant changes of the trade pattern between Japan and Malaysia and between Japan and China can be traced back to the late 1980s and early 1990s. The history of structural changes in East Asian region during the same period reveals that these changes were induced by the large outflows of Japanese FDIs to ASEAN-4 after the 1985 Plaza Accord as well as the second wave of Japanese FDI flows to China after the Asian Financial Crisis (AFC) in 1997/1998. Considering the substantial importance of Japanese FDI in reshaping the pattern of regional trade activities on the one hand and its role in filling the investment-saving gap and technological gap in developing countries such as Malaysia and China on the other hand, it has become empirically clear that the rapid process of Japanese production realignment in East Asia has influenced the rise of IIT indices between Malaysia and China in the 1990s and 2000s.[19]

Second, although the trade shares of commodities with horizontal IIT index range $IIT \geq 0.666$ between Japan and Malaysia and Japan and China, respectively, have increased over the years, by and large, the overall trade competitiveness is still largely determined by national comparative advantage, which in turn reflects the relative development gap between trading partners. This is indicated by a higher trade share of $IIT \geq 0.666$ commodities between Japan and Malaysia compared to Japan and China but lower than Malaysia and China.

Third, as far as manufacturing activities are concerned, according to sectoral share of annual trade and range of IIT index, trade between Japan and Malaysia and Japan and China is concentrated more on those commodities classified as SITC.2 (7), which accounted for 47.44% and 42.8% respectively of the annual bilateral trade share between these countries in 2005. However, looking at the relative trade share across the period, the trade pattern between Japan and Malaysia and between Japan and China has gradually shifted to two-way trade activities. This tendency fortifies the earlier argument that the rising share of two-way trade in both combinations is largely attributed to the bulk inflows of Japanese FDIs to these countries. According to Yun (2004), by 1999, approximately one-third of major Japanese electronics companies' overseas plants were concentrated in Southeast Asia, whereby those companies have followed their major buyers in creating the *keiretsu*-like industrial clusters in host nations.

Table 3: Export-import Share According to Criteria in Equation 5 and IIT Index Group in Equation 6

	Trade Share Threshold	IIT Category \ Trade Flow	Export (%)						Import (%)						Total Trade (%)					
			1980	1985	1990	1995	2000	2005	1980	1985	1990	1995	2000	2005	1980	1985	1990	1995	2000	2005
Japan-Malaysia	Trade Value Less than 0.1%		8.33	8.75	5.90	4.47	5.03	5.76	0.68	0.62	2.28	3.49	2.48	3.00	3.53	3.34	4.11	4.09	3.72	0.01
	Trade Value More than 0.1%	IIT≤0.333 SITC.2 (0)	0.93	0.61	0.04	0.02	0.01	0.01	1.69	1.27	1.72	1.49	0.79	0.80	1.41	1.05	0.87	0.59	0.41	0.43
		SITC.2 (1)																		
		SITC.2 (2)	0.53	0.30	0.43	0.46	0.41	0.65	44.35	31.64	36.63	15.29	4.77	3.38	28.02	21.16	18.39	6.19	2.64	2.10
		SITC.2 (3)	0.07	0.11	0.10	0.00	0.17	0.00	37.89	54.71	37.14	22.73	22.62	31.39	23.80	36.45	18.48	8.78	11.63	16.71
		SITC.2 (4)	0.00	0.00	0.00	0.00	0.00	0.00	2.69	2.58	2.10	3.10	1.32	2.08	1.69	1.72	1.04	1.20	0.68	1.11
		SITC.2 (5)	4.10	3.33	4.03	4.07	3.13	2.44	0.00	0.00	0.76	1.39	0.89	1.61	1.53	1.11	2.41	3.04	1.98	2.00
		SITC.2 (6)	22.66	18.19	14.14	10.27	8.59	10.72	9.92	4.42	3.93	6.80	5.37	6.96	14.67	9.03	9.08	8.93	6.94	8.72
		SITC.2 (7)	56.86	58.87	48.36	60.85	36.25	27.74	0.11	0.39	1.81	21.67	25.58	15.14	21.26	19.95	25.27	45.71	30.80	21.03
		SITC.2 (8)	1.47	3.99	2.73	2.44	2.80	1.90	0.08	0.18	0.74	1.84	2.37	2.96	0.60	1.45	1.75	2.21	2.58	2.46
		SITC.2 (9)	0.12	0.07	0.01	0.19		2.51	0.00	0.00	0.00	0.01		0.39	0.04	0.02	0.01	0.12		1.38
		0.333>IIT<0.666 SITC.2 (0)		0.14		0.05	0.00	0.00		0.15		0.03	0.01	0.01		0.15		0.04	0.01	0.01
		SITC.2 (1)																		
		SITC.2 (2)		0.17	0.03					0.02	0.07					0.07	0.05			
		SITC.2 (3)						0.09						0.03						0.06
		SITC.2 (4)																		
		SITC.2 (5)		0.49	0.28	0.89	0.37	1.03		0.90	0.34	0.81	0.35	1.26		0.76	0.31	0.86	0.36	1.15
		SITC.2 (6)	0.30	0.07	0.17	1.70	2.32	2.25	0.13	0.02	0.08	1.23	0.85	0.63	0.19	0.03	0.12	1.52	1.57	1.39
		SITC.2 (7)	1.57	0.05	16.22	7.16	15.29	13.04	0.35	0.01	4.58	6.77	10.71	6.05	0.80	0.02	10.44	7.01	12.95	9.32
		SITC.2 (8)	0.04	0.38	2.25	1.10	1.00	0.72	0.11	0.07	0.89	1.65	1.25	0.71	0.08	0.18	1.58	1.31	1.12	0.72
		SITC.2 (9)		0.72	1.51	1.22	1.30			1.72	3.56	4.44	0.26			1.38	2.53	2.46	0.77	
		IIT≥0.666 SITC.2 (0)	0.00		0.07		0.04	0.07	0.00		0.04		0.02	0.04	0.00		0.06		0.03	0.05
		SITC.2 (1)																		
		SITC.2 (2)				0.02						0.03						0.02		
		SITC.2 (3)				0.12						0.12						0.12		
		SITC.2 (4)																		
		SITC.2 (5)	0.36	0.09	0.81	0.10	2.45	2.41	0.30	0.06	0.99	0.20	1.78	2.22	0.32	0.07	0.90	0.14	2.11	2.31
		SITC.2 (6)	0.15	0.32	0.64	0.28	0.62	0.85	0.07	0.17	0.46	0.31	0.48	0.69	0.10	0.22	0.55	0.29	0.55	0.77
		SITC.2 (7)	1.37	3.21	2.08	3.37	14.55	19.64	1.00	0.99	1.69	4.42	13.81	15.03	1.14	1.74	1.88	3.78	14.17	17.19
		SITC.2 (8)	0.54	0.14	0.21	1.25	2.34	3.11	0.39	0.08	0.18	2.19	1.91	2.48	0.45	0.10	0.19	1.61	2.12	2.78
		SITC.2 (9)	0.60				3.32	5.05	0.25				2.39	3.12	0.38				2.84	4.02

Table 3: (continued)

Trade Share Threshold		Trade Flow / IIT Category	Export (%) 1980	1985	1990	1995	2000	2005	Import (%) 1980	1985	1990	1995	2000	2005	Total Trade (%) 1980	1985	1990	1995	2000	2005
Japan-China	Trade Value Less than 0.1%		2.15	2.63	6.05	5.80	6.43	5.71	2.93	2.64	3.15	3.76	4.45	5.60	2.51	2.63	4.13	4.53	5.15	5.65
Trade Value More than 0.1%	IIT≤0.333	SITC.2 (0)	0.00	0.11	0.18	0.16	0.20	0.10	10.20	13.85	14.98	12.35	9.87	6.16	4.69	4.81	9.98	7.72	6.43	3.60
		SITC.2 (1)																		
		SITC.2 (2)	3.38	1.89	3.17	2.37	2.12	3.11	10.39	11.61	8.84	3.78	2.38	1.20	6.60	5.21	6.93	3.25	2.29	2.01
		SITC.2 (3)	0.08	0.11	0.33	1.41	0.65	0.16	55.52	46.24	24.26	5.92	3.81	2.48	25.57	15.88	16.18	4.21	2.69	1.50
		SITC.2 (4)	0.01	0.00	0.00	0.00	0.00		0.20	0.18	0.08	0.03	0.01		0.10	0.06	0.06	0.02	0.00	
		SITC.2 (5)	8.35	4.22	5.49	5.53	8.36	7.57	1.89	2.69	2.49	1.94	1.24	0.90	5.38	3.70	3.50	3.30	3.77	3.72
		SITC.2 (6)	39.88	31.71	19.04	15.80	16.18	8.77	8.10	8.19	9.65	11.35	8.47	7.16	25.27	23.67	12.82	13.04	11.21	7.84
		SITC.2 (7)	39.46	53.03	37.90	30.97	20.78	14.86	0.08	0.24	1.65	1.89	7.82	17.93	21.35	34.98	13.89	12.91	12.43	16.63
		SITC.2 (8)	3.03	3.84	4.43	3.80	3.05	1.20	7.73	9.72	26.39	42.58	39.95	28.22	5.19	5.85	18.97	27.88	26.83	16.80
		SITC.2 (9)	0.00	0.01				5.05	0.00	0.00				0.74	0.00	0.00				2.56
	0.333>IIT<0.666	SITC.2 (0)	0.01		0.18	0.06		0.07	0.03		0.26	0.09		0.24	0.02		0.23	0.07		0.17
		SITC.2 (1)																		
		SITC.2 (2)		0.05	0.03	0.01	0.25	0.06		0.08	0.04	0.02	0.08	0.02		0.06	0.04	0.01	0.14	0.04
		SITC.2 (3)						0.04						0.08						0.06
		SITC.2 (4)						0.00						0.01						0.01
		SITC.2 (5)	0.96	0.48	3.95	1.52	2.07	1.67	0.55	0.27	0.79	0.43	0.75	1.24	0.77	0.40	1.85	0.84	1.22	1.42
		SITC.2 (6)	0.05	0.21	4.87	3.58	2.37	4.19	0.20	1.22	2.27	1.11	0.71	1.89	0.12	0.56	3.15	2.05	1.30	2.86
		SITC.2 (7)	0.00		6.05	14.47	12.57	18.58	0.00		1.29	6.40	6.71	7.11	0.00		2.90	9.46	8.79	11.96
		SITC.2 (8)	0.05	0.11	0.64	1.31	2.10	5.76	0.06	0.12	0.27	1.51	2.35	3.69	0.05	0.11	0.40	1.44	2.26	4.57
		SITC.2 (9)	1.20			1.50	0.04	0.20	0.44			0.36	0.00	0.06	0.85			0.79	0.02	0.12
	IIT≥0.666	SITC.2 (0)				0.16	0.20	0.23				0.11	0.20	0.26				0.13	0.20	0.25
		SITC.2 (1)																		
		SITC.2 (2)			0.11	0.09					0.07	0.08					0.08	0.08		
		SITC.2 (3)			0.85	0.01	0.14	0.08			0.43	0.01	0.12	0.04			0.57	0.01	0.13	0.06
		SITC.2 (4)																		
		SITC.2 (5)	0.80	0.42	1.36	0.89	0.55	1.71	0.95	0.55	0.65	0.50	0.35	0.91	0.87	0.47	0.89	0.65	0.42	1.25
		SITC.2 (6)	0.58	0.09	1.19	2.54	1.17	1.29	0.72	0.09	0.80	1.34	0.67	0.90	0.64	0.09	0.93	1.79	0.85	1.06
		SITC.2 (7)	0.00		2.32	7.75	16.36	17.24	0.01		0.83	4.30	8.61	11.98	0.01		1.33	5.61	11.37	14.20
		SITC.2 (8)		0.01	0.37	0.27	1.84	2.32		0.02	0.26	0.15	0.65	1.18		0.01	0.29	0.20	1.08	1.66
		SITC.2 (9)		1.10	1.47	0.00	2.59			2.29	0.54	0.00	0.80			1.50	0.86	0.00	1.44	

Table 3: (continued)

	Trade Share Threshold	IIT	Trade Flow / IIT Category	Export (%) 1980	1985	1990	1995	2000	2005	Import (%) 1980	1985	1990	1995	2000	2005	Total Trade (%) 1980	1985	1990	1995	2000	2005
Malaysia-China	Trade Value Less than 0.1%			0.00	0.34	0.62	1.57	1.49	2.80	5.24	3.65	5.13	6.58	5.63	5.49	2.83	2.35	2.76	3.91	3.63	4.38
	Trade Value More than 0.1%	IIT≤0.333	SITC.2 (0)	0.08	2.57	1.57	1.17	0.61	0.15	31.08	37.25	25.70	10.56	14.06	2.88	16.80	23.69	13.03	5.56	7.57	1.76
			SITC.2 (1)	0.00	0.00	0.00	0.11	0.01	0.01	1.47	1.13	0.38	0.21	0.17	0.17	0.79	0.69	0.18	0.16	0.09	0.11
			SITC.2 (2)	86.35	82.12	19.43	9.18	9.18	9.20	9.22	15.71	13.63	3.74	2.85	0.56	44.76	41.69	16.67	6.64	5.91	4.10
			SITC.2 (3)	0.49	0.12	15.90	4.87	10.62	1.82	1.54	1.01	3.18	0.62	0.81	0.07	1.05	0.66	9.86	2.88	5.55	0.79
			SITC.2 (4)	11.62	10.59	47.78	38.41	11.20	13.02	0.17	0.29	0.22	0.05	0.09	0.10	5.45	4.32	25.19	20.49	5.46	5.40
			SITC.2 (5)	0.06	0.50	1.73	2.13	7.50	8.26	9.23	8.24	8.67	6.83	4.61	2.42	5.01	5.22	5.03	4.33	6.00	4.81
			SITC.2 (6)	1.09	3.12	6.94	25.22	7.62	2.93	28.13	23.50	27.01	31.94	8.84	5.55	15.67	15.53	16.47	28.36	8.25	4.47
			SITC.2 (7)	0.19	0.49	2.61	6.41	3.78	1.97	5.61	3.10	8.49	16.74	10.65	16.34	3.11	2.08	5.40	11.23	7.33	10.44
			SITC.2 (8)	0.00	0.00	0.54	0.38	0.38	1.72	8.17	6.00	4.86	6.62	5.41	3.17	4.41	3.66	2.60	3.29	2.98	2.57
			SITC.2 (9)		0.03	0.46	0.01		0.47		0.00	0.08	0.00		0.03		0.01	0.28	0.01		0.21
		0.333>IIT<0.666	SITC.2 (0)			0.01	0.05	0.05	0.46			0.03	0.03	0.19	0.96			0.02	0.04	0.12	0.76
			SITC.2 (1)			0.01			0.02			0.02			0.00			0.02			0.01
			SITC.2 (2)					0.00	0.29					0.01	0.11					0.01	0.18
			SITC.2 (3)			0.00	0.00	0.35	1.06			0.00	0.01	0.13	1.66			0.00	0.01	0.23	1.41
			SITC.2 (4)	0.00		0.02		0.04		0.00		0.01		0.02		0.00		0.01		0.03	
			SITC.2 (5)	0.07		0.01	0.33	1.08	2.23	0.02		0.05	0.16	0.55	0.87	0.04		0.03	0.25	0.81	1.43
			SITC.2 (6)	0.03		0.18	1.29	1.88	1.70	0.12		0.05	1.56	1.36	1.63	0.08		0.11	1.41	1.61	1.66
			SITC.2 (7)		0.07	0.09	4.15	29.26	15.13		0.06	0.19	6.79	29.59	34.74		0.06	0.14	5.38	29.43	26.69
			SITC.2 (8)		0.03	0.03	0.51	0.48	1.89		0.07	0.09	0.67	0.44	1.92		0.06	0.05	0.58	0.46	1.91
			SITC.2 (9)	0.01			0.50	0.90	0.93	0.00			2.82	1.71	2.11	0.01			1.59	1.32	1.63
		IIT≥0.666	SITC.2 (0)				0.06		0.04				0.06		0.02				0.06		
			SITC.2 (1)																		0.03
			SITC.2 (2)				0.02						0.04						0.03		
			SITC.2 (3)				0.00		0.05				0.00		0.04				0.00		0.04
			SITC.2 (4)				0.02						0.05						0.03		
			SITC.2 (5)			0.37	0.62	0.19	0.40			0.23	0.48	0.20	0.20			0.31	0.55	0.19	0.29
			SITC.2 (6)			0.65	0.34	1.72	2.26			0.83	0.33	1.33	1.45			0.74	0.33	1.52	1.78
			SITC.2 (7)			0.91	2.44	9.84	30.37			1.03	2.84	9.77	16.96			0.97	2.63	9.80	22.46
			SITC.2 (8)			0.14	0.22	1.84	0.81			0.11	0.30	1.60	0.53			0.13	0.26	1.71	0.65
			SITC.2 (9)																		

Source: Computed from UN Comtrade database (see Appendix 2 for SITC.2 – 1-digit code definitions).

Fourth, in terms of the adverse impact of China's rapid economic development on Malaysia's bilateral trade pattern with Japan, our analytical results show that the relative degrees of IIT index and trade share of overlapping commodities with respect to export to Japan from Malaysia and China have changed across time and across sectors.

In the past, the volume of trade for commodities with trade overlaps between Japan and Malaysia and between Japan and China was characterized by a low IIT index (see Table 4). Before the 1990s, trade between these countries was largely distinguished by their development gap (i.e. trade specialization characterized by different labour productivity). However, towards the end of the period under study, the trade pattern for this category of commodities exhibits the following two features. Firstly, the expansion of two-way trade activities between Japan and Malaysia and between Japan and China. Secondly, in many cases, the expansion exhibits different degrees of IIT index, that is, when Japan-Malaysia's IIT index is higher, Japan-China's IIT index tends to be lower for a particular commodity.

The empirical evidence implies that although Japan's IIT value with Malaysia and China has increased throughout the period, the relative degree of IIT index is different across industries and commodities.

Figure 1 summarizes the value of trade between Japan and Malaysia and between Japan and China according to product differentiation and IIT index range. The findings based on horizontal and vertical IIT reveal several salient features of the trade pattern between Japan and Malaysia and Japan and China.

(a) Product Differentiation across Development Gap

As discussed earlier, we can observe that a bulk of trade shares between Japan and Malaysia and between Japan and China is attributed to one-way trade with no overlapping export from Malaysia and China to Japan. This reflects the prominence of these countries' comparative advantage in their trade pattern. However, throughout the time series, our empirical results illustrate that the relative share of trade according to national comparative advantage has gradually shifted to IIT trade activities especially in vertically differentiated products.

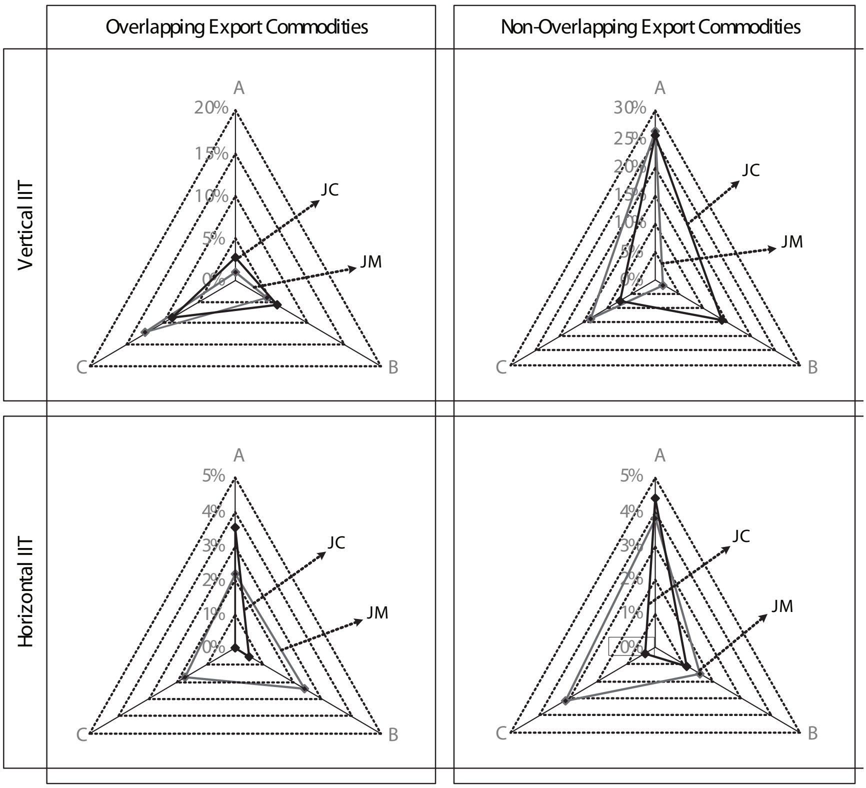
For example in 1980, more than half of the Japan-Malaysia annual trade and more than one-fourth of the Japan-China annual trade was attributed to one-way trade activities. By 2005, the relative share of such trade activity between Japan and Malaysia and between Japan and China had declined to 4.8% and 2.5%, respectively. The gap was subsequently filled by IIT in vertically differentiated products, which in 2005 accounted for about 58.2% and 65.7% of annual trade value between Japan and Malaysia and between

Table 4: Trade Composition According to IIT Index Group for Commodities with Annual Trade Value Greater than 0.1%

Trade	IIT Group	JC						JM					
		1980	1985	1990	1995	2000	2005	1980	1985	1990	1995	2000	2005
Overlaps	Cross Range	4.21	4.19	10.07	19.04	29.67	34.55	4.10	4.98	18.94	31.46	43.18	35.71
	IIT<0.3333	67.72	68.20	39.37	26.37	21.28	19.19	82.60	66.82	55.90	44.49	32.23	23.17
	0.3333<IIT<0.6666		0.02	1.61	2.73	1.64	2.66		0.03	2.72	4.73	1.63	6.53
	IIT>0.6666		0.06	0.46	1.67	2.30	9.76		0.07	0.77	1.71	4.01	7.29
Overlaps (Total)		71.93	72.47	51.51	49.81	54.89	66.16	86.70	71.90	78.33	82.39	81.05	72.70
JC Only 24.23		23.56	42.91	44.27	38.62	26.84							
JM Only								8.98	24.06	16.81	12.70	14.42	22.26
Grand Total		96.16	96.03	94.42	94.08	93.51	93.00	95.68	95.96	95.14	95.09	95.47	94.96

Source: Computed based on UN Comtrade database.

Figure 1: IIT Comparisons between JM and JC (percentage of annual trade share in 2005)



Notes: A – $IIT \leq 0.333$
B – $0.333 < IIT < 0.666$
C – $IIT > 0.666$

Source: Authors.

Japan and China, respectively.[20] The evolution of this pattern of trade is well captured by investment development path theory[21] and catching up theory,[22] which reflects the technological gap of Malaysia and China compared with Japan. For horizontally differentiated products, although the relative trade share between Japan and Malaysia and between Japan and China is still low – namely 22.7% and 14.1%, respectively – the results exhibit an increasing trend in trade value attributed to this category of commodities. This can be considered as an outcome of Malaysia's and China's transition from lower-capacity in the 1980s to higher value-added manufacturing activities after a series of profound structural transformation from the late 1980s onwards.

(b) Product Differentiation and IIT Index Range

As already discussed, the average IIT index between Japan and Malaysia and between Japan and China is very low, namely, below 0.333. In light of theoretical explanations of the determinants of IIT as propounded by Bergstrand (1983), Gavelin and Lundberg (1983), Greenaway (1983), Greenaway *et al*. (1995), Havrylyshyn and Civan (1983), Grubel and Lloyd (1993), Jayant *et al*. (1999), Kandogan (2003), Fontagné *et al*. (2005) and Abdul and Robert (2006), on the one hand the IIT index and the degree of product differentiation are considered as two different stages of IIT, which in turn reflect the extent of the development gap between trading nations. In other words, our empirical findings suggest that the tendency for trade in horizontally differentiated products is observable after trade between the countries concerned reached a higher average IIT index. Correspondingly, trade patterns between Japan and Malaysia and between Japan and China are consistent with this argument where their low average values of IIT index are largely characterized by vertical product differentiation. On the other hand, the degrees of product differentiation also correspond with other factors such as culture, religion, geographical borders and climate. The effects of these elements are exhibited in the trade pattern between Japan and China, where its relative value of horizontal IIT is higher than that between Japan and Malaysia.

(c) Product Differentiation across Industry

The effects of economic development in determining the relative value of trade according to product differentiation can be observed at the level of industrial classification for each commodity.[23] For example, in the year 2000, 30.1% of Japan-Malaysia's vertical IIT annual trade value was attributed to the "manufacture of radio, television and communication equipment and apparatus (ISIC.3-32)" especially the "electronic microcircuits (SITC.2-7764)", which accounted for 44.0% of trade in this category, whereas it was only 5.5% for the Japan-China trade with zero contribution from SITC.2-7764. Japan-China's vertical IIT is still largely characterized by the labour-intensive manufacturing activities especially the "manufacture of wearing apparel; dressing and dyeing of fur (ISIC.3 18)", which accounted for 13.3% of the annual trade share. Nevertheless, it is noteworthy that China's higher degree of industrial diversification is also showing an increasing trend in vertical IIT with Japan in various industries such as electrical and electronic (E&E), chemicals industry and machinery and transport equipment (M&TE) industry.

The industrial classifications of Japan-Malaysia and Japan-China horizontal and vertical IIT also exhibit the importance of non-economic factors in determining their relative share of trade according to product differentiation.

Table 5: JM and JC Trade Pattern According to Product Differentiation and IIT Index Range for Selected Years (percentage)

SITC Rev.2 (4-digit code) Commodity Categorization					Japan-China						Japan-Malaysia					
Trade Share Threshold	Trade Quantity	Export Overlaps	Product Differentiations	IIT Index	1980	1985	1990	1995	2000	2005	1980	1985	1990	1995	2000	2005
Trade Value Less than 0.1%					2.51	2.63	4.13	4.53	5.15	5.65	3.53	3.34	4.11	4.09	3.72	4.29
"Trade Value More than 0.1%"	Reported	Export Overlaps	1- Vertical	0.333>IIT<0.666	0.04	0.13	1.43	4.69	2.78	2.70	0.78	0.10	0.83	6.66	7.25	0.70
				IIT<0.333	5.69	8.65	9.00	10.59	8.56	8.77	8.35	6.71	13.25	16.55	12.23	12.34
				IIT>0.666	0.06	0.01	1.23	1.08	6.97	7.55	0.22	0.21	1.38	2.13	0.92	3.77
			2- Horizontal	0.333>IIT<0.666	0.00	0.06	0.09	0.07	1.40	0.49	0.00	0.00	4.25	0.00	3.02	2.39
				IIT<0.333	1.56	8.23	6.09	2.94	4.89	3.55	0.14	2.73	1.16	2.48	3.00	2.15
				IIT>0.666	0.00	0.00	0.23	3.21	0.36	0.01	0.01	0.00	0.84	1.82	1.02	1.73
			3- One way	0.333>IIT<0.666	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
				IIT<0.333	0.36	0.38	0.22	0.01	0.00	0.41	0.71	0.63	0.37	0.17	0.09	0.66
				IIT>0.666	0.00	0.00	0.00	0.00	0.00	1.60	0.12	0.00	0.00	0.00	0.00	0.00
			4- NA	0.333>IIT<0.666	0.00	0.00	0.00	0.00	0.00	1.33	0.23	0.00	0.00	0.17	0.00	0.12
				IIT<0.333	15.76	12.64	2.04	0.15	0.15	1.59	11.61	6.13	3.33	2.01	0.28	1.44
				IIT>0.666	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.46
		No	1- Vertical	0.333>IIT<0.666	1.25	0.80	6.07	6.75	5.74	13.84	0.07	0.28	8.46	5.93	5.17	1.67
				IIT<0.333	16.03	17.41	34.94	42.70	38.22	25.62	6.79	22.26	15.00	39.91	34.01	26.27
				IIT>0.666	1.30	0.15	1.95	3.93	5.45	7.18	1.75	0.14	1.37	1.12	17.61	13.44
			2- Horizontal	0.333>IIT<0.666	0.38	0.09	0.71	2.87	3.49	1.10	0.00	0.00	1.35	0.45	1.29	1.52
				IIT<0.333	0.71	1.16	6.05	9.24	9.87	4.38	0.30	1.71	2.79	3.54	3.61	3.83
				IIT>0.666	0.17	0.02	0.97	0.25	2.69	0.33	0.18	0.00	0.00	0.80	2.17	3.12
			3- One way	0.333>IIT<0.666	0.02	0.00	0.16	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.00
				IIT<0.333	24.19	16.82	16.69	4.21	0.50	0.15	50.78	39.83	36.16	8.27	3.02	3.61
				IIT>0.666	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57

Table 5: (continued)

SITC Rev.2 (4-digit code) Commodity Categorization					Japan-China						Japan-Malaysia					
Trade Share Threshold	Trade Quantity	Export Overlaps	Product Differentiations	IIT Index	1980	1985	1990	1995	2000	2005	1980	1985	1990	1995	2000	2005
"Trade Value More than 0.1%"			4-NA	0.333>IIT<0.666	0.02	0.03	0.09	0.27	0.30	1.43	0.00	2.20	0.13	0.16	0.05	6.24
				IIT<0.333	19.55	24.21	1.50	0.75	0.44	8.94	11.71	10.53	4.26	3.45	1.39	5.43
				IIT>0.666	0.00	1.82	0.00	0.00	0.00	1.60	0.11	1.78	0.00	0.09	0.10	4.02
		Non Traded	1- Vertical	IIT<0.333	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00
			4-NA	IIT<0.333	0.80	0.00	0.01	0.04	0.03	0.03	0.34	0.26	0.17	0.10	0.03	0.08
	RM				0.00	0.00	0.00	0.00	0.00	0.00	2.27	1.09	0.81	0.27	0.00	0.14
	RC				9.62	4.41	6.40	1.71	3.00	1.24	0.00	0.00	0.00	0.00	0.00	0.00
Grand 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*

Notes: (i) "Trade Quantity" column categorized the commodity according to whether the quantity traded is reported or not "Reported" indicates that quantity of a particular commodity is reported for both JM and JC. RM and RC indicate that traded quantity is reported by Malaysia and China respectively.

(ii) "Export Overlaps" column indicates whether an export of a particular commodity to Japan by Malaysia and China overlaps or not.

(iii) Non Trade row represents a commodity which is found to be only traded either between JM or JC.

(iv) "4 NA" row represents a commodity where the unit value of that commodity cannot be calculated due to missing records.

(v) Output tabulated in this table is based on trade data reported by Japan.

Source: Computed from UN Comtrade database.

For example, about 21.2% of Japan-China trade in the year 2000 in vertical IIT was attributed to commodities that were categorized under "manufacture of food products and beverages (ISIC.3-15)", "manufacture of textiles (ISIC.3-17)" and ISIC.3-18 whereas it was only 0.6% in the Japan-Malaysia trade. Japan and China also claimed a significant trade share in horizontal IIT commodities in ISIC.3-18 and in commodities "manufacture[d] with medium skill and technology intensity" under the category "manufacture of electrical machinery and apparatus n.e.c. (ISIC.3-31)". That trend is partially attributed to geographical factors and cultural similarity between Japan and China.

(d) Japan-China and Japan-Malaysia Horizontal and Vertical IIT

In order to investigate the extent to which China's trade development with Japan is affecting Malaysia's trade pattern with Japan, we have narrowed our analytical data to those commodities produced by Malaysia and China which are sold on the Japanese market. Our justification for such an approach rests upon Krugman and Obstfeld's theory that a firm under the monopolistic competition sells less when there is a greater number of suppliers in the market (Krugman and Obstfeld, 2003: 127-128).

As shown in Table 5, the total volume of export attributed to overlapping export commodities for the year 2000 by China and Malaysia to Japan is about 20% and 25%, respectively.[24] By and large, our empirical results indicate that the relative share of trade between Japan and Malaysia and between Japan and China according to the IIT indices and the degrees of product differentiation are still in an early stage, namely low range of IIT index characterized by vertical product differentiation. Both Malaysia and China also capture different segments of the market in Japan (see Figure 1). More impressively, more than 65% of the trade value of these two developing countries with Japan comes from non-overlapping export commodities in 2005. Even in the trade of commodities with overlapping export to Japan, products from a similar industry in China do not have a big impact on exports from Malaysia to Japan.

As shown in Figure 1, the IIT indices between Japan and Malaysia and between Japan and China in this group of commodities largely fall under the vertical IIT category. This suggests that exports from Malaysia and China to Japan consist of products with different features for different market segments. The findings on relative trade share of horizontal IIT reconfirm this line of reasoning. Compared to Japan-China IIT, the trend and the relative share of horizontal IIT between Japan and Malaysia is higher. Based on this trend, it is logical to assume that vertical IIT between Japan and Malaysia and Japan and China is distinguished by not only different characteristics but also by differences in terms of quality.

Table 6: Malaysia-China Trade Pattern According to Product Differentiation and IIT Index Range (percentage)

"Trade Share Threshold"	"Product Differentiation"	IIT Index Range	1980	1985	1990	1995	2000	2005
Trade Value Less than 0.1%			7.17	6.92	9.72	11.93	11.60	11.79
"Trade Value More than 0.1%"	1-Vertical	0.3333>IIT<0.6666	0.00	0.00	0.11	3.56	21.70	7.22
		IIT<0.3333	1.53	3.10	17.48	30.51	21.33	22.20
		IIT>0.6666	0.00	0.00	1.40	1.20	9.64	5.39
	2-Horizontal	0.3333>IIT<0.6666	0.00	0.00	0.00	0.24	9.66	20.25
		IIT<0.3333	1.40	2.11	1.99	5.63	7.24	5.12
		IIT>0.6666	0.00	0.00	0.00	1.53	2.38	16.28
	3-One Way		76.71	76.06	59.75	28.51	14.89	0.63
	4-NA		13.20	11.81	9.54	16.88	1.57	11.12
Grand Total			100.00	100.00	100.00	100.00	100.00	100.00

Source: Calculated and compiled by authors.

(e) Malaysia-China Vertical and Horizontal IIT

While our examination of export characteristics of Malaysian and Chinese commodities to Japan reveals that IIT between Japan and Malaysia and between Japan and China is explained by vertical product differentiation, empirical evidence on IIT between Malaysia and China reveal increasing trade value in horizontal product differentiation (see Table 6). In 2005, trade value accruing to horizontal IIT had increased to about 41% compared to only 7.4% in 1995. The rise in trade value of horizontal IIT with Malaysia implies that China has improved its capacity to produce products that are not only cheap but also with significant improvement in terms of quality.[25] This is plausible because of the mass inflows of FDI – especially in the production of commodities classified under SITC.2 (7) – to China following its accession to the World Trade Organization (WTO).[26]

5. Conclusions

Although China has dynamically integrated into industrial progress in East Asia, there is insufficient evidence to conclude that China's development is at the expense of other developing economies. In this study, we have attempted to examine the extent of the effect of China's rapid economic development on Malaysia's bilateral trade pattern especially *vis-à-vis* Japan. For this purpose, we have designed our analytical procedures to address our research issues using the IIT index analysis. The analytical findings reveal three salient points.

First, based on the IIT index of aggregate commodity, China is engaged in a higher degree of IIT with Japan *vis-à-vis* Malaysia. A closer examination of the composition of commodities suggests that the nature of IIT between Japan and China and between Japan and Malaysia is largely determined by relative differences in terms of geographical factors, which in turn are influenced by climate, culture, religion, and other non-economic factors. Such an explanation is consistent with a similar proposition by Gavelin and Lundberg (1983). The effect of the development gap becomes more apparent when we segregate export commodities according to whether they overlap. In this group of commodities, Japan and Malaysia exhibit a greater degree of horizontal and vertical IIT. In this regard, a longer history of Japanese FDI inflows and a greater ratio of FDI capital accumulation in Malaysia could be one of the major determining factors.

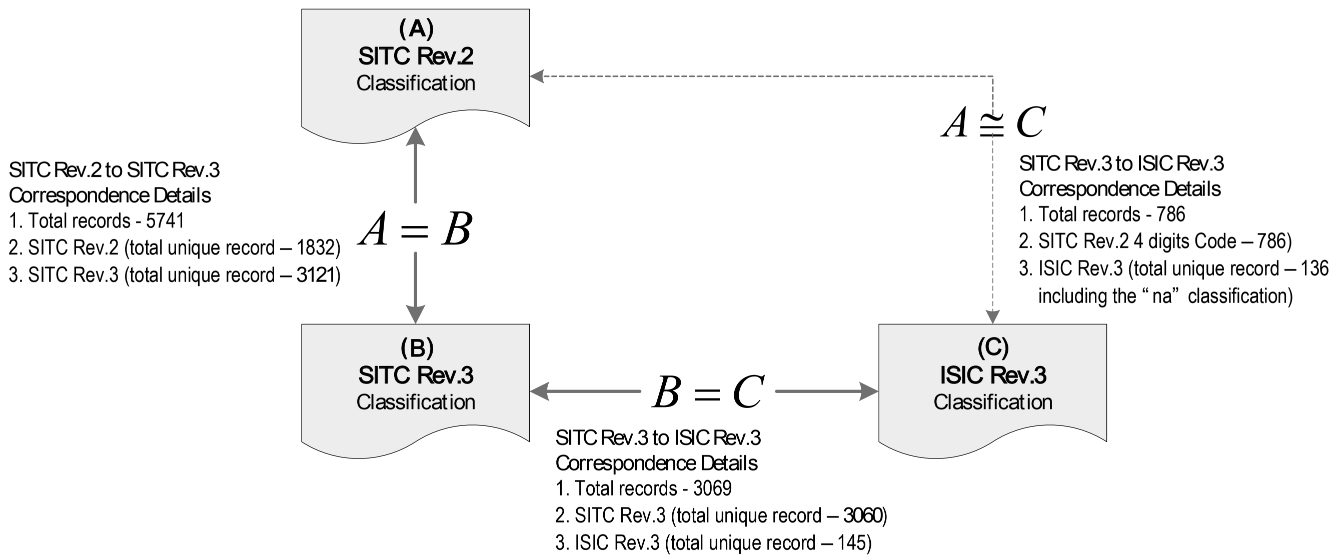
Second, in relation to the question of whether China's rapid trade development is affecting Malaysia's exports to Japan, our empirical findings suggest that Malaysia and China are targeting different segments of the Japanese market with regard to overlapping export products. This is indicated by a higher degree of horizontal IIT between Japan and Malaysia. Even in vertical IIT, these countries also show a higher value of IIT indices for most of the commodities. Such intra-industry specialization could also be attributed to the history of Japanese outflows of FDI.

Third, China's fast-growing industrialization has resulted in the expansion of trade in horizontally differentiated products between Malaysia and China. In 2005, trade value accruing to horizontal IIT increased to about 41% in contrast to only 7.4% in 1995. The index of horizontal IIT also shows an upward trend from medium IIT ($0.333 < IIT < 0.666$) to higher index of IIT ($IIT \geq 0.666$). More impressively, Malaysia-China's higher composition of horizontal IIT has expanded without significant changes in vertical IIT. Such a trend implies that China has rapidly improved its capacity in production activities that are not only of higher added value but also of higher quality.

The above findings reveal serious concerns for Malaysia in terms of its global competitive position in the international products market and supply of FDI. The latter is considered extremely crucial as it has contributed to a large portion of Malaysia's exports since the mid-1980s. Considering the recent trend of FDI flows and relocation of many existing MNCs' subsidiaries to emerging countries especially China and India, Malaysia will face greater challenges in sustaining certain industrial activities which used to be the major contributors to job creation and export earnings. For this reason, it is important for Malaysia to increase local content that is of higher added value and to diversify existing industries. In this context, therefore, Malaysia needs to put more emphasis on strengthening research and development (R&D) activities so as to promote productivity-driven growth.

Appendices

Appendix 1: SITC Rev.2 to ISIC Rev.3 Proxy Method



Note: ——— Concordance based on the United Nations Statistics Division Trade Classification Correspondence List.

– – – – Estimated concordance based on the existing correspondence list using the lookup, unique and manually weighted function.

1. A cross check of SITC Rev.3 commodity list between A = B and B = C reveals that 34 commodities (mostly in 5 digits code) in A = B do not exist in B = C. After the filtering process, 16 of these commodities was manually concord to the closer SITC Rev.2 4 digits code. The remaining 18 commodities which do not have a specific concordance were manually concords by the authors.
2. A reverse cross-check of SITC Rev.3 commodity list between A = B and B = C also reveals that 9 commodities (mostly in 3 and 4 digits code) in B = C do not exist in A = B.

Appendix 2: Standard International Trade Classification (SITC) Revision 2 – 1 Digits Code Definitions

Code	Descriptions
SITC.2 (0)	Food and live animals chiefly for food
SITC.2 (1)	Beverages and tobacco
SITC.2 (2)	Crude materials, inedible, except fuels
SITC.2 (3)	Mineral fuels, lubricants and related materials
SITC.2 (4)	Animal and vegetable oils, fats and waxes
SITC.2 (5)	Chemicals and related products, n.e.s.
SITC.2 (6)	Manufactured goods classified chiefly by materials
SITC.2 (7)	Machinery and transport equipment
SITC.2 (8)	Miscellaneous manufactured articles
SITC.2 (9)	Commodities and transactions not classified elsewhere in the SITC

Source: UN Comtrade, Commodity List.

Appendix 3: ISIC Revision 3 – 2 Digits Code Definitions

ISIC Rev.3	Details
ISIC 01	Agriculture, hunting and related service activities
ISIC 05	Fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing
ISIC 10	Mining of coal and lignite; extraction of peat
ISIC 13	Mining of metal ores
ISIC 15	Manufacture of food products and beverages
ISIC 16	Manufacture of tobacco products
ISIC 17	Manufacture of textiles
ISIC 18	Manufacture of wearing apparel; dressing and dyeing of fur
ISIC 19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
ISIC 20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
ISIC 22	Publishing, printing and reproduction of recorded media
ISIC 23	Manufacture of coke, refined petroleum products and nuclear fuel
ISIC 24	Manufacture of chemicals and chemical products
ISIC 25	Manufacture of rubber and plastics products
ISIC 26	Manufacture of other non-metallic mineral products
ISIC 27	Manufacture of basic metals
ISIC 28	Manufacture of fabricated metal products, except machinery and equipment

Appendix 3: (continued)

ISIC Rev.3	Details
ISIC 29	Manufacture of machinery and equipment n.e.c.
ISIC 30	Manufacture of office, accounting and computing machinery
ISIC 31	Manufacture of electrical machinery and apparatus n.e.c.
ISIC 32	Manufacture of radio, television and communication equipment and apparatus
ISIC 33	Manufacture of medical, precision and optical instruments, watches and clocks
ISIC 34	Manufacture of motor vehicles, trailers and semi-trailers
ISIC 35	Manufacture of other transport equipment
ISIC 36	Manufacture of furniture; manufacturing n.e.c.
ISIC 37	Recycling
ISIC 93	Other service activities

Source: UN Comtrade, Commodity List

Notes

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1. See Wells, L.T. Jr. (1972) "International Trade: The Product Life Cycle Approach", in Wells, L.T. Jr. (ed.), *The Products Life Cycle and International Trade*, Boston: Harvard University, pp. 3-33.
2. See Flam, H. and Flanders, M.J. (1991) "Introduction", in Flam, H. and Flanders, M.J. (eds), *Heckscher-Ohlin Trade Theory*, London: The MIT Press, pp. 1-37. For further discussion, see Harry Flam and M. June Flanders's translation of Heckscher, E.F. (1920) "The Effect of Foreign Trade on the Distribution of Income", reprinted in Flam, H. and Flanders, M.J. (1991) (eds), *Heckscher-Ohlin Trade Theory*, London: The MIT Press, pp. 46-69. Also Ohlin, B. (1924) "The Theory of Trade", reprinted in Flam, H. and Flanders, M.J. (1991) (eds), *Heckscher-Ohlin Trade Theory*, London: The MIT Press, pp. 75-214.
3. Jones, R.W. (1968) "Variable Returns to Scale in General Equilibrium Theory", *International Economic Review*, 9(3): 261-272. See also Helpman, E. (1981) "International Trade in the Presence of Product Differentiation, Economies of Scale and Monopolistic Competition: A Chamberlin-Heckscher-Ohlin Approach", *Journal of International Economics*, 11(3): 305-340.
4. The term "multi-behavioral" trade was used by Jones and Neary (1986) to capture the following characteristics of the market: (i) market distortions; (ii) increasing returns; and (iii) imperfect competition. See for further explanation, Fontagné,

L., Freudenberg, M. and Gaulier, G. (1997) *Intra-Industry Trade: Methodological Issues Reconsidered*, CEPII, Paris.

5. Vernon, R. (1971) *Sovereignty at Bay: The Multinational Spread of U.S. Enterprises*, New York: Basic Books, Inc. Hirsch, S. (1965), "The United States Electronics Industry in International Market", in Wells, L.T. Jr. (ed.), *The Products Life Cycle and International Trade*, Boston: Harvard University, pp. 39-42.
6. Greenaway, D., Hine, R. and Milner, C. (1994) "Country-Specific Factors and the Pattern of Horizontal and Vertical Intra-Industry Trade in the UK", *Review of World Economics*, 127(1): 77-100.
7. Tharakan, P.K.M. (1983) "The Economics of Intra-Industry Trade: A Survey", in Tharakan, P.K.M. (ed.), *Intra-Industry Trade: Empirical and Methodological Aspects*, Amsterdam: North-Holland, pp. 1-34.
8. Kol, J. and Mennes, L.B.M. (1983) "Two-Way Trade and Intra-Industry Trade with an Application to the Netherlands", in Tharakan, P.K.M. (ed.), *Intra-Industry Trade: Empirical and Methodological Aspects*, Amsterdam: North-Holland, pp. 47-85.
9. See also for discussion on Michaely (1962) adjusted model for aggregate IIT measurement in Gavelin, L., and Lundberg, L. (1983) "Determinants of Intra-Industry Trade: Testing Some Hypotheses on Swedish Trade Data", in Tharakan, P.K.M. (ed.), *Intra-Industry Trade: Empirical and Methodological Aspects*, Amsterdam: North-Holland, pp. 141-160.
10. The difference between both measurements is that the Grubel-Lloyd model focuses on the trade flow, while the Michaely model focuses on the trade pattern. See, for more discussion, Kol, J. and Mennes, L.B.M. (1983) "Two-Way Trade and Intra-Industry Trade with an Application to the Netherlands", in Tharakan, P.K.M. (ed.), *Intra-Industry Trade: Empirical and Methodological Aspects*, Amsterdam: North-Holland, pp. 47-85.
11. The use of index range for the purpose of generalization is found in Balassa, B. (1966) "Tariff Reductions and Trade in Manufactures among the Industrial Countries", *The American Economic Review*, 56(3): 466-473.
12. See for example, Abd-el-Rahman, K. (1991) "Firms' Competitive and National Comparative Advantages as Joint Determinants of Trade Composition", *Review of World Economics*, 127(1): 83-97; and Greenaway, D., Hine, R. and Milner, C. (1994) "Country-Specific Factors and the Pattern of Horizontal and Vertical Intra-Industry Trade in the UK", *Review of World Economics*, 127(1): 77-100.
13. One of the reasons for choosing the 25% price wedge is that the value recorded in trade statistics is often affected by fluctuations in the exchange rate. See Fukao, K., Ishido, H. and Ito, K. (2002) "Vertical Intra-Industry Trade and Foreign Direct Investment in East Asia", paper presented at the New Development in Empirical International Trade Conference, Tokyo, Japan.
14. UN Comtrade contains detailed import and export statistics reported by statistical authorities of every country and it is considered the most comprehensive trade database available. For more information on details and limitation of UN Comtrade, see http://comtrade.un.org/. Until March 2006, the SITC classification has undergone four series of revision.
15. Scott (2001) asserts that the coarse division between commodity and industry within the existing international trade database is one of the main limitations in

assessing the changing pattern of trade between economies. See Scott, P.K. (2001) "Do Rich and Poor Countries Specialize in a Different Mix of Goods? Evidence from Product-Level US Trade Data" [Electronic Version]. *NBER Working Paper*, 8492. Retrieved 26 September 2001 from http://www.nber.org/papers/w8492.

16. Eurostat is the European Union's statistical office. See http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1090,30070682,1090_33076576&_dad=portal&_schema=PORTAL.
17. Discussion on the relative degree of IIT index differences between combinations of countries is based on Gavelin and Lundberg (1983). There are three factors outlined by Gavelin and Lundberg (1983): (i) factor endowment; (ii) average and differences in per capita income; and (iii) geographical distance. See, for more discussion, Gavelin, L. and Lundberg, L. (1983) "Determinants of Intra-Industry Trade: Testing Some Hypotheses on Swedish Trade Data", in Tharakan, P.K.M. (ed.), *Intra-Industry Trade: Empirical and Methodological Aspects*, Amsterdam: North-Holland, pp. 141-160.
18. The Grubel-Lloyd method focuses more on the flow of trade, while the Michaely measure emphasizes the trade pattern. See Kol, J. and Mennes, L.B.M. (1983) "Two-way Trade and Intra-industry Trade with an Application to the Netherlands", in Tharakan, P.K.M. (ed.), *Intra-Industry Trade: Empirical and Methodological Aspects*, Amsterdam: North-Holland, pp. 47-85.
19. Hiley, M. (1999) "Industrial Restructuring in ASEAN and the Role of Japanese Foreign Direct Investment", *European Business Review*, 99(2): 80-90.
20. The relative annual trade value as stated here is based on the sum of commodities with records on traded quantities that are available in the database. Therefore, taking into account the trade share of other commodities with missing records on the quantities traded, the relative share as mentioned in this section could be higher. It should also be noted that data for empirical analysis in this study were taken from 2006, in instances where trade records for 2005 were not available. As such, the output for 2005 could be largely affected by statistical outliers.
21. See for further discussion, Dunning, J. H. and Narula, R. (1996) "The Investment Development Path Revisited: Some Emerging Issues", in Dunning, J.H. and Narula, R. (eds), *Foreign Direct Investment and Governments: Crystals for Economic Restructuring*, London: Routledge, pp.1-33.
22. See for further discussion, Kojima, K. (2000) "The 'Flying Geese' Model of Asian Economic Development: Origin, Theoretical Extension, and Regional Policy Implications", *Journal of Asian Economics*, 11(4): 375-401.
23. Although most of the commodities exhibit a low degree of IIT index (i.e. $IIT \leq 0.333$) reflecting trade imbalance between trading nations, based on the assumption that the IIT index is positively correlated with economic development, the current volume of trade based on the current IIT index will portray the relative trade share of each commodity in future when the degree of IIT index increases.
24. About 60% to 70% of trade value in the selected years is attributed to trade based on a country's specific advantage.
25. These are the main reasons for rising concern about extensive flows of Chinese goods in the world markets. See Hu, X. and Watkins, D. (1999) "The Evolution

of Trade Relationships between China and the EU", *European Business Review*, 99(3): 154-161.

26. See Agarwal, J. and Wu, T. (2004) "China's Entry to WTO: Global Marketing Issues, Impact, and Implications for China", *International Marketing Review*, 21(3): 279-300.

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