Reorganization of Intra-ASEAN Trade Flows: The China Factor

By:

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Abstract

There is burgeoning literature on the implications of China's ascendance on the region. There are claims that China's influence on ASEAN (Association of Southeast Asian Nations) is direct in that she has encouraged more exports to flow into her huge markets and changed trade flows amongst member countries. Demand and supply are deemed to have become more China-centered. The study therefore examines the dynamic shifts in trade between the five original ASEAN member countries to identify if China has indeed reorganized trade flows away from intra-ASEAN interactions to that of individual ASEAN countries with China. Specifically, the study explores the plausibility of China as a 'factor' that influences (directly/ indirectly) bilateral intra-ASEAN trade flows through demand (exporting country) and supply (importing country). China's integration in the region increases the size of the key ASEAN member economies export market (scale of production). There is also no indication that import sourcing from China by ASEAN countries reduces export expansion within the latter. The results accord with the fact that though China has become an important export destination and an import source for individual ASEAN countries, this has not reduced intra-ASEAN trade.

Keywords: vertical intra-industry trade, trade-induced adjustment, product quality, gravity model

JEL Codes: F100, F140

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1. INTRODUCTION

China has emerged as an important trading partner for the Association of Southeast Asian Nations (ASEAN) since the mid-1990s. ASEAN-China trade is said to have expanded more than five-fold between 1997 and 2005 (Yeoh, 2007). By 2006, China ranked as the fifth export market destination and third import market origin for ASEAN (ASEAN Secretariat, 2007). Sourcing most of its components from the region (Gangnes and Van Assche, 2008), China has also become the nucleus of trade in the region. This is the result of China repositioning itself from the first periphery into the core of production networks (Srholec, 2006) between 1995 and 2004 and thus emerging as the endpoint of the Asian assembly line (Chaturvedi *et al*., 2006; Haltmeier *et al.*, 2007).

China's deeper integration in merchandise trade came with its accession to the World Trade Organization (WTO) in 2001 whilst at the regional level, the cornerstone of her ascendance is establishment of the ASEAN-China Free Trade Agreement (ACFTA) by 2010 for the original ASEAN members (see Tambunan, 2005; Saw *et al.,* 2005). The inception of the ACFTA is supposed to lead to major restructuring of the region's trade patterns through intra-industry specialization in manufactures. This is already evident based on recent trends. Particularly, China's rise at the center of the regional production systems has inadvertently resulted in a reconfiguration of networks (Gill and Kharas, 2007; Gaulier *et al.,* 2007) and enhanced specialization (Amiti and Freund, 2008). Thus, the export intensities of ASEAN to China though increasing, are said to differ considerably amongst member countries (Lau and Hooi, 2007).

The above developments resulted in burgeoning literature on the implications of China's ascendance on the region. While some view China as indirect threat particularly in third markets, others contend with a co-movement of export expansion between China and Asia due to the vertical integration of many products (see Wong, 2003; Greenaway *et al.*, 2006; Harrigan and Deng, 2007; Athukorala, 2008a, 2008b). There are also claims that China's influence on ASEAN is direct in that she has encouraged more exports to flow into her huge markets and changed trade flows amongst member countries. As demand and supply become more China-centered, Tambunan (2005) questions the relevancy of ASEAN given that individual countries trade more with China than among themselves.

With the advent of the ACFTA, it is therefore timely to examine dynamic shifts in trade between the five original ASEAN[1] (Malaysia, Singapore, Thailand, Indonesia and the Philippines) member countries to identify if China has indeed reorganized trade flows away from intra-ASEAN interactions to that of individual ASEAN countries with China. The purpose is to identify changes in complementary (of the intra-industry type, IIT) trading relationships in ASEAN-China and intra-ASEAN trade, adjustments incurred by ASEAN in IIT-type of trade with China and the influence of China as an export source and import demand on intra-ASEAN trade flows. Specifically, the study provides answers to the following questions:

- To what extent have ASEAN countries become partners in production with China?
- Are the ASEAN countries specializing in more sophisticated production processes to support the regional supply chain?
- What are the envisaged adjustments for ASEAN brought about by production sharing with China?
- Has the rise of China reorganized and influenced the trading relationships amongst the key ASEAN countries?

The paper is structured in the following manner. Section 2 of the paper reviews the arguments on production sharing. Section 3 describes the methods employed to identify dynamic IIT, changes in product quality, adjustments and elaborates on the gravity model used for empirical estimations. The data used are also detailed. Section 4 maps the IIT patterns of specialization in the region and outlines the adjustments incurred in trade over the sub-periods 1995-2000 and 2000-2005. Section 5 presents the empirical estimations for the bilateral trade flows of ASEAN. The final section, Section 6, concludes.

2. PRODUCTION SHARING AND ASEAN TRADE

The theory of production sharing explains the resulting growth of IIT. It posits that if different stages of the production process are separable and have varying factor intensities, then firms will relocate certain production processes or segments abroad (Jones and Kierzkowski, 2001). However, production sharing requires that the benefits of trade exceed coordination costs associated with trade barriers, transportation, communication and governance (Gangnes and Van Assche, 2008).

Production sharing essentially characterizes the ASEAN trade. The combination of technological progress and economic development (sparked historically by the offshoring to Asia by multinationals of the US and Japan) enabled electronic products in particular to standardize the interfaces between components (Gangnes and Van Assche, 2008). Thus electronics became the heart of the region's production chain and production sharing gradually spread to other products in the category of machinery and transport equipment (Section 7 of the Standard International Trade Classification).

Following which, the share of IIT in trade in manufactures within the ASEAN countries has grown to attain high levels, dominated mainly by vertically differentiated goods (VIIT or trade in intermediate goods which are quality-based) (Ito and Umemoto, 2004) that reflects different factor intensities (Hurley, 2003). The growth of IIT in the region, particularly VIIT, is attributed to market size (Hurley, 2003), foreign direct investment (Ito and Umemoto, 2004), apart from other factors such as similar export structures (Hapsari and Mangunsong, 2006) and different factor endowments.

The rise in VIIT however is also said to come with a cost as countries shift their trade and production patterns to realign with their comparative advantages. Adjustments incurred following VIIT are high/ severe relative to that associated with little or no change in quality of products traded. One explanation is that labour requirements are likely to be significantly different between VIIT within a given industry so that job movers between firms making products of different quality will require greater training to undertake such a move or may remain under or unemployed (Brulhart, 2000; Azhar and Elliott, 2008).

In the ASEAN context, China with a huge domestic market is considered an important ***factor*** in: (a) raising intra-regional IIT (Zebregs, 2004); (b) realigning regional production patterns with comparative advantages; (c) increasing regional adjustments (Batra, 2006) that are trade-related.

3. DATA AND METHODS

3.1 S and PQV Indices

Studies to assess specialization of the IIT type are generally based on coefficients of specialization and conformity or the use of traditional indices such as the complementarity index, trade overlap index and the GL (Grubel-Lloyd, 1975) index. The method adopted for the study differs from previous work in that it uses the S and PQV indices, recently proposed by Azhar and Elliott (2003, 2006a, 2006b). Both indices have the following properties that account for its superiority. The S index satisfies four criteria (see Azhar and Elliott, 2003): monotonicity (increasing function of the net change in trade); consistency (adjustment costs associated with an industry expansion equals that with an industry contraction); country specificity (adjustment costs association with expanding or contracting industries) and matched trade changes do not involve resource reallocation costs. The PQV index exhibits proportionate scaling which is country invariant and thus less prone to distortions in product quality measurement, unlike that of the GHM (Greenaway, Hine and Milner, 1994) and FF (Fontagne and Freudenberg, 1997) approaches (see Azhar and Elliott, 2006a; Azhar *et al.*, 2006b).

To uncover the dynamic changes in IIT and subsequently quality changes of products, a two-stage approach is followed. In Stage 1, the S index (Azhar and Elliott, 2003) is used to measure dynamic IIT. This index, also labeled as an index of trade-induced adjustment, is used to measure products that may have experienced large increases or decreases in matched trade over the period of analysis. The S index is given as:

$$S = 1/2L\,(\Delta X - \Delta M) = (\Delta X - \Delta M)/\,2[\max\{\,|\Delta X|_t, |\Delta M|_t\,\}] \quad (1)$$

where

L = largest change in exports (X) and imports (M) over the period studied

For the study, to infer the adjustments posed by matched trade, products with little IIT change and those that represent inter-industry trade are removed. Therefore the S index values are taken to be $-0.4 < S < 0.4$. A S index of 0 means X and M are exactly matched. At the extremes, X and M move in exact opposite directions either beneficial for the home country or *vice versa,* with S indices of +0.4 and –0.4 respectively.

In Stage 2, each product identified in Stage 1 is split into vertical and horizontal components using the product quality value (PQV) index (Azhar and Elliott, 2006a; Azhar *et al.*, 2006b). The PQV index is a measure of the dispersion of product quality in IIT flows. The basis for the PQV index is the calculation of crude unit values (UV)[2] by dividing the monetary value of trade by the quantity. The PQV is given as:

$$PQV = 1 + [(UVX - UVM)/\,(UVX + UVM)] \quad \text{where } 0 < PQV < 2 \quad (2)$$

where

UVX = unit value of export
UVM = unit value of import

From the PQV index, the extent of quality differences at the product level associated with the various bilateral trade relationships are quantified. The products are considered as

HIIT or of similar quality if the X and M share at least 85 per cent[3] of their costs (reflected in the price). Thus,

$0.85 \leq PQV \leq 1.15$, HIIT

When all two-way trade is equal in quality (VIIT = 0), the PQV index is equal to unity. When imports and exports of a product share only 50 per cent of their costs, they are classified as VIIT. Products that are VIIT are further decomposed into those that are high quality (VIITH) and those that are low quality (VIITL) as follows:

$PQV > 1.15$, VIITH
$PQV < 0.85$, VIITL

For the above calculations, the data are sourced from the UN COMTRADE database that records imports and exports in quantities and values. Merchandise imports and exports recorded in millions USD are deflated by the US consumer price index (CPI) at 1990 constant prices. This study will be based on highly disaggregated data, compiled at the 5-digit SITC (Standard International Trade Classification), Revision 3, to minimize composition problems. The total number of products considered is 2,090 manufactured products (Sectors 5-8). Product quality changes in matched trade are tracked over two sub-periods, the pre- and post accession of China to the WTO, 1995–2000 and 2000–2005. The bilateral trade relationships are considered for the individual ASEAN countries with China and the intra-ASEAN trade flows.

3.2 Modified Gravity Model

The gravity equation[4] is employed for analyzing intra-ASEAN bilateral trade flows. The basic equation is augmented (see Mulapruk and Coxhead, 2005; Athukorala, 2008a, 2008b) and the following are estimated in log-linear form[5]:

$$\ln X_{i,j} = \alpha + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln PGDP_i + \beta_4 \ln PGDP_j + \beta_5 \ln DST_{i,j} + \beta_6 ADJ_{i,j} + \beta_7 \ln RER_{i,j} + \beta_8 \ln X_{i,CHINA} + \beta_9 \ln X_{CHINA,j} + \varepsilon_{ij} \quad (3a)$$

$$\ln X_{i,j} = \alpha + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln N_i + \beta_4 \ln N_j + \beta_5 \ln DST_{i,j} + \beta_6 ADJ_{i,j} + \beta_7 \ln RER_{i,j} + \beta_8 \ln X_{i,CHINA} + \beta_9 \ln X_{CHINA,j} + \varepsilon_{ij} \quad (3b)$$

$$\ln X_{i,j} = \alpha + \beta_1 \ln PGDP_i + \beta_2 \ln PGDP_j + \beta_3 \ln N_i + \beta_4 \ln N_j + \beta_5 \ln DST_{i,j} + \beta_6 ADJ_{i,j} + \beta_7 \ln RER_{i,j} + \beta_8 \ln X_{i,CHINA} + \beta_9 \ln X_{CHINA,j} + \varepsilon_{ij} \quad (3c)$$

where subscripts i and j refer to the exporting and the partner (importing) country respectively. The other variables are defined below:
X[6] = bilateral exports[7] between i and j
GDP = real gross domestic product (GDP). The variable GDP_i is alternated with $GDP_{i,t-1}$ (a one-year lag) for equations 3(a) and 3(b) to address endogenous determination of current trade levels and current GDP (see Edmonds *et al.*, 2008).
PGDP = real GDP per capita
N = population
ADJ = common border between i and j (dummy variable equal to one if i and j share a border and 0 otherwise)

DST = distance between economic centres of i and j
RER = bilateral real exchange rate
$X_{i,CHINA}$ = exports of country i to China
$X_{CHINA,j}$ = exports of China to country j
ε = error term that picks up other influences on bilateral trade
α = constant term

The GDP, PGDP, N, DST and ADJ are standard arguments of the gravity model. The GDP variable is a proxy for country size (market size and production/ trading capacity; see Tinbergen, 1962; Poyhonen, 1963). The postulated signs for β_1 and β_2 are positive since a large country is more likely to achieve economies of scale, increase exports and simultaneously possess the capacity to absorb imports. Equations (3a) and (3b) use PGDP and N[8] interchangeably. PGDP in equations (3a) and (3c)[9] serve to measure the income level and/ or purchasing power of a country and is expected to relate positively with bilateral trade volumes. Broadly speaking, PGDP also captures better trade-related infrastructure and trade facilitation measures. Conversely, the coefficient on N in equations (3b) and 3(c) is expected to bear a negative sign as a large country is considered to be less open to trade. Further explanations for this is that a country with a large population implies a large domestic market and a more diversified range of output that would result in less dependence on international specialization. Conversely, a country with large population may be able to capture economies of scale in production and therefore trade more. Hence the expected sign of the coefficient on N is ambiguous (Brada and Mendez, 1983; Garman and Gilliard, 1998; Cheng and Wall, 2005).

Though DIST is no longer an issue with technological advancement, geographical distance remains important for considerations of transport costs, transaction costs (Bergstrand, 1985; Edmonds *et al.,* 2008) and timeliness in delivery (see also Rojid, 2006; Athukorala, 2008) and is included in the estimations. Similarly ADJ captures additional advantages of proximity. Thus the expectations are for $\beta_5 < 0$ (Tinbergen, 1962; Poyhonen, 1963) and $\beta_6 < 0$.

To reflect further the phenomena of production sharing in intra-ASEAN trade flows, the above equations are augmented with RER. RER is a measure of international competitiveness[10] of country i against country j (Bergstrand, 1989; Carrere, 2006; Athukorala, 2008; see also Rojid, 2006), which is an important consideration for production sharing. A decrease in the bilateral real exchange rate reflecting an appreciation of the importing country' currency against that of the exporting country, one would expect $\beta_7 > 0$.

The most important explanatory variables for the purpose of the study is $X_{i,CHINA}$ and $X_{CHINA,j}$ to obtain some indications on the influence of China on intra-ASEAN trade flows, following similar reasoning of that of Mulapruk and Coxhead (2005). However the study provides a different interpretation from that of Mulapruk and Coxhead (2005) since the partner country j is not third markets outside ASEAN but are ASEAN member countries themselves. The inclusion of these variables in the study therefore capture the role of China in influencing intra-ASEAN trade *via* two confounding effects of an (a) expansion in export supply to China by the exporting country i; and (b) expansion in import sourcing from China by the importing country j. If an increase in exports from i to China crowds out exports from i to j, then $\beta_8 < 0$. However, if an increase in exports from i to China promote exports from i to j, then $\beta_8 > 0$. The variable $X_{CHINA,j}$ in turn indirectly measures the comparative advantage between China and i through the exports of the former to j. If China has a comparative advantage over i, then exports from China to j will bear a negative impact on exports from i to j and $\beta_9 < 0$. Conversely, $\beta_9 = 0$ when country i possesses a comparative advantage over China.

The above estimations are conducted for ten bilateral trade flows (Malaysia-Thailand, Malaysia-Philippines, Malaysia-Indonesia, Malaysia-Singapore, Indonesia-Singapore, Philippines-Indonesia, Philippines-Singapore, Thailand-Indonesia, Thailand-Philippines and Thailand-Singapore) in manufactures between the five founding ASEAN countries for the period 1995 - 2006[11]. The analysis is first conducted for aggregate exports of manufactures at the 1-digit SITC level (SITC 5, 6, 7, and 8) and subsequently for the sub-sample[12] of SITC 7 at the two-digit level (SITC 71, 72, 73, 74, 75, 76, 77, 78, 79), which shows huge trade potentials (see Table 2). For a detailed description of the construction of variables and the various data sources, see Appendix 2.

4. ASEAN-CHINA AND INTRA-ASEAN TRADE PATTERNS: DYNAMIC SHIFTS

4.1 ASEAN-China Trade

Prior to uncovering the dynamic shifts in trade patterns between ASEAN countries and ASEAN-China, it is important to examine the importance of China as an export destination and import source relative to the ASEAN market. Table 1 presents the market shares of ASEAN and China.

Table 1: Market Shares of ASEAN and China, (in percent)

	Share of Intra-ASEAN* Trade						Share of China, 2006		
	Exports		Imports		Total Trade				
Country	1995	2006	1995	2006	1995	2006	Exports	Imports	Total Trade
Malaysia	26.3	26.1	23.4	25.2	25.0	25.7	5.3	11.4	8.0
Singapore	45.3	30.9	45.8	26.1	45.5	28.6	8.6	10.6	9.5
Thailand	15.1	22.2	16.5	18.5	15.7	20.3	6.4	10.3	8.4
Indonesia	9.2	18.3	7.9	31.7	8.6	23.4	2.3	8.1	4.5
Philippines	3.4	17.3	4.6	19.7	3.9	18.6	9.0	6.6	7.8
TOTAL	99.2	94.3	98.1	90.3	98.8	92.5	6.1	9.4	7.6

Note: 1. * represents the percentage trade share of the ten ASEAN countries. For 1995, it is the percentage share of the eight ASEAN countries as data is not available for Lao PDR and Vietnam.
2. Latest data available is 2006.

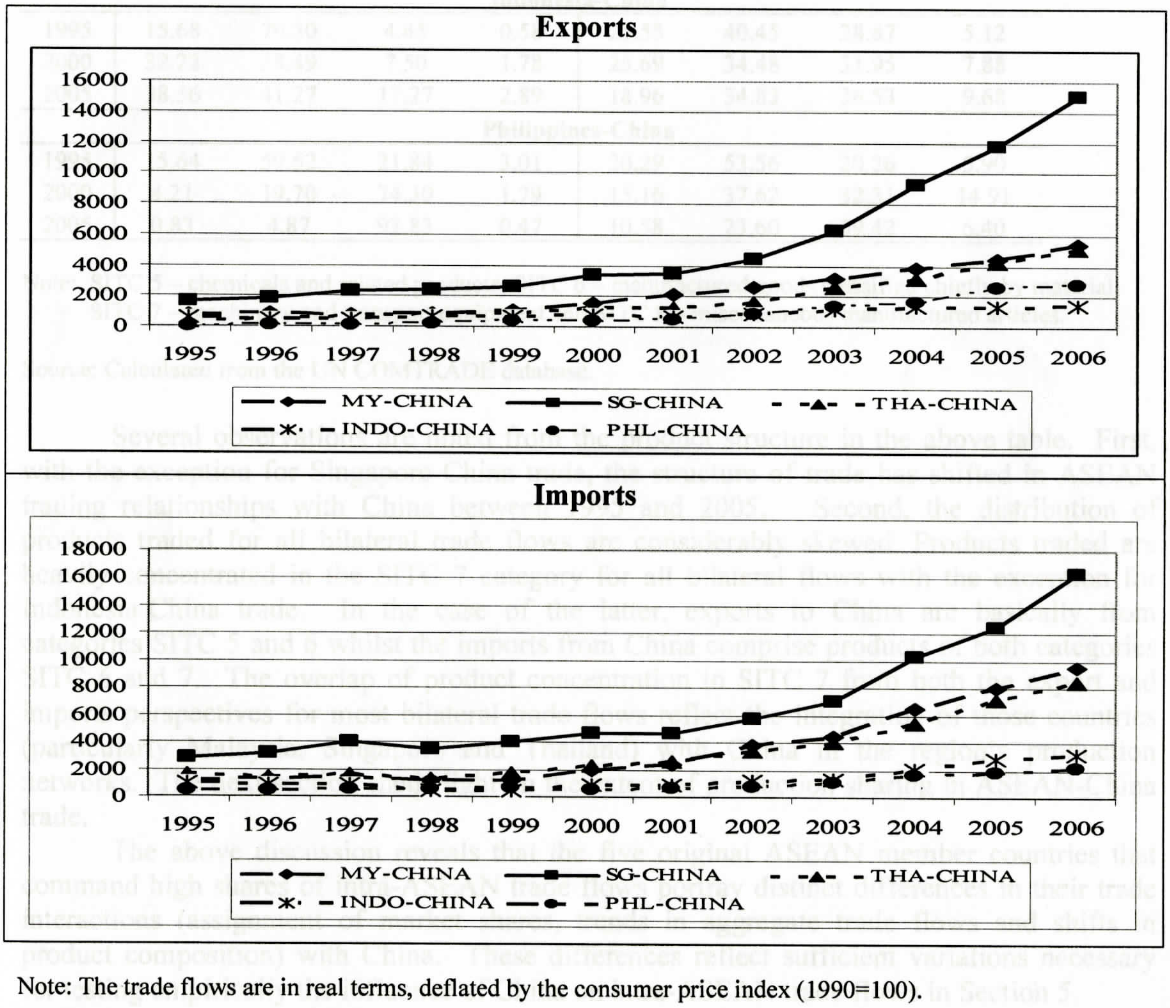
Source: ASEAN Secretariat.

The combined market share of the five original ASEAN member countries are representative of intra-ASEAN trade flows as they command more than 90 per cent of intra-ASEAN trade. Increases in intra-ASEAN trade between 1995 and 2006 signify an increase in interdependence. However in the case of Singapore, her interactions with the other ASEAN countries have declined considerably. Based on the 2006 data, the percentage shares of each individual ASEAN country in total intra-ASEAN trade does not differ much, implying that they have now assigned almost equal importance to intra-regional trade flows.

By contrast to the share of intra-ASEAN trade, the trade shares of China in each individual market of ASEAN are relatively small. China commands a higher share in imports relative to exports for all countries, with the exception for the Philippines. In total, Indonesia appears to be less integrated with China in terms of trade though the latter represents 8 per cent of Indonesian imports.

Despite the small market shares of China in ASEAN trade, the ASEAN-China interactions have grown over time. Figure 1 depicts the ASEAN-China trade flows for the period 1995 to 2006. There are interesting observations that emerge from the ASEAN-China trade interactions. First, both export and import flows in ASEAN-China trade depict a sharp upward trend since China's accession to the WTO in 2001. Second, trade interactions between the individual ASEAN member economies with China exemplify three levels of integration. Singapore-China (SG-CHINA) trade relations take a distinct lead in terms of exports and imports, whilst the other four remaining countries are behind moving in a pair-wise sync. The second layer comprises trade flows of Malaysia-China (MY-CHINA) which parallel Thailand-China (THA-CHINA) whilst the third layer is Indonesia-China (INDO-CHINA) trade flows that follow closely that of Philippines-China (PHL-CHINA). Third, all countries at large record consistent trade deficits with China over the period of review, with the exception for the Philippines. The Philippines, since 2002, has recorded surpluses in trade balance with China. Fourth, Indonesia appears to be importing more from China in the recent past relative to its corresponding exports.

Figure 1: ASEAN-China Trade, 1995-2006 (in US$ million)



Note: The trade flows are in real terms, deflated by the consumer price index (1990=100).

Source: UN COMTRADE database.

Further to the above differences in aggregate trade flows, it is important to identify at a disaggregate level the product concentration of trade. Table 2 presents the structure of ASEAN-China trade from the export and import perspectives.

Table 2: Product Composition in ASEAN-China Exports

	SITC 5	SITC 6	SITC 7	SITC 8	SITC 5	SITC 6	SITC 7	SITC 8
	EXPORTS				IMPORTS			
Year	**Malaysia-China**							
1995	7.17	60.49	29.50	2.84	10.32	44.16	34.54	10.98
2000	13.70	17.50	64.64	4.16	7.97	16.60	64.69	10.74
2005	17.07	9.68	66.37	6.87	4.79	11.28	76.83	7.10
	Singapore-China							
1995	18.69	18.85	57.28	5.19	4.94	31.49	49.33	14.23
2000	17.68	5.49	69.43	7.40	3.34	13.11	69.95	13.60
2005	16.84	2.88	73.63	6.65	2.79	9.77	76.29	11.15
	Thailand-China							
1995	31.88	26.56	31.57	9.99	14.80	50.81	28.03	6.37
2000	20.16	16.57	59.70	3.56	10.31	25.23	53.60	10.86
2005	22.29	12.40	61.94	3.36	8.98	27.29	56.02	7.70
	Indonesia-China							
1995	15.68	79.30	4.45	0.58	25.55	40.45	28.87	5.12
2000	32.22	58.49	7.50	1.78	25.69	34.48	31.95	7.88
2005	38.56	41.27	17.27	2.89	18.96	34.83	36.53	9.68
	Philippines-China							
1995	15.64	59.52	21.84	3.01	20.29	53.56	20.26	5.90
2000	4.21	19.70	74.30	1.79	15.16	37.62	32.31	14.91
2005	0.83	4.87	93.83	0.47	10.58	23.60	59.42	6.40

Note: SITC 5 – chemicals and related products; SITC 6 – manufactured goods classified chiefly by material; SITC 7 – machinery and transport equipment and SITC 8 – miscellaneous manufactured articles.

Source: Calculated from the UN COMTRADE database.

Several observations are noted from the product structure in the above table. First, with the exception for Singapore-China trade, the structure of trade has shifted in ASEAN trading relationships with China between 1995 and 2005. Second, the distribution of products traded for all bilateral trade flows are considerably skewed. Products traded are heavily concentrated in the SITC 7 category for all bilateral flows with the exception for Indonesia-China trade. In the case of the latter, exports to China are basically from categories SITC 5 and 6 whilst the imports from China comprise products of both categories SITC 6 and 7. The overlap of product concentration in SITC 7 from both the export and imports perspectives for most bilateral trade flows reflect the integration of those countries (particularly Malaysia, Singapore and Thailand) with China in the region's production networks. The next section sheds light on the extent of production sharing in ASEAN-China trade.

The above discussion reveals that the five original ASEAN member countries that command high shares of intra-ASEAN trade flows portray distinct differences in their trade interactions (assignment of market shares, trends in aggregate trade flows and shifts in product composition) with China. These differences reflect sufficient variations necessary for testing empirically the influence of China on intra-ASEAN trade flows in Section 5.

4.2 Production Sharing and Quality Changes

Table 2 reports the dynamic changes in IIT over the sub-periods 1995-2000 and 2000-2005 for ASEAN-China and intra-ASEAN trade in terms of the number of products.

Table 2: Dynamic Intra-Industry Trade in Manufactures (No. of Products)

Bilateral Trade	2000-2005	1995-2000
ASEAN-China		
Malaysia-China	382	293
Singapore-China	458	366
Thailand-China	315	229
Indonesia-China	221	187
Philippines-China	129	95
INTRA-ASEAN		
Malaysia-Thailand	455	346
Malaysia-Philippines	159	163
Malaysia-Indonesia	344	299
Malaysia-Singapore	504	567
Indonesia-Singapore	379	322
Philippines-Indonesia	100	83
Philippines-Singapore	184	164
Thailand-Indonesia	247	165
Thailand-Philippines	163	134
Thailand-Singapore	339	305

Note: 1. The above are the total number of products that have experienced significant changes in matched trade for the period based on the S index ($-0.4 < S < 0.4$) in equation (1).
2. The S index is calculated at the 5-digit level for SITC 5-8 and reported for total manufactures.

Source: Calculated from the UN COMTRADE.

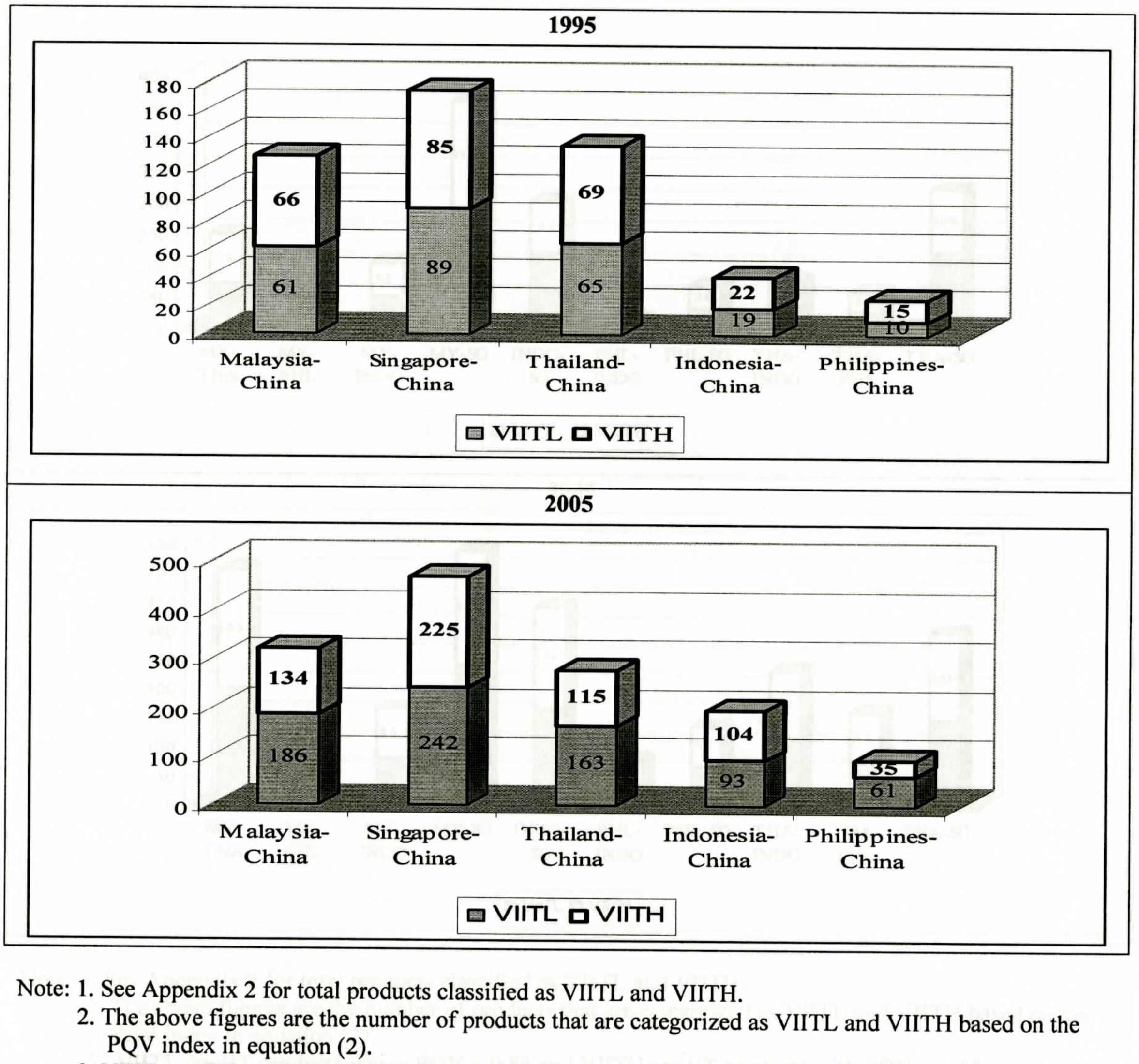
The above table shows increasing evidence of IIT between ASEAN and China (see also Tambunan, 2005), though Philippines (and Indonesia, to a lesser extent) appears to be less integrated in the production chain (Tambunan, 2006). The reason for the low level of complementary IIT relations of Indonesia with China is that the former is basically an exporter of final goods that are labour intensive (Tambunan, 2005). By contrast, Singapore posted the highest level of production sharing with China, followed by Malaysia and Thailand. Singapore is a special case as she has significantly reduced her own production through offshoring.

Similar trends are observed in the context of intra-ASEAN trade flows. IIT has increased for most bilateral trade relationships with some marginal declines noted in Malaysia-Philippines and Malaysia-Singapore trade. Likewise, production sharing is also highest in Malaysia-Singapore trade, followed by that for Malaysia-Thailand (see also Hurley, 2003). The high IIT levels for Malaysia-Singapore trade reflect high complementarity (Hapsari and Mangunsong, 2006), which means that the export supply structure of the exporting country fits in with the import demand structure of the destination country.

Based on the number of products categorized as dynamic IIT, significant variations are again noted in the various interactions between ASEAN and China and within ASEAN countries. Clearly, the development of IIT is different across the individual ASEAN countries. It appears that countries that are less integrated with China in terms of production sharing (Indonesia and Philippines) also portray lower levels of production sharing with other ASEAN member countries.

However, since production sharing has grown in trade interactions within this region, it is important to distinguish the products into vertical or horizontal differentiation. Appendix 2 clearly shows that ASEAN-China IIT and intra-ASEAN IIT in manufactures is more differentiated by quality (see also Hurley, 2003; Ito and Umemoto, 2004). Thus Figures 2a and 2b focus on the quality of products traded in ASEAN-China and intra-ASEAN trade respectively. The basic idea is to identify if there are quality improvements in products traded between 1995 and 2005.

Figure 2a: Quality of Products in ASEAN-China Trade, 1995 and 2005



Note: 1. See Appendix 2 for total products classified as VIITL and VIITH.

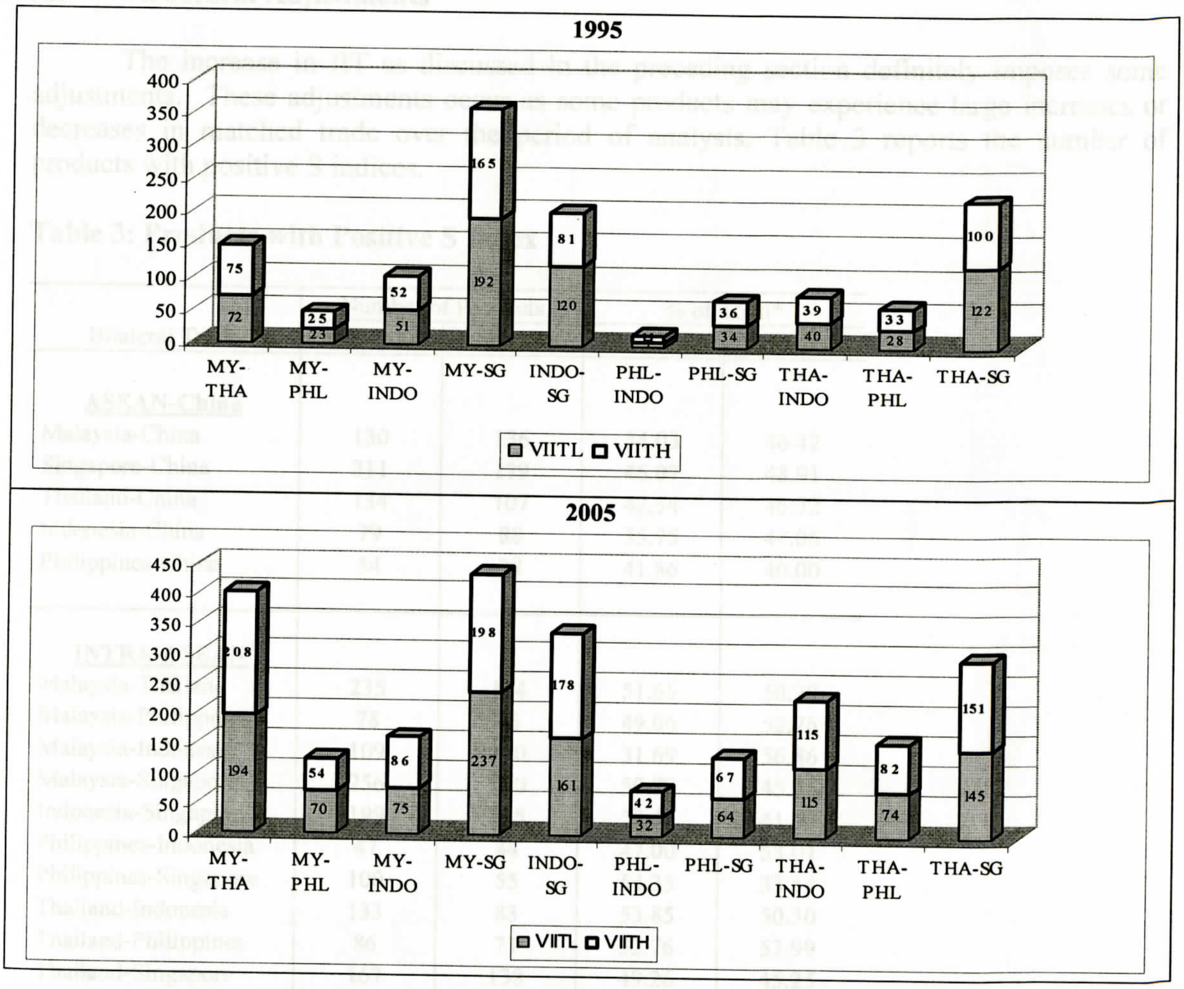
2. The above figures are the number of products that are categorized as VIITL and VIITH based on the PQV index in equation (2).

3. VIITL are IIT products where PQV < 0.85 and VIITH are IIT products with PQV > 1.15.

Source: Calculated from UN COMTRADE database.

For each of the ASEAN-China trading relationships, there is an increase in both VIITL and VIITH products between 1995 and 2005. However for the three actively engaged ASEAN countries in the production chain with China, which are Singapore, Thailand and Malaysia, there appears to be no quality advantage over China in products traded particularly based on the 2005 data. It should be noted that China's large share of processing trade contributes to the rising unit values of Chinese exports within a given product category (see Van Assche *et al.*, 2008 for arguments that there is an upward bias in the rising sophistication of production activities in China due to processing trade). However, Shi and Zhang (2008) attribute China's rising export sophistication to improvement in human capital and government-sponsored hi-tech zones apart from processing trade. They find the former two factors to have significantly raised the unit values of Chinese exports within a given product category. In this regard, the lower export unit values of Singapore, Thailand and Malaysia relative to China cannot be dispelled on grounds of a statistical mirage.

Figure 2b: Quality of Products in Intra-ASEAN Trade, 1995 and 2005



Note: 1. See Appendix 2 for total products classified as VIITL and VIITH.
2. The above figures are the number of products that are categorized as VIITL and VIITH based on the PQV index in equation (2).
3. VIITL are IIT products where PQV < 0.85 and VIITH are IIT products with PQV > 1.15.

Source: Calculated from UN COMTRADE database.

Similar trends on product quality prevail for intra-ASEAN trade flows in Figure 2b. There is combination of both high and low quality of varieties traded between the major ASEAN countries. Notably, the extent of VIIT has increased dramatically in the Malaysia-Thailand trade flows between 1995 and 2005 whilst Malaysia seems to distinctly export low quality varieties to Singapore, which strengthens the case that differences in factor endowments fuel intra-ASEAN IIT.

Several caveats are still worth mentioning in analyzing quality of products traded. First, the quality of products traded may be sensitive to yearly trade shocks and the above statistics should therefore be interpreted with caution. Second, Kumakura and Kuroko (2007) aptly point out that prices (proxied by unit values) of intermediate electronics (the product that is highly integrated in the region's production chain) particularly are highly unstable and thus may account for the erroneous changes in products qualified as low- and high quality varieties.

4.3 Structural Adjustments

The increase in IIT as discussed in the preceding section definitely imposes some adjustments. These adjustments occur as some products may experience large increases or decreases in matched trade over the period of analysis. Table 3 reports the number of products with positive S indices.

Table 3: Products with Positive S Index

Bilateral Trade	Number of Products		% of Total*	
	2000-2005	1995-2000	2000-2005	1995-2000
ASEAN-China				
Malaysia-China	130	136	34.03	46.42
Singapore-China	211	179	46.07	48.91
Thailand-China	134	107	42.54	46.72
Indonesia-China	79	88	35.75	47.06
Philippines-China	54	38	41.86	40.00
INTRA-ASEAN				
Malaysia-Thailand	235	174	51.65	50.29
Malaysia-Philippines	78	86	49.06	52.76
Malaysia-Indonesia	109	170	31.69	56.86
Malaysia-Singapore	256	260	50.79	45.86
Indonesia-Singapore	199	135	52.51	41.93
Philippines-Indonesia	47	44	47.00	53.01
Philippines-Singapore	100	55	54.35	33.54
Thailand-Indonesia	133	83	53.85	50.30
Thailand-Philippines	86	71	52.76	52.99
Thailand-Singapore	167	138	49.26	45.25

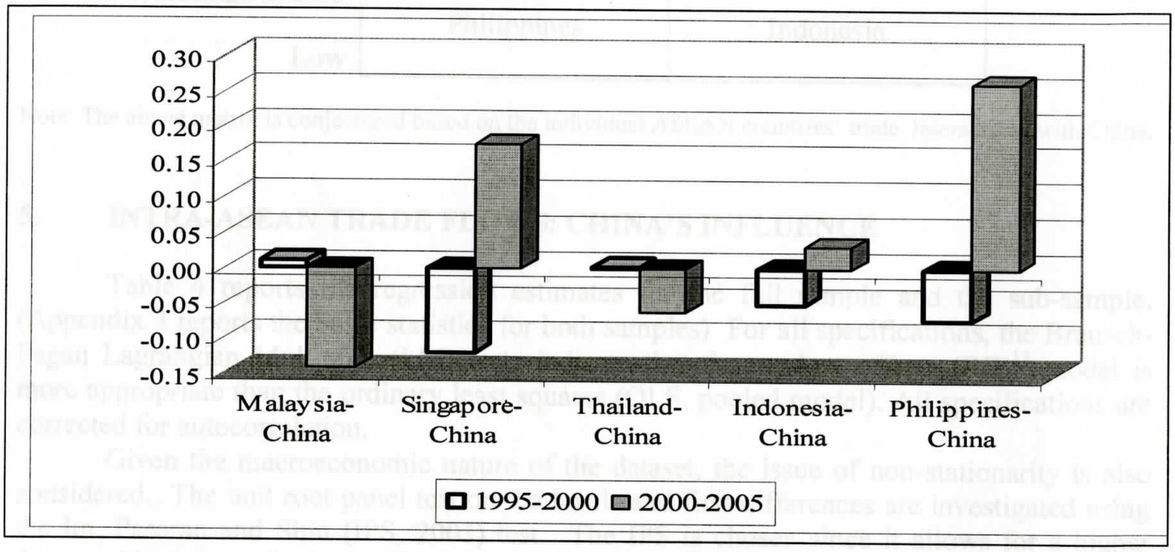
Note: * refers to the total number of products engaged in IIT as listed in Table 2.
1. The S index is calculated at the 5-digit level for SITC 5-8 and reported for total manufactures.

Source: Calculated from the UN COMTRADE.

In the context of ASEAN-China IIT trade, the percentage of products with positive S indices are below 50 per cent for both periods from the ASEAN perspective. This suggests that most ASEAN products experienced contractions in matched trade with China. This concurs with the findings of Batra (2006) that regional orientation of exports is low for China in an alignment with ASEAN. The large decreases in matched trade between the sub-periods in terms of number of products are obvious for the Malaysia-China and Indonesia-China IIT.

The above adjustments depicted in terms of number of products with positive S indices do not speak much about the actual expansions and contractions for individual ASEAN countries at the aggregate level for trade in manufactures. Thus the aggregate S index for total manufactures are calculated and caricatured in Figure 3.

Figure 3: Aggregate S Index



Note: 1. The S index is aggregated from calculations made at the 5-digit SITC level.
2. Table 2 provides information on the total number of industries considered.

Source: Calculated from the UN COMTRADE.

From the above chart, it is obvious that Singapore, Indonesia and the Philippines have experienced positive adjustments in the recent period, implying that IIT with China has resulted in industry expansion in those countries. However the adjustments are only modest in the case of Indonesia relative to the Philippines. The large positive adjustments for Philippines most plausibly reflect her potentials to become more integrated into the production chain as her export structure has become more concentrated in products of the SITC 7 category (see Table 1).

As for Malaysia-China and Thailand-China IIT, the change in the S index from positive to negative between sub-periods implies severe contracting pressures for the industry in both countries. The negative adjustments for Malaysia and Thailand plausibly reflect similar upgrading trajectory with that of China (Gangnes and Van Assche, 2008) that led to contractions in exports relative to imports. Hanson and Robertson (2008) further allude to this argument that comparative advantage of Malaysia and Thailand is closely aligned with that of China.

Given the distinct differences in the extent of production sharing and therefore the type of adjustments incurred by ASEAN in trade with China, the former can be categorized into following matrix of IIT induced-adjustments and IIT.

Figure 4: Matrix of Trade-Induced Adjustments and Production Sharing

IIT/VIIT (S Index and PQV Index) \ Trade-Induced Adjustments (Aggregate S Index)	**High**	**Low**
High	Malaysia Singapore	Thailand
Low	Philippines	Indonesia

Note: The above matrix is conjectured based on the individual ASEAN countries' trade interactions with China.

5. INTRA-ASEAN TRADE FLOWS: CHINA'S INFLUENCE

Table 4 reports the regression estimates for the full sample and the sub-sample. (Appendix 3 reports the basic statistics for both samples) For all specifications, the Breusch-Pagan Lagrangian Multiplier (LM) tests indicate that the random effects (RE)[13] model is more appropriate than the ordinary least squares (OLS, pooled model). All specifications are corrected for autocorrelation.

Given the macroeconomic nature of the dataset, the issue of non-stationarity is also considered. The unit root panel test on the levels and first differences are investigated using the Im, Pesaran and Shin (IPS, 2003) test. The IPS is chosen since it allows for a higher degree of heterogeneity in cross-section dynamics and also has a higher power than the Levin and Lin (LL) test. Appendix 4 presents the results of the panel unit root test in levels. The results confirm that the null of a unit root is rejected for almost all variables in levels (with the exception for $PGDP_i$). Thus, most variables are found to be of I(0) process, which is stationary in levels.

All the standard arguments of the gravity model bear the expected sign, with the exception for GDP_i and $PGDP_i$, albeit insignificant. Since the magnitudes of the coefficients of income are greater for the importer (partner) than that for the exporter, income elasticity of intra-ASEAN trade is more elastic with respect to the importing country's income than it is to the exporting country's income. Interestingly, the results in equation 3(c) concur with the perception that highly populated economies engage more in trade. Contiguity is found to be not important for explaining export expansion at the very least within the key ASEAN countries. Alternatively, the results suggest that transaction (transportation) costs and competitiveness have especially great significance for ASEAN economies, given the importance of production sharing.

More importantly is the coefficient estimates of China's influence on intra-ASEAN trade flows along the dimensions of an export destination and an import source. The variables of concern ($X_{i,CHINA}$ and $X_{CHINA,j}$) in both sets of estimates of Table 4 are consistent in terms of signs and significance and robust to the various specifications[14]. The magnitude of the coefficients is larger in the sub-sample of trade in SITC 7, indicating the influence of China in the regional production networks. The coefficients of exports from i to China are positive

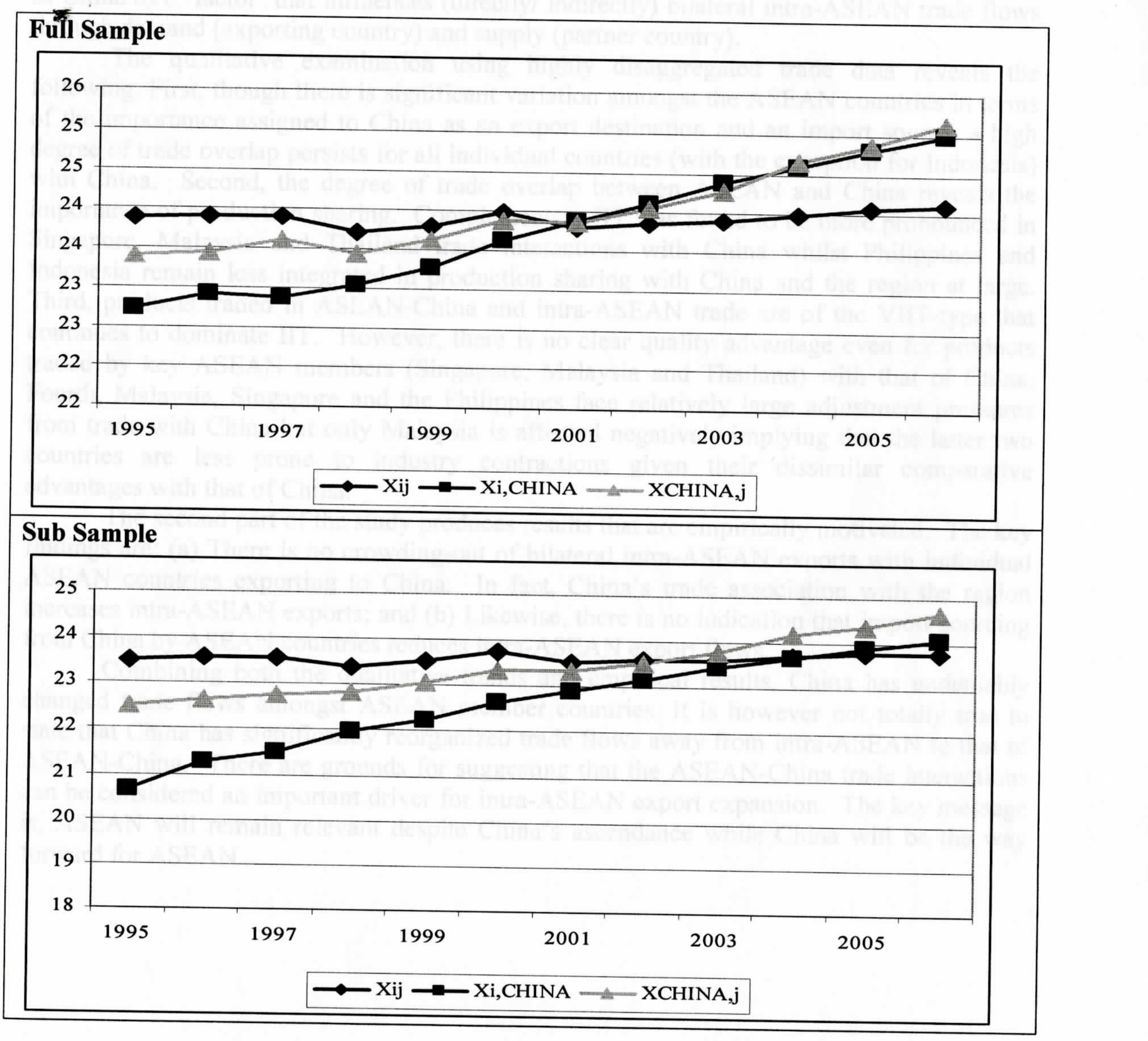
Table 4: Bilateral Trade Flows of ASEAN: Gravity Equation Estimates

Variable	Full Sample (SITC 5-8)						Sub-Sample (SITC 7)					
	Equation 3(a)		Equation 3(b)		Equation 3(c)		Equation 3(a)		Equation 3(b)		Equation 3(c)	
	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
$lnGDP_i$	0.022	0.206	-0.014	0.120	-	-	-0.155	0.340	0.025	0.261	-	-
$lnGDP_j$	0.535**	0.207	0.487**	0.126	-	-	0.371	0.255	0.581**	0.239	-	-
$lnPGDP_i$	-0.036	0.159	-	-	-0.047	0.095	0.162	0.201	-	-	-0.119	0.211
$lnPGDP_j$	-0.024	0.171	-	-	0.508**	0.121	0.173	0.109	-	-	0.673**	0.232
lnN_i	-	-	-0.374	0.343	-0.410	0.353	-	-	-0.351	0.226	-0.467	0.310
lnN_j	-	-	0.009	0.172	0.520**	0.208	-	-	-0.184	0.109	0.501**	0.247
$lnDST_{i,j}$	-1.793**	0.560	-1.868**	0.566	-1.889**	0.569	1.672**	0.392	-1.712**	0.392	-1.831**	0.382
$ADJ_{i,j}$	-0.919	0.755	-1.432	0.849	-1.451	0.851	-0.733	0.599	-0.969	0.606	-1.136*	0.590
$lnRER_{i,j}$	0.148**	0.068	0.137*	0.068	0.136**	0.068	0.136	0.140	0.128	0.139	0.119	0.137
$lnX_{i,CHINA}$	0.108**	0.042	0.117**	0.043	0.117**	0.043	0.227**	0.023	0.226**	0.023	0.226**	0.023
$lnX_{CHINA,j}$	0.283**	0.068	0.309**	0.072	0.311**	0.072	0.322**	0.050	0.331**	0.051	0.328**	0.051
constant	9.833	5.110	17.916**	7.618	18.129**	7.517	11.407	7.188	13.800**	7.023	15.874**	6.389
No. of observations	480		480		480		1080		1080		1080	
Groups	40		40		40		90		90		90	
R^2 overall	0.441		0.462		0.460		0.621		0.623		0.619	
Breusch Pagan test (p-value)	0.000		0.000		0.000		0.000		0.000		0.000	

Note: 1. The above estimations are based on the GLS random effects model, corrected for AR1disturbances.
2. Statistical significance is denoted as **5% and *10%.

and significant, suggesting that an increase in exports from a member country of ASEAN (i) to China does not crowd out exports between ASEAN countries (i to j). Instead, the results imply that China's integration in the region increases the size of the key ASEAN member economies export market, consistent with newer theories of international trade which emphasize the important effect of economies of scale. Similarly, the coefficients for $X_{CHINA,j}$ are positive and significant. There is therefore no indication that import sourcing from China by ASEAN countries reduces export expansion within the latter. The results accord with the fact that though China has become an important export destination and an import source (see Figure 4) for individual ASEAN countries, this has not reduced intra-ASEAN trade.

Figure 4: Export Series (in logarithmic value)



From the above, it can be said that despite claims that regional flows are becoming more China-centered, the evidence shows no diversion away from intra-ASEAN trade to ASEAN-China trade. In fact, ASEAN-China export expansion is a boon to intra-ASEAN trade flows for the key member economies. This can be tied in with other studies that have found the ASEAN integration scheme in itself to have insignificant effects on intra-ASEAN trade (Sharma and Chua, 2000; Elliott and Ikemoto, 2004). Thus the relevancy of ASEAN in the context of the ACFTA can be considered more justified.

6. CONCLUDING REMARKS

The study is divided into two parts. The first part of the study assesses the trade interactions between the five founding ASEAN members and China and the interactions amongst the ASEAN member countries. The second part of the study looks at the plausibility of China as a 'factor' that influences (directly/ indirectly) bilateral intra-ASEAN trade flows through demand (exporting country) and supply (partner country).

The qualitative examination using highly disaggregated trade data reveals the following. First, though there is significant variation amongst the ASEAN countries in terms of the importance assigned to China as an export destination and an import source, a high degree of trade overlap persists for all individual countries (with the exception for Indonesia) with China. Second, the degree of trade overlap between ASEAN and China reveals the importance of production sharing. Complementary IIT was found to be more pronounced in Singapore, Malaysia and Thailand trade interactions with China whilst Philippines and Indonesia remain less integrated in production sharing with China and the region at large. Third, products traded in ASEAN-China and intra-ASEAN trade are of the VIIT-type that continues to dominate IIT. However, there is no clear quality advantage even for products traded by key ASEAN members (Singapore, Malaysia and Thailand) with that of China. Fourth, Malaysia, Singapore and the Philippines face relatively large adjustment pressures from trade with China but only Malaysia is affected negatively implying that the latter two countries are less prone to industry contractions given their dissimilar comparative advantages with that of China.

The second part of the study produces results that are empirically motivated. The key findings are: (a) There is no crowding-out of bilateral intra-ASEAN exports with individual ASEAN countries exporting to China. In fact, China's trade association with the region increases intra-ASEAN exports; and (b) Likewise, there is no indication that import sourcing from China by ASEAN countries reduces intra-ASEAN export flows.

Combining both the qualitative trends and empirical results, China has undeniably changed trade flows amongst ASEAN member countries. It is however not totally true to state that China has significantly reorganized trade flows away from intra-ASEAN to that of ASEAN-China. There are grounds for suggesting that the ASEAN-China trade interactions can be considered an important driver for intra-ASEAN export expansion. The key message is, ASEAN will remain relevant despite China's ascendance while China will be the way forward for ASEAN.

Appendix 1: Variable Construction and Data Source

Variable	Variable Construction	Data Source
X	Value of bilateral exports in US$ measured at constant (1990) price. Exports are deflated by the US consumer price index.	Exports (at fob price, US$) compiled from UN COMTRADE database.
GDP	Real GDP (at 1990 price). GDP is deflated by the US consumer price index.	International Financial Statistics, IMF.
PGDP	Real GDP per capita (at 1990 price). Real GDP divided by population.	International Financial Statistics, IMF.
N	Population.	International Financial Statistics, IMF.
DST	Bilateral great-circle distance between major cities of each country.	CEPII database.
ADJ	A binary dummy variable which takes the value 1 for countries which share a common land border and 0 otherwise.	CEPII database.
RER	$RER_{ij} = NER * (P_j/P_i)$ where NER = nominal bilateral exchange rate index P_j = price level of country j proxied by the producer price index P_i = price level of country i proxied by the GDP deflator. RER is at 2000 price.	International Financial Statistics, IMF.
$X_{i,CHINA}$	Value of bilateral exports from individual ASEAN countries to China at constant (1990) price. Exports are deflated by the US consumer price index.	Exports (at fob price, US$) compiled from UN COMTRADE database.
$X_{CHINA,j}$	Value of bilateral exports from China to individual ASEAN countries at constant (1990) price. Exports are deflated by the US consumer price index.	Exports (at fob price, US$) compiled from UN COMTRADE database.

Appendix 2: Product Differentiation (Number of Products)

	2000 - 2005						1995 - 2000					
	2000			2005			1995			2000		
	VIITL	VIITH	HIIT	VIITL	VIITH	HIIT	VIITL	VIITH	HIIT	VIITL	VIITH	HIIT
ASEAN-China												
Malaysia-China	135	108	32	186	134	79	61	66	15	154	101	41
Singapore-China	213	188	166	242	225	295	89	85	90	176	85	138
Thailand-China	113	85	118	163	115	185	65	69	70	110	89	124
Indonesia-China	68	56	77	93	104	109	19	22	29	95	65	94
Philippines-China	25	34	28	61	35	61	10	15	12	48	36	43
INTRA-ASEAN												
Malaysia-Thailand	161	160	170	194	208	225	72	75	85	146	139	165
Malaysia-Philippines	59	56	71	70	54	71	23	25	34	58	70	89
Malaysia-Indonesia	63	63	72	75	86	99	51	52	67	116	108	139
Malaysia-Singapore	219	200	237	237	198	235	192	165	200	225	207	224
Indonesia-Singapore	169	128	171	161	178	176	120	81	109	161	125	168
Philippines-Indonesia	21	34	33	32	42	31	7	11	8	26	42	36
Philippines-Singapore	56	74	75	64	67	82	34	36	42	53	77	72
Thailand-Indonesia	79	73	105	115	115	126	40	39	44	72	67	84
Thailand-Philippines	48	66	68	74	82	84	28	33	34	54	75	76
Thailand-Singapore	144	159	166	145	151	196	122	100	117	135	129	143

Note: The total number of products in the above table does not match that which is indicated in Table 2 given that for some products, the unit values could not be calculated either due to missing data on quantity or different units of quantity measurement for exports and imports.

Source: Calculated from the UN COMTRADE.

Appendix 3: Basic Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
		Full Sample:			
lnX_{ij}	480	18.961	1.620	14.392	23.027
$lnGDP_i$	480	25.186	0.334	24.679	26.188
$lnGDP_j$	480	25.229	0.413	24.679	26.188
$lnPGDP_i$	480	7.490	0.644	5.943	8.696
$lnPGDP_j$	480	7.979	1.517	5.943	9.953
lnN_i	480	17.710	0.698	16.841	19.223
lnN_j	480	17.251	1.726	15.075	19.223
$lnDST_{i,j}$	480	7.370	0.721	5.754	8.467
$lnRER_{i,j}$	480	4.554	0.339	3.123	5.456
$lnX_{i,CHINA}$	480	20.862	1.032	17.424	22.402
$lnX_{CHINA,j}$	480	21.565	0.817	20.068	23.349
		Sub Sample:			
lnX_{ij}	1080	17.090	2.479	7.004	22.409
$lnGDP_i$	1080	25.186	0.334	24.679	26.188
$lnGDP_j$	1080	25.229	0.413	24.679	26.188
$lnPGDP_i$	1080	7.490	0.644	5.943	8.696
$lnPGDP_j$	1080	7.979	1.517	5.943	9.953
lnN_i	1080	17.710	0.698	16.841	19.223
lnN_j	1080	17.251	1.726	15.075	19.223
$lnDST_{i,j}$	1080	7.370	0.721	5.754	8.467
$lnRER_{i,j}$	1080	4.554	0.339	3.123	5.456
$lnX_{i,CHINA}$	1080	16.315	2.839	7.008	21.479
$lnX_{CHINA,j}$	1080	18.108	1.480	12.639	21.870

Appendix 4: IPS Panel Unit Root Test

	Full Sample		Sub-Sample	
Variables	t-bar	W(t-bar)	t-bar	W(t-bar)
lnX_{ij}	-2.356**(2)	-2.220	-2.530**(1)	-3.466
$lnGDP_i$	-2.942**(1)	-4.951	-2.942**(1)	-7.426
$lnGDP_j$	-6.061**(1)	-25.239	-2.407**(1)	-2.285
$lnPGDP_i$	-1.791	2.420	-1.791	3.631
$lnPGDP_j$	-5.870**(2)	-24.055	-2.373**(1)	-1.961
lnN_i	-7.510**(1)	-34.211	-7.510**(1)	-51.317
lnN_j	-2.438**(1)	-1.723	-2.438**(1)	-2.585
$lnDST_{i,j}$	-	-	-	-
$lnRER_{i,j}$	-3.448**(1)	-8.195	-3.448**(1)	-12.293
$lnX_{i,CHINA}$	-2.895**(2)	-5.566	-2.796**(1)	-6.025
$lnX_{CHINA,j}$	-2.587**(1)	-2.677	-2.490**(1)	-3.084

Note: 1. The above test assumes a constant with trend.
2. The number of lags is indicated in the parenthesis.
3. ** Reject the null hypothesis of a unit root at 5%.

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Notes

[1] The focus is on the ASEAN-5 founding nations because of continuous data availability.

[2] Price is considered an indicator (albeit imperfect) of quality, that is higher quality goods command higher prices (see Widell, 2005; Azhar, 2006a; Hallak, 2006). There are also concerns that price (or rather UVs) may pick up other influences such as production costs, efficiency and compositional changes (Hallak, 2006; Silver, 2007; Fabrizio *et al.*, 2007). It is assumed that these factors generate noise in the mapping of unit value against product variety (Zhi and Shang-Jin, 2008).

[3] The cut-off point however does involve a certain degree of arbitrariness.

[4] Tinbergen (1962) and Poyhonen (1963) were the first authors applying the gravity equation to analyze international trade flows. Until the 1970s, theoretical support for this model remained weak. Thereafter, various theories emerged to explain the model based on solid microeconomics foundation such as constant elasticity of substitution preferences and product differentiation (Anderson, 1979), monopolistic competition and the Heckscher-Ohlin model of inter-industry trade (Bergstrand, 1985, 1989) and increasing returns to scale (Helpman and Krugman, 1985).

[5] Since the equations are linear in logarithms, the estimated coefficients of the continuous variables are elasticities.

[6] Exports are used as the dependent variable, rather than total bilateral trade because it permits to identify export and import diversion separately and is a more direct performance indicator for trade reforms. Also, the gravity model is reported to perform consistently better with export data than with import data as the former is reported fob (freight on board) with the latter includes cif (cost, insurance and freight) (Fitzpatrick, 1984).

[7] Since Singapore did not report data on its bilateral trade with Indonesia for the period 1995-2002, the data gaps were filled using the corresponding trading partner records.

[8] Both specifications 3(a) and 3(b) are equivalent; specification 3(a) is often used to estimate bilateral exports for specific sectors whereas specification 3(b) is often used to estimate aggregate exports (Martinez and Nowak, 2004).

[9] Specification 3(c) is based on Breuss and Egger (1997) who point out that using GDP per capita instead of absolute GDP avoids high collinearity often present between absolute GDP and N (see also Garman and Gilliard, 1998, Smith, 1999; Sandberg *et al.*, 2006).

[10] Some regard RER as a proxy for price.

[11] Latest data available from the UN COMTRADE database at the time of study.

[12] This would also allow for the checking of the sensitivity of the gravity model to the choice of data structure (Cheng and Wall, 2005).

[13] The random effects (RE) model is also chosen since the distance variable (DST_{ij}) and contiguity (ADJ_{ij}) are invariant across time periods. Yet, the estimations are also conducted for country-pair fixed effects model (which captures both physical distance and contiguity, see Cheng and Wall, 2005). The results do not differ substantially from those obtained in the RE model for the full sample. However, for the sub-sample, the coefficient estimates for $X_{i,CHINA}$ is consistently negative and insignificant whilst that for RER_{ij} is positive and significant.

[14] The results are also robust to the using the lagged value of GDP of country i ($GDP_{i,\,t-1}$) instead of GDP_i for equations 3(a) and (3b). The results are not reported in the paper.