CHAPTER 3

China's Intermediate Goods Trade with ASEAN: A Profile of Four Countries

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CHAPTER 3

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INTRODUCTION

It is widely acknowledged that the nature of trade between China and the Association of Southeast Asian Nations (ASEAN) has changed dramatically in the past decade. One of the most important changes involves the increasing trade of intermediate goods.

In this study, we pursue two goals: First, we examine the characteristics and performance of intermediate goods trade between China and ASEAN. In particular, we document the importance of intermediate goods trade to regional industrial development and economic integration. We ask whether China or ASEAN deepened their industrial linkages through more trade of intermediate goods. Second, in order to generalize the major trend of intermediate goods trade, we chose four countries to be cases for our presentation on trade patterns: Malaysia, Singapore, Thailand and Vietnam. These four countries have been the most dynamic economies in the ASEAN region for the past two decades, even after total trade performance is taken into account. The four also provide fertile ground for assessing the extent to which industrial specialization has emerged among East Asian economies. And perhaps more importantly, we provide evidence on the balance of various intermediate goods trade

between China and the four countries. The performance and features of trade over the past ten years are outlined. Specifically, we ask what is the type of trade in intermediate goods between China and these four countries.

Briefly, the results of the study show that there are three main features of trade performance between China and ASEAN in the context of intermediate goods. First, China has been the largest market for ASEAN exports of parts and components in intermediate goods since 2004. Second, given the importance of regional industrial growth, an argument can be made for greater industrial integration between China and ASEAN. As the degree of intra-industry trade in metal fabrication will enlarge the production base for ASEAN countries, this may provide an opportunity to form production networks within regional industrial capacity. Third, China is still lagging behind ASEAN in competitiveness in the electronics production chain due to the dominance of foreign direct investment (FDI).

The study is divided into the following sections. Section 2 reviews the literature on the trade of intermediate goods, particularly for the East Asian region. Section 3 briefly discusses the trade performance of intermediate goods between China and ASEAN, mainly with the four countries of Malaysia, Singapore, Thailand and Vietnam. Section 4, using the BEC (Broad Economic Categories) code, analyses statistical data on the trade balance of some selected intermediate goods. Section 5 reiterates the different patterns of intermediate goods trade as regards two industries: machinery and electronics. And the last section presents conclusions.

1. THEORY DISCUSSION AND RELATED LITERATURE

Increasing trade in intermediate goods is one of the major reasons for world trade experiencing larger changes than world GDP.[1] Each time goods cross a frontier, an international transaction is recorded. When international supply chains include a number of tasks – as in the case of transport equipment and electronics – unfinished goods may cross frontiers several times during the assembly process. Actually, this activity involves the increasing interconnectedness of production processes in a vertical trading chain that stretches across many countries, with each country specializing in particular stages of a goods production sequence.[2] This phenomenon has variously been called fragmentation, unbundling, off-shoring, vertical specialization, slicing up the value-added chain and trade in tasks.

Although the WTO describes the importance of intermediate goods trade to global trade growth, more theoretical discussion is still needed for this study. The different views on this issue will also be addressed with special focus on East Asian patterns.

1.1. Vertical Linkage with the Contribution of FDI

The rising trend of intermediate goods trade should be largely attributed to FDI flows. Over the past twenty years, the composition of FDI has changed from labor-seeking assembly-based and resource-extracting to more recently production-fragmenting FDI, as multinational enterprises (MNEs) fragment their production processes in different economies based on varying location-specific advantages. Much of input trade involves

[1] WTO (2009a) *World Trade Report 2009*, pp. 1-2.

[2] David Hummels, Jun Ishii, Kei-Mu Yi, (2001) "The Nature and Growth of Vertical Specialization in World Trade," *Journal of International Economics*, 54(1), pp. 75-76.

multinational firms locating input processing in their foreign affiliates, thereby creating global vertical production networks. Some findings show that demand for inputs is higher when affiliates face lower trade costs, lower wages for less-skilled labor, and lower corporate tax rates.[3]

This has resulted in vertical intra-industry trade in parts, components, semi-finished and finished products.[4] Traditionally, some reasons have been put forward for the growth of intra-regional trade, such as the appreciation of the Japanese and then the Korean currencies in the late 1980s. This appreciation would have encouraged Japanese and Korean firms to relocate some of their production activities to lower-cost economies in the region, giving rise to intra-Asian FDI. For instance, Japan's FDI flows in East Asia in the 2002 to 2006 period show that the largest amounts went to China.[5]

Around the turn of the century, Robert C. Feenstra analyzes simply the integration of trade and the disintegration of production. The disintegration of production itself leads to more trade, as intermediate inputs cross borders several times during the manufacturing process. This is surely an important factor in the great surge in exports from East Asian countries. As their economies have expanded, these countries have become producers of a vast array of consumer and industrial products, relying substantially on imported intermediate inputs.[6] Recent studies summarized again that

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[3] Gordon H. Hanson, Raymond J. Mataloni, Jr., and Matthew J. Slaughter (2005) "Vertical Production Networks in Multinational Firms," *The Review of Economics and Statistics*, 87(4) (Nov.): 664-678, p.664.

[4] Maria Socorro Gochoco-Bautista (2008) "Output Movements in East Asia: Is There a Regional Factor?" *The World Economy*, 31(6), p. 739.

[5] S. Mansoob Murshed (2001) "Patterns of East Asian Trade and Intra-Industry Trade in Manufactures," *Journal of the Asia- Pacific Economy*, 6(1): 99-123.

[6] Robert C. Feenstra (1999) "Integration of Trade and Disintegration of Production in the Global Economy," *Journal of Economic Perspectives*, 12(4), Fall, pp.32-36.

one characteristic of intra-regional trade is the importance of East Asia as a source of imports for parts and components used in making final products outside the region such as to the United States and the EU, rather than as an export destination.[7] Today, two novel features of the current process of globalization and the increased trade in intermediate inputs and FDI flows may be reiterated: Trade in inputs has grown much faster than trade in final goods, and Yeats estimates that intermediates now account for 30 percent of world trade in manufactures.[8] So, multinationals now mediate a large portion of world trade. For instance, within manufacturing, the majority of these exports are of intermediates; 93 percent of exports by U.S. parent firms to their foreign manufacturing affiliates in 1999[9] were inputs for further processing. Furthermore, according to a 2008 WTO report, the share of manufactured intermediates in the manufacturing sector was 48.3 percent in China.[10]

1.2. Home Market Effect in Production Fragmentation

The home market effect predicts that a country will export those goods for which it has a large home market. In effect, the large domestic production serves as a base for exports. It turns out that reduction in trade costs magnifies the importance of market size in determining which country concentrates on producing and exporting manufactured goods. According to the new economic geography, the larger the labor force of a country,

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[7] Maria Socorro Gochoco-Bautista (2008) "Output Movements in East Asia: Is There a Regional Factor?" *The World Economy*, 31(6), p. 738.

[8] Yeats, Alexander J. (2001) "Just How Big in Global Production Sharing?" in Sven W. Arndt and Henryk Kierzkowski (Eds.), *Fragmentation: New Production Pattern in the World Economy*, Oxford: Oxford University Press.

[9] U.S. Bureau of Economic Analysis (2002) *U.S. Direct Investment Abroad: Preliminary Results from the 1999 Benchmark Survey*, Washington, DC: U.S. Government Printing Office.

[10] WTO (2008) *World Trade Report 2008: Trade in a Globalizing World*, Geneva, p. 89.

the higher its share of aggregate manufacturing output. In fact, if a country is sufficiently large, it is even possible for all manufactured products to be made there, i.e. complete specialization in manufactured goods by the large country.[11] Of course, this manifestation is only the theoretical discussion of an extreme point of view.

By virtue of the home market, the large country has the lion's share of global manufacturing output; the operation of increasing returns to scale makes manufactured products cheaper in the large country. Even with the cost of transport factored in, it will be able to export manufactured goods to the smaller country. The pioneering studies on the home market effect were conducted by Davis and Weinstein. In general, they provide support for the home market effect, particularly for manufactured goods.[12] Among the more recent studies undertaken to empirically test the home market effect are Lundback and Torstensson,[13] Feenstra et al.[14] and Weder. These later studies continue to find empirical confirmation of a home market effect.

Normally, real GDP is used to represent the size of the home market. There are other kinds of measures such as domestic consumption and national preferences. We see the Chinese economy growing at a stronger pace over the past ten years. In 2000, the Chinese economy was USD 1.2 trillion in size. Now this economy has more than tripled the size of a decade ago: USD 5.5 trillion. Looking ahead, the Chinese economy

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[11] Paul Krugman (1980) "Scale Economies, Product Differentiation, and the Pattern of Trade," *American Economic Review*, 70(5): 950-959.

[12] Davis, D.R. and Weinstein, D.E. (1999) "Economic Geography and Regional Production Structure: An Empirical Investigation," *European Economic Review*, 43(2):379-407. (2003) "Market Access, Economic Geography and Comparative Advantage: An Empirical Assessment," *Journal of International Economics*, 59(1):1-23.

[13] Lundback, E. and Torstensson, J. (1998) "Demand, Comparative Advantage and Economic Geography in International Trade: Evidence from the OECD," *Review of World Economics*, 134(2):230-249.

[14] Feenstra, R.C., Markusen, J.R., and Rose, A.K. (2001) "Using the Gravity Equation to Differentiate among Alternative Trade," *Canadian Journal of Economics*, 34(2):430-447.

will grow to around USD 20 trillion over the next ten years in nominal dollar value. Actually, the rate of change in consumer spending in China is already high, albeit from a much lower base than U.S. consumption. Assuming nominal consumer spending growth, for instance, of 11% in China and 4% in the United States, the increase in China's consumer spending will overtake that of the United States in the next decade in dollar terms.[15] Therefore, the Chinese home market will become the world's largest within ten years.

As such, a country will expand products for which there is large domestic demand. In effect, the large domestic market serves as a base for developing a competitive export sector. Clearly, a large market size such as China's provides more room for increasing returns to scale to operate, helping to drive down the production costs of domestic producers and giving them a price edge in the world market.

1.3. Technological Factor in Location Determinants

Another point of view regarding the new economic geography involves the factors in relocation of manufacturing production among the East Asian region. In reality, what we observe is the rapid consolidation in China of final assembly stages of East Asian-centered global production networks for these products. Ample supply of relatively cheap and trainable labor and the scale economies arising from China's vast domestic market are contributing factors to China's attractiveness as a global assembly center.[16] Many previous studies argue that acquiring external technology is of vital importance for innovation, especially spillovers of FDI, which have been emphasized

[15] Standard Chartered Bank (2010) *Global Research: The Super-Cycle Report*, 15 November 2010.
[16] Prema-Chandra Athukorala (2009) "The Rise of China and East Asian Export Performance: Is the Crowding-Out Fear Warranted?" *The World Economy*, 32(2), February, p. 238.

for many years. Using Japan's experience, Freeman demonstrated convincingly that international flows of stocks of knowledge from developed to developing economies make a sequential shift involving import, adaptation, assimilation and innovation.[17] Lall showed how firms move up the technology trajectory by learning initially simple and later complex technological capabilities before eventually participating in R&D activities.[18]

The most empirical evidence in the past twenty years tended to support the view that MNEs only relocated standardized product technologies, and whenever R&D was carried out at these sites, it was confined to minor modifications to equipment and processes. It is obvious that local firms can participate in R&D activities with intensity varying from one economy to another depending on the level of development of their high-tech institutions, and this requires more investment in R&D operations. If local firms simply participate in low value-added assembly and processing activities at host-sites facing a weak R&D infrastructure, it is unlikely these economies will increase their technological capability. Therefore, these countries should contribute more resources to improve their innovation ability.

In the process of raising China's technological capacity, it has become increasingly important to increase R&D activities to realize the construction of an innovative national program. Our study revealed that China's R&D as a ratio of its GDP has increased significantly from 1.00 percent in 2000 to 1.59 percent in 2009. This ratio is greater than that of most ASEAN countries, except for Singapore. Among the world's low- and low-middle-income countries, China has been the only one whose level of

[17] Freeman, Christopher (1987) *Technology Policy and Economic Performance: Lessons from Japan*, London: Frances Pinter. (1989) "New Technology and Catching Up," *European Journal of Development Research*, 1(1):85-99.

[18] Lall, S., "Technological Capabilities and Industrialization," *World Development*, 20(2): 165-86.

R&D intensity has risen beyond 1.5 percent. Clearly, a positive and strong relationship is expected between R&D intensity and export intensity. Export intensity differentials between China and ASEAN countries can be explained simply by examining the R&D ratio to GDP. Therefore, China has relatively improved its technological capability in industrial production compared to ASEAN countries since 2000. Fragmentation is likely to expand global well-being because it will systematically expand what the world is able to do potentially with its given resources.[19] Several recent studies suggest that China's rapid integration into cross-border production networks of vertically integrated global industries has opened new opportunities for the other East Asian countries to specialize in parts and components production and assembly.[20] The scale of China is huge as discussed above, and this should provide more trade for many countries, including those connected geographically with China such as ASEAN countries.

2. OVERVIEW OF TRADE GROWTH ACROSS CHINA AND ASEAN

According to the Chinese statistical data, the average annual growth rate of trade in China was about 20 percent between 2000 and 2008. As a consequence, China's share in world exports rose from 5.9 percent to 9.5 percent between 2003 and 2009. Overall, Asia's share of China's total trade decreased from 57.7 percent in 2000 to 53.10 percent in 2009. This reflected largely the diversification of China's trade instead of a

[19] WTO (2008) *World Trade Report 2008: Trade in a Globalizing World*, Geneva, p. 38.
[20] Prema-Chandra Athukorala (2009) "The Rise of China and East Asian Export Performance: Is the Crowding-Out Fear Warranted?" *The World Economy*, 32(2), February, p. 236.

diminishing role of Asia. Actually, the value of China's trade with Asia increased from USD 273.65 billion to USD 1,172.17 billion over this period. It should be pointed out that Asia is usually a more important market than North America and Europe. Because of the difference of industrial structure and geographical connections, Asia has been the most important trade partner to China for a long time. It is also worthwhile to outline some of the stylized facts about China's trade development with ASEAN countries during the past decade.

Over the past ten years, bilateral trade growth has been accelerating between China and ASEAN countries. ASEAN's exports of manufactures have been growing much more rapidly than imports from China. Therefore, the share of exports to China among ASEAN countries' total merchandise exports has increased persistently over this decade. Table 1 provides data on China's trade development with all ASEAN countries over the past ten years. Based on this survey, ASEAN countries increased their presence in China's trade development.

Table 1: China's Trade Trend with ASEAN Countries, 2000-2009, USD million

	Exports		Growth	Imports		Growth
	2000	2009	Fold	2000	2009	Fold
Brunei	13.02	140.44	2.11	61.35	281.99	3.60
Indonesia	3061.82	14720.53	3.81	4401.95	13668.23	2.11
Malaysia	2564.87	19631.78	6.65	5480.00	32335.92	4.90
Philippines	1464.41	8590.59	4.87	1677.32	11948.44	6.12
Singapore	5761.04	30051.94	4.22	5059.63	17803.93	2.52
Thailand	2243.25	13285.51	4.92	4380.79	24905.31	4.69
Sub-total	15108.41	86420.79	4.72	21061.04	100943.82	3.79
Cambodia	164.06	907.26	4.53	59.49	36.89	-37.98
Laos, PDR	34.42	377.17	9.96	6.42	374.63	57.35
Myanmar	496.44	2253.99	3.54	124.82	646.13	2.57
Vietnam	1537.26	16297.65	9.60	929.15	4747.53	4.11
Sub-total	2232.18	19836.07	7.89	1119.88	5805.18	4.18
ASEAN total	17340.59	106256.86	5.13	22180.92	106749	3.81
% of Asia total	13.11	18.69		15.69	17.69	
% of World	6.96	8.84		9.85	10.61	
Asia total	132308.23	568650.19	3.30	141341.88	603520.46	3.27
World total	249202.55	1201610.00	3.82	225093.73	1005920.00	3.47

Source: China Statistical Yearbook, 2001, p.591.

First, ASEAN's share of China's trade rose from 8.33 percent to 9.65 percent between 2000 and 2009. China's exports to ASEAN increased from USD 17.34 billion to USD 106.26 billion, and imports climbed from USD 22.18 billion to USD 106.75 billion. In comparison to China's world trade growth, more progress has been made both in exports and imports with most ASEAN countries.

Second, the share of ASEAN's combined exports to China's total trade has shown a slight increase, from 9.85 percent to 10.61 percent, while China's exports to ASEAN only accounted for 6.96 percent and 8.84 percent between 2000 and 2009, respectively. Third, among ASEAN countries, individual trade performance has differed widely over the past decade.

Three groups can be distinguished. Representing the first one, most of the forerunners of ASEAN have expanded their exports and imports by more than four times. For instance, Singapore became the largest importer from China, followed by Malaysia, which kept its spot as the top ASEAN exporter to China up to 2009. Second, Vietnam's import volume has dramatically increased, from USD 1.54 billion to USD 16.30 billion worth, and continues to outpace the trade growth of the ASEAN latecomers. The third group's (Cambodia, Laos and Myanmar) trade volume is still a small amount.

From the review of countries above, it is apparent that some ASEAN members such as Malaysia, Singapore and Thailand outperformed their peers in trade with China. The combined merchandise exports of China to the forerunners rose by 4.72 times to USD 86.42 billion, and the country's imports rose by 3.79 times to USD 100.94 billion, resulting in an aggregate deficit in excess of USD 14.52 billion in 2009. Relatively, the expansion of China's exports and imports to the latecomers has been even stronger than for the forerunners over the past ten years. However, the share of these latecomers in China's trade with Asia has been insignificant, accounting for 3.49 percent of China's exports and 0.96 percent of its imports in 2009.

The data shows obviously that the expansion of exports and imports between China and ASEAN countries exceeded significantly Asian and global growth. What

factors can be proposed for these rapid trade growth rates? East Asia's manufacturing industry has undergone a structural shift from light activities such as textiles to the heavier activities dominated by multinationals such as electronics and automobiles, with the latter activities relying greatly on imported inputs. Therefore, the substantial increase in trade values was principally the result of the surge in intermediate goods trade, particularly for information technology and electronics goods, in cross-border trade. We now present our findings on this issue.

3. INTERMEDIATE GOODS TRADE BETWEEN CHINA AND ASEAN

As discussed in Section 2, an important phenomenon over the past decade has been the increase in the trade of manufactured parts and components. The WTO estimated that the share of intermediate manufactured products in non-fuel world trade was around 40 percent in 2008.[21] By a variety of measures, the increased use of imported inputs, and the narrowing of production activities within each country, is a characteristic feature of East Asian countries over the past two decades. This section will attempt to clarify the estimated size and recent trend of intermediate goods trade between China and ASEAN over the 2000-2009 period. It will describe how the trade developed and explain the process of the production chain across ASEAN countries and industries.

[21] WTO (2009b) *International Trade Statistics 2009*, p. 2.

3.1. Trade Trend in General

After China liberalized its tariffs on imported inputs intended for the production of export goods in the early 1980s, the country experienced very rapid growth in its vertical specialization. Data from Naughton (1996) indicates that China's vertical specialization share of imports was about 0.25 in 1988. This rose to 0.41 by 1994.[22] After joining the WTO, China continued to increase its imports of intermediate goods for the purpose of exports. One example for China is that the share of intermediate goods in non-fuel merchandise is 38 percent.[23]

We identify the broad trade pattern in intermediate goods and changes over time and document our findings in four summary tables. The next table shows both the volume and the percentage of intermediate goods in terms of different parts and components trade between China and ASEAN over the 2000-2009 period (Table 2). Unsurprisingly, available data from the United Nations has highlighted the trade trend of intermediate goods. In that period, intermediate goods dominated the trade between ASEAN forerunners and China, making up 82.56 percent for China's exports and 95.77 percent for its import. But latecomers only accounted for 17.44 percent of exports and 4.23 percent of imports over the period. Except for Vietnam, the combined balance of intermediate goods trade in Cambodia, Laos and Myanmar with China has been negligible. Therefore, Vietnam is a suitable country among ASEAN's new members for our analysis on intermediate goods trade.

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[22] Naughton. B. (1996) "China's Emergence and Prospects as a Trading Nation," *Brookings Papers on Economic Activity*, Vol. 2, Washington, DC.

[23] Andreas Maurer and Christophe Degain (2010) "Globalization and Trade Flows: What You See Is What You Get!" *WTO Staff-Working Paper* ERSD-2010-12, June.

Table 2: China's Trade of Intermediate Goods with ASEAN Countries, 2000-2009

USD million

	Exports	Share (%)	Imports	Share (%)	Balance
Brunei	359.7	0.11	2051.0	0.37	-1691.3
Indonesia	52742.0	15.56	74917.6	13.67	-22175.6
Malaysia	59879.0	17.66	168524.8	30.74	-108645.8
Philippines	30505.9	9.00	86271.0	15.74	-55765.1
Singapore	89189.0	26.31	97417.3	17.77	-8228.3
Thailand	47208.7	13.93	95895.1	17.49	-48686.4
Sub-total	279884.3	82.56	525076.8	95.77	-245192.5
Cambodia	4094.3	1.21	316.8	0.06	3777.5
Lao, PDR	500.3	0.15	694.0	0.13	-193.7
Myanmar	6859.5	2.02	2606.2	0.48	4253.3
Vietnam	47672.8	14.06	19551.7	3.57	28121.1
Sub-total	59126.9	17.44	23168.7	4.23	35958.2
Total	339011.2	100.00	548245.5	100.00	-209234.3
MRBC*	106335.6	31.17	119063.8	21.72	-12728.2

Note: *MRBC refers to the Mekong River Basin countries: Cambodia, Lao, Myanmar, Thailand and Vietnam.

Sources: UN Comtrade.

First, China's imports grew more rapidly than its exports. There was a variety of performance for individual countries. From the beginning of this century, Malaysia has succeeded in sharply increasing its intermediate goods exports to China, from USD 4.76 billion in 2000 to USD 28.38 billion in 2008, and surprisingly to USD 29.04 billion in 2009. China's exports to Vietnam increased significantly from USD 9.0 million to USD 98.71 million between 2000 and 2008, and further to USD 99.84 million in 2009 despite China's overall trade contraction. China's imports from

Vietnam expanded less than the exports, increasing from USD 8.94 million to USD 31.97 million, and further to USD34.08 million. The rest of the ASEAN countries experienced a contraction of trade to China. Clearly, Malaysia and Vietnam are winners in their exports of intermediate goods to China even during the financial crisis.

Second, in contrast to exports of intermediate goods, generally China's imports from ASEAN rose more rapidly, by nearly fivefold during the 2000-2008 period. Actually, the share of individual countries in China's intermediate goods trade varied, largely due to their own industrializing stages and evolvement in the global production chain. Thailand accounted for 16.13 percent of China's trade with ASEAN countries, while the share of Vietnam was 7.58 percent. Those two nations have been the major partners to China among the Mekong River Basin Countries (MRBCs), and Cambodia, Laos and Myanmar are far lagging behind Thailand and Vietnam in trade with China up to today.

Third, according to UN Comtrade, the trade balance between China and ASEAN favors the latter in this period. For intermediate goods, on the Chinese side there is a large deficit accumulation of USD 209.23 billion, largely from the ASEAN forerunners. But when excluding Thailand, China's trade of intermediate goods with the MRBCs turns out to be a surplus of USD 35.96 billion. More recently, in response to the stimulus policy, the trade of the MRBCs (excluding Thailand) with China increased 12.08 percent in 2009.

There is a significant factor that explains the trade growth of intermediate goods between China and ASEAN countries. Apparently, both Indonesia and the Philippines are unable to actively participate in this integrated regional production base to the same extent as other ASEAN forerunners such as Malaysia and Singapore. For instance,

Indonesia and the Philippines account for 13.67 percent and 15.74 percent of China's imports from ASEAN, and 15.56 percent and 9.00 percent of its exports to the region, respectively. Malaysia and Singapore, however, account for 30.74 percent and 17.77 percent of the imports and 17.66 percent and 26.31 percent of the exports, respectively.

Therefore, Indonesia and the Philippines as well as Brunei are excluded in this study. In some way, this reflects the real phenomenon that these three countries are outliers in the region. For that reason, this study will not analyze the trade performance of intermediate goods between China and these three countries. Besides, Cambodia, Laos and Myanmar are also excluded because of the small amount of intermediate goods trade in the machinery and electronics industries. Therefore, the countries included in this section and the next are three forerunners, namely, Malaysia, Singapore and Thailand, plus Vietnam. These four countries accounted for 71.96 percent of China's exports to ASEAN and 69.57 percent of its imports in intermediate goods over the past decade (2000-2009).

To arrive at an assessment of the trade performance of intermediate goods between China and these four countries, we should analyze the trade of intermediate inputs across the four countries.

3.2. Different Trade Performances in Three Categories of the BEC Code

Having examined the growth of intermediate goods trade, in this sub-section we provide decompositions that address two issues. First, what is the percentage of major intermediate goods in the sector composition of overall exports and imports? Second, what can we say about the geographic orientation of intermediate goods trade between China and the four countries?

Since the late 1990s, there has been a notable shift in export composition away from conventional labor-intensive product lines towards more sophisticated product lines – in particular those within the broad category of machinery, electronics and transport equipment. Between 2000 and 2008, the share of miscellaneous manufactures – a catch-all commodity group encompassing most of the traditional labor-intensive products – in China's total manufactured exports declined from 35.56 percent to 24.84 percent, and the share of machinery increased from 36.92 percent to 49.78 percent. By 2009, the volume of machinery exports had reached USD 590.28 billion worth, accounting for 49.12 percent of China's total trade, while that of imports was USD 407.80 billion or 40.54 percent. Therefore, the exports of machinery are estimated to contain more imported parts and components, which indicates the rapid integration of China's production into global networks. As other studies have suggested, the trade growth in China again seems to provide evidence of its greater dependence on inputs from the region for its own growth.[24] A manufacturer that relies heavily on imported inputs will likely be more exposed to international shocks through costs than a producer that relies mostly on domestically produced inputs.

We need to present a measure of intermediate inputs. Trade in intermediate products is generally measured through a breakdown of trade statistics according to the BEC classification of the United Nations. A rough measure of trade in intermediate goods based on existing statistics is the sum of trade in classification headings having the words "parts" or "components" in their description (BEC 22+42+53) as a share of world trade. Therefore, we present the trade performance of main intermediate goods from 2000 to 2009 for three categories proposed by UN Comtrade. Category 22 covers

[24] Maria Socorro Gochoco-Bautista (2008) "Output Movements in East Asia: Is There a Regional Factor?" *The World Economy*, 31(6), p. 754.

industrial processed supplies, while 42 refers to parts and accessories of capital goods, and 53 defines parts and accessories of transport equipment. Overall, the intermediate goods examined represent 87.37 percent of exports and 69.23 percent of imports in 2009 between China and ASEAN countries. The decomposition is given in Table 3.

Table 3: Market Share of Intermediate Goods Trade between China and ASEAN, BEC Code

	Exports			Imports		
	2000	2009	Change	2000	2009	Change
22	42.4.0	50.50	7.80	37.33	22.84	-14.49
42	33.67	32.00	-1.67	34.56	45.93	11.37
53	3.85	5.17	1.32	0.47	0.46	-0.01
Total	79.92	87.37	7.45	72.36	69.23	-3.13

Source: UN Comtrade

We decompose changes in the category level of the intermediate goods of overall exports and imports based on the BEC code. Among intermediates trade between China and ASEAN countries, there has been a long-term decline in the relative importance of primary industrial goods and fuels and lubricants. The share of primary industrial goods (category 21) experienced a substantial decrease from 6.83 percent to 1.19 percent of the total trade of intermediate inputs, and the share of fuels and lubricants (category 31) went from 4.38 percent to 0.86 percent between 2000 and 2009. The following two tables provide detailed information on specific features of each category of intermediate goods within a given period. Categories 22 and 42 constitute the dominant portion of intermediate goods, while category 53 only accounts

for less than 1 percent of China's imports from ASEAN over this period. Each category consists of many kinds of parts and components.

For expositional convenience, we describe the trade into exports and imports of these three categories and make this picture clear regarding changes of the percentage points. These results are given in Table 3. We see that changes in intermediates across three categories account for most of the growth in the overall trade share between China and ASEAN. However, the trade of three categories differs across countries because of different industrial capacities and openness to the global production chain. Using the available data, we can draw some points of view from the following discussion.

A. Table 3 presents our calculation for each sector using the initial year and final year of data. For both years, the greatest export share for the Chinese side was sector 22, while the biggest import share was sector 42. Comparing the initial year to the final year, we see that only sector 53 had a minor number in the vertical specialization of China's imports, which fell from 0.47 percent to 0.46 percent. So, excluding category 53, two categories (22 and 42) accounted for two-thirds of total trade in intermediate goods.

B. However, changes in the category composition of overall trade in intermediates play a big role. First, China increased its exports of category 22 to ASEAN from 42.40 percent to 50.50 percent between 2000 and 2009, while its imports decreased from 37.33 percent to 22.84 percent. Second, China's imports of category 42 from ASEAN increased from 34.56 percent to 45.93 percent, while its exports declined 1.67 percentage points. Third, the decomposition indicates a minor contribution of auto parts to China's trade with ASEAN countries.

The above discussion shows the trade development of intermediate inputs between China and ASEAN countries. As a report published by the United Nations Industrial Development Organization (UNIDO) pointed out, an important consequence of the growth of trade in manufacturing is that the location of production has been shifting from developed to developing countries, a process that is gradually accelerating.

3.3. Geographic Profile

We employ similar decompositions to assess whether cross-country change in vertical specialization is due to vertical intensity or export composition. In this exercise, we examine country differences by calculating a simple average of category composition over the four countries.

Table 4 shows a sharp contrast between different categories. The total deficits in categories 22 and 42 of China to these three countries reached USD 18.22 billion and USD 96.01 billion, respectively, while the total surplus of category 53 was only USD 6.37 billion. These findings reflect the difference in intra-regional production networks.

Table 4: Geographical Profile of China's Trade with ASEAN Countries (2000-2009)

USD million

BEC Code	Malaysia	Singapore	Thailand	Total	Vietnam
22					
Exports	22239.47	26942.53	28975.62	78157.62	32149.22
Imports	26306.95	32687.91	37378.51	96373.37	2845.47
Balance	-4067.48	-5745.38	-8402.89	-18215.75	29303.75
42					
Exports	31297.84	46960.46	14307.18	92565.48	43943.67
Imports	105224.00	44667.55	38684.62	188576.17	916.69
Balance	-73926.16	2292.91	-24377.44	-96010.69	43026.98
53					
Exports	3329.50	2870.66	1968.42	8168.58	2543.01
Imports	518.53	640.66	636.95	1796.14	59.24
Balance	2810.97	2230.00	1331.47	6372.44	2483.77

Source: UN Comtrade.

A. Among three categories, the 22 category is notable for China's deficits with three countries: Malaysia, Singapore and Thailand, totaling USD 18.22 billion over the past ten years. However, the volume of China's exports to Vietnam reached USD 32.15 billion worth, while imports from Vietnam were USD 2.85 billion over the survey period. Among these four countries, clearly Vietnam is the largest importer of category 22, which reflects its low level of machinery production capacity.

B. As far as category 42 is concerned, Malaysia has been the biggest exporter of this to China, maintaining a large surplus of USD 73.93 billion for the past ten years. Thailand also has a huge surplus of USD 24.38 billion. In addition, China exports more

than it imports in this category as regards Singapore and Vietnam. In particular, China's exports to Vietnam amounted to USD 43.94 billion, compared to imports of USD 0.92 billion.

C. Within category 53, China's superior performance is clearly visible for parts and components of transport equipment. Nevertheless, the four countries considered here have experienced a wave of export growth since 2000. Relatively speaking, Malaysia, Singapore and Thailand have had more trade of auto parts with China, with Vietnam still lagging behind them. The share of category 53 in total intermediate goods imports has remained at about 1 percent, which implies that the regional production chain in the automobile industry has not been expanded by FDI. There is overwhelming evidence of export markets being critical to driving technological change in auto parts manufacturing. Because of the greater reach of auto firms in global markets, both domestic and foreign firms have incentives to export their parts to overseas markets. The emergence of China as a great power in the global automobile industry has shown that new trade of parts and components is possible. According to this author's estimation, China's total units of auto production will be more than 22 million before 2015, which would reshape the production networks in East Asia.[25] Put simply, the expansion of automobile production will create new demand for auto parts and components from ASEAN countries.

The vertical specialization share rose because exports increased in sectors that use imported intermediates intensively, and because the sectors with high exports increased their share of total imported intermediates. By moving across the panels of Figure 1, it is possible to trace changes in both exports and imports over time for each country. The

[25] Xingmin Yin (2010) "The Future of China's Automobile Industry," *Fudan Journal of Humanities and Social Science*, 3(3): 39-69, September.

real picture of the trade balances of different categories between China and individual countries can be found in Figure 1.

Figure 1: Trend of China's Trade with Four ASEAN Countries of Commodity by BEC Code

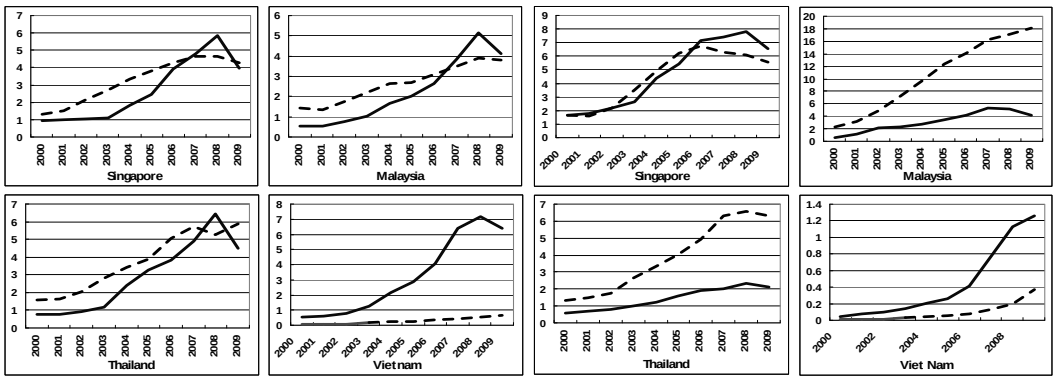

Figure 1 (a) 22

Figure 1 (b) 42

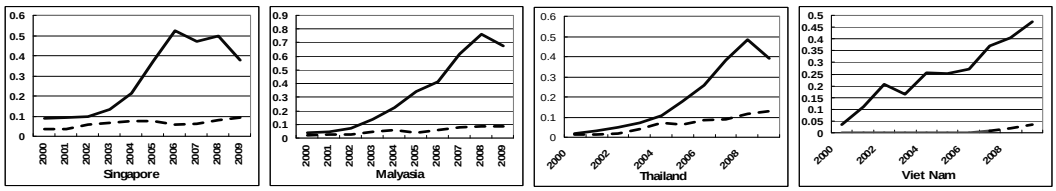

Figure 1 (c) 53

First, we see in the similarities of category 22 trade by cross-country comparison (excluding Vietnam) that the growth of exports and imports shows an upward trend in vertical specialization (Figure 1(a)). The following point may be distinguished: The contribution of China’s technology in the changes of vertical specialization across countries turned China’s trade balance into a surplus with these countries between 2006 and 2008.

Second, a direct comparison of Singapore relative to China's trade with Malaysia and Thailand in category 42 is instructive. China's trade balance with Singapore turned into a surplus in 2006-2008. However, our calculation of China's trade deficits shows one of USD 73.93 billion emerging with Malaysia and one of USD 24.38 billion with Thailand. Malaysia and Thailand moved in a similar upward curve in their exports to China. Vietnam displays a strikingly low level of exports to China. This difference may be due to greater sector vertical intensity in Malaysia and Thailand designed by MNEs. In particular, greater vertical intensity in category 42 alone accounts for 46.98 percent of China's total deficit with ASEAN in intermediate goods trade.

Third, Figure 1(c) shows how low each country's export/import ratio was with China. For instance, Thailand's export/import ratio with China was 32.33 percent, Singapore's was 22.32 percent and Malaysia's was 15.57 percent. Taken together, China's import/export ratio of transport equipment (category 53) with these four countries was 21.99 percent over the survey period. The following information may be useful to our understanding of potential trade in auto parts between China and ASEAN countries. A special study[26] shows that in China's auto parts production, foreign firms have higher export intensity than local firms. Trade has become so central to auto manufacturing that it is no longer realistic to regard vehicle assembly as a largely internal process. Actually, China's boom in parts exports, along with the many multinational auto makers now setting up shop, has contributed to virtually every first-tier supplier, including Robert Bosch in Germany, Delphi in the United States, Valeo in France, and Denso in Japan, as well as companies such as Lear and Siemens. Trade in auto parts has remarkably increased. During the 2000-2008 period, exports of

[26] Rajah Rasiah (2007) "R&D and Export Intensities in Automotive Parts Firms in China, Malaysia, Philippines and Taiwan: Does Ownership Matter?" *RIETI Discussion Paper Series* 07-E-025.

auto parts grew from USD 1.12 billion to USD 14.82 billion, while imports went from USD 2.1 billion to USD 13.45 billion. China's auto parts trade volume has increased significantly.[27] In comparison, however, China's trade with ASEAN countries in auto parts has not grown rapidly over the past ten years.

As pointed out above, this discussion highlights three facts. First, China's exports of category 22 have been diversified into these four countries. Second, Malaysia and Singapore account for the lion's share of category 42 with China. Third, Vietnam accounts for only a tiny share in categories 42 and 53 with China.

4. CASE STUDIES: DIFFERENT FEATURES IN MACHINERY AND ELECTRONICS

Note that vertical specialization involves both an import side and an export side. On the import side, vertical specialization is essentially a subset of intermediate goods trade. On the export side, it can involve either intermediate goods or final goods. A narrow concept of vertical specialization involves those imported goods that are used as inputs to produce a country's export goods.[28] For instance, China now exports raw steel to Thailand, where the steel is stamped and pressed and then exported to Vietnam, where it is manufactured into industrial tools, some of which are then exported to Cambodia. Reflecting this emerging pattern of complementarities in global production sharing, intermediate goods trade between China and ASEAN has significantly increased under the wave of production fragmentation.

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[27] Xingmin Yin (2010) "The Future of China's Automobile Industry," *Fudan Journal of Humanities and Social Science*, 3(3), September, pp. 59-60.

[28] David Hummels, Jun Ishii, Kei-Mu Yi (2001) "The Nature and Growth of Vertical Specialization in World Trade," *Journal of International Economics*, 54(1), p. 76.

In estimating the trade performance of intermediate goods between China and ASEAN, it is important to take into account the different features of different products. Briefly, almost three-quarters of the increase in total intermediate goods exports from ASEAN to China between 2000 and 2009 came from electronics, with components and parts having a 40 percent share of that. The contribution of components and parts in machinery exports was much less. In this section, we empirically study the trade performance of intermediate goods by focusing on two industries: machinery and electronics. These two industrial production systems consist of many parts and components, requiring a long supply chain.

The two case studies on machinery and electronics will provide more precise figures on the size of intermediate goods trade as well as showing the different features between China and each country as chosen by this report.

4.1. Definition of Parts and Components in Intermediate Goods

Data on trade in parts and components is currently limited. Trade statistics are generally not well adapted to measuring trade in stages of production. Therefore, a major problem when attempting to measure the magnitude and the trade trend of intermediate goods is that the definitions do not easily match the officially collected economic data. As such, estimates of the pattern and the size of industrial fragmentation have to rely on proxy measures. Is vertical specialization primarily intra-industry, or does it also involve China's trade with ASEAN countries? To show the sector orientation of vertical specialization in intermediate inputs trade, we combine our China Customs data and data from the United Nations.

The classification of China Customs is compatible to the BEC of the United Nations. For instance, electronic components such as integrated circuits (ICs) and micro-assemblies are included in the electronic parts category 8542-43 of China Customs and 7764 of the BEC code. The four to eight-digit industry classification of machinery and electronic parts production is shown in Table 5. For our convenient analysis, we consider eight categories of intermediate goods by each country over the 2000-2006 period. Available data do not allow us to extend our database to the latest years.

An obvious phenomenon in manufacturing development, the product architecture between machinery and electronics is completely different. A machine is a typical example of an integrated product of mutually interdependent components; it should be designed in an integrated manner through the coordination of an assembler and parts suppliers. In addition, the parts and components in machinery are based on the metal fabrication that involves many stages of production and close cooperation in production. In contrast, an electronics product has a modular architecture in general, which allows an assembler and parts suppliers to work more independently. So, such supply chain characteristics will lead to a different pattern between China and ASEAN in the trade of intermediate goods.

We identify broad external orientation patterns of intermediate inputs in the machinery and electronics industries and changes over time, and document our findings in a series of tables and figures.

Table 5: Classification of Intermediate Goods between China Customs and BEC

China Customs	Description of intermediate products	BEC
Metal fabrication		
8402-8410	Boilers, steam-turbines, other vapor turbines, internal combustion piston engines, and parts thereof.	
8480-8485	A. Ball-or roller bearings; taps, cocks, valves and similar appliances for pipes, boiler shells, tanks, vats or the like, including pressure-reducing valves.	746-748
	B. Gears and other speed exchanges.	
8501-8511	Rotating electric plant, electrical transformers, and parts, suitable for use solely or principally with the machines falling within group 716.	716
8706-8708	Parts and components for motor vehicles.	
Electronics		
84714100-6000	Digital processing units, input or output units for automatic data-processing machines, storage units, data-processing equipment.	
84716070-8000	Hard-disk drivers and parts.	
8517	Telecommunication equipment and its parts, storage units, whether or not presented with the rest of a system.	7527
8542-8543	Electronic integrated circuits and micro-assemblies, parts and the articles of IC.	7764

Source: China Custom data.

Briefly, categories 8402-8410, 8480-8485 and 8501-8511 consist of intermediate products that are intensive in the use of domestically produced inputs. Categories 8706-8708 are auto parts and components, what many commentators refer to as domestic-based specialization, using imported inputs to serve the domestic market.

These activities use imported intermediate inputs to produce exports, either for final sale or as intermediate inputs into further stages of manufacturing. However, the four categories detailed above and associated with electronics have had different features both in production and trade. Therefore, industry characteristics should be taken into account in order to draw more precise implications from different industries.

4.2. Empirical Evidence from China Customs

To understand the trend of parts and components of the metal fabricated and electronics industries, we make use of the data permitted by China Customs. In total, eight categories have been picked up for research purposes. It should be pointed out that the volume of trade is denominated in RMB due to the data source. To begin our examination of different performance between the values of exports and imports of intermediate goods, we divided intermediate goods into two subgroups: metal fabrication and electronics.

4.2.1. Trade surplus in the metal fabricated industry

A variety of characteristics in Table 6 can be summarized when we consider the four categories detailed below by each country using seven-year trade data. Categories 8402-8410, 8480-8485, 8501-8511 and 8706-8708 can be classified into metal fabricated production.

For the machinery sector, except in Thailand, the orientation numbers in vertical specialization are quite similar to the overall trade performance of these countries, with a large number of deficits to China. Among the four countries, Thailand maintained a trade surplus both in 8480-85 and 8501-11. Excluding China's imports from Vietnam

in category 8480-85, the share of China's vertical specialization of imports originating from the three countries was 67.15 percent in the four categories over this period.

Table 6: Trade Profile of Metal Fabrication Products, 2000-2006, RMB million

Sub-group	Malaysia	Singapore	Thailand	Three Total	Vietnam
8402-8410					
Exports	120.34	112.41	177.68	410.43	840.20
Imports	1.94	56.84	45.88	104.66	2.45
Balance	118.40	55.57	131.80	305.77	837.75
Im/Ex ratio	1.61%	50.57%	25.82%	26.10%	0.29%
8480-8485					
Exports	464.38	800.27	644.13	2167.36	258.58
Imports	303.33	884.32	715.45	1913.20	10.10
Balance	157.05	-84.05	-71.32	254.16	248.48
Im/Ex ratio	65.32%	110.50%	111.07%	88.27%	3.91%
8501-8511					
Exports	1206.80	1751.17	967.55	4182.14	256.62
Imports	809.38	872.16	1552.07	3393.15	159.54
Balance	397.42	879.01	-584.52	788.99	97.08
Im/Ex ratio	49.10%	49.80%	160.41%	81.31%	62.17%
8706-8708					
Exports	296.50	170.11	174.16	820.02	179.25
Imports	51.17	21.76	167.73	240.93	0.27
Balance	245.33	148.35	6.43	579.09	178.98
Im/Ex ratio	17.26%	12.79%	96.31%	29.38%	0.15%

Source: China Custom data.

First, in categories 8402-8410, China has an absolute advantage in exports with each country, the total surplus being RMB 1.14 billion.

Second, trade differentials between China and the four countries are substantial in

categories 8480-85. China has deficits with Singapore and Thailand, and surpluses with Malaysia and Vietnam. The data shows that since 2005, China has increased its export superiority over each country in the trade of these categories.

Third, categories 8501-11 reveal a complicated phenomenon. Surprisingly, Thailand exported consistently more than it imported, gaining a surplus of RMB 584.52 million over this period. Looking at the other three countries, we again see differences in trade performance that vary across them. For instance, China's imports from Malaysia seem to be in a slowing trend, and they are even decreasing from Singapore. However, China's imports from Vietnam are experiencing strong growth. This is perhaps related to the border connection between China and Vietnam.

Fourth, as mentioned above, categories 8706-08 cover the trade of auto parts and components with each country. Compared to its peer countries, Thailand has already established a very large automobile production base with the huge investment of MNEs in the past three decades. We find a large change in total trade between China and Thailand with the rapid growth of China's automobile industry in recent years. The year 2005 was a watershed in the trade balance for auto parts and components between China and Thailand, as China's exports (RMB 40.41 million) exceeded its imports (RMB 30.43 million). In 2006, the value of China's exports was RMB 63.20 million, while that of its imports was only RMB 33.59 million. Such evidence shows the increasing competitiveness of China's exports of auto parts and components over the period.

Generally, ASEAN countries have not significantly increased their exports of metal fabricated parts and components to China and still have trade deficits, except for Thailand's trade in categories 8501-8511 over the 2000-2006 period.

Figure 2: Trade between China and Each Country in Metal Fabricated Inputs

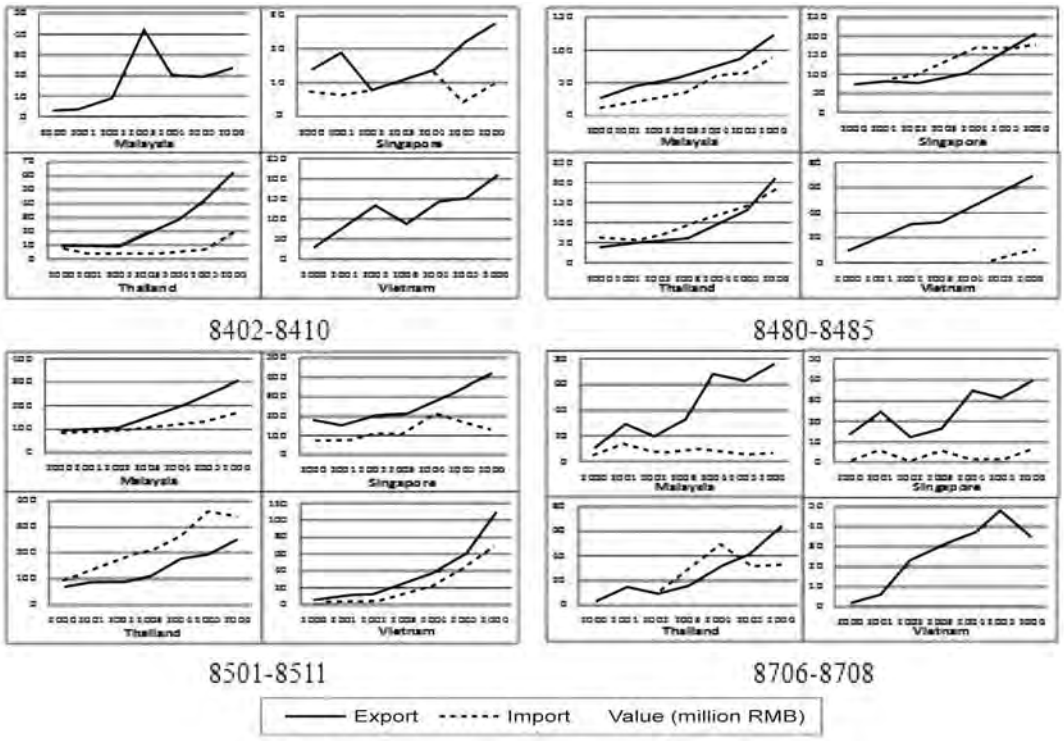


Figure 2 shows the growth trend of trade between China and each country in metal fabricated inputs between 2000 and 2006.

The growth of trade in these four categories has been impressive. Between 2000 and 2006, China kept its strong dynamics in exports of metal fabricated intermediate goods to each country, as shown in Figure 2. The four panels in Figure 2 have vividly plotted the growth curves. The upper left panel shows that Vietnam became the largest destination of China's exports of category 8408-8410. The upper right panel shows the typical vertical specialization of intermediate goods between China and each country, except Vietnam. As indicated in the lower left panel, both exports and imports in

category 8501-8511 between China and each country increased more rapidly than the other categories, signaling a higher integration of production networks in this sector. The lower right panel shows the competitiveness of China's industrial capacity compared to these four countries. Imported intermediate inputs have not increased both as a ratio of intermediate input exports or, more surprisingly, as an absolute number.

The production and export structure is the outcome of technological capabilities developed by incremental learning processes and the production system. As mentioned earlier, the output of automobile production in China has dramatically expanded. China is now highly active in exports and production in the automobile industry. Indeed, the improvement of production technology and the export structure in machinery are China's main advantages in its ability to compete and cooperate with East Asian countries amid the changing regional production networks. Besides, China's metal fabricated industries have also experienced large expansion in imports as a ratio to exports. The increase in the import of metal fabricated intermediate inputs is compatible to the growth in exports. In categories 8402-8410 and 8706-8708, the combined import/export ratio remained at a low level of 26.10 percent and 29.38 percent, respectively. By contrast, categories 8480-8485 and 8501-8511 maintained a high import/export ratio between 2000 and 2006. The differences among categories across the countries have been calculated in Table 6.

Table 6 and Figure 2 confirm China's export performance in each category over time for each country. The categories associated with vertical specialization – in particular 8480-8485 and 8501-8511 – have had a proportionate role in both the export and import growth of each country. It is obvious that in machinery exports, the impact is more complementary than competitive, presumably reflecting supply-side

complementarities within regional production networks.

The visible trade pattern in the metal fabricated industry between China and ASEAN countries is not consistent with the ongoing view that the pattern of intermediate goods trade reflects the global production networks. But this impact seems to be country-specific, depending on a given country's comparative advantage in the fabrication of metal products and its related production capabilities.

A related dimension of the trade story in intermediate goods is that China's surplus in metal fabrication turns into a deficit in the electronics sector when taking ASEAN as a whole. The picture shows a difference.

4.2.2. Trade of intermediate inputs in electronics

Although in recent years much attention has been paid to the production chain in East Asian's electronics industry, such as the case of Apple's iPad production through a global supply chain,[29] researchers have tried to establish the precise link between the location of MNEs and local industrial development.[30] For instance, the production and assembly of the motherboard, hard drive, display panel, memory and microprocessor for a laptop need not all take place on a single factory floor. In fact, their production can take place at different factories in different countries at different times. Such a production system allows producers of intermediate goods and assemblers to hold smaller amounts of inventory. Electronics is an industry particularly thus concerned. Clearly, as electronic goods become standardized, this is characterized by a high value-to-weight ratio, and the

[29] Andreas Maurer and Christophe Degain (2010) "Globalization and Trade Flows: What You See is What You Get!" *WTO Staff-Working Paper* ERSD-2010-12, June.

[30] S. Mansoob Murshed (2001) "Patterns of East Asian Trade and Intra-Industry Trade in Manufactures," *Journal of the Asia- Pacific Economy*, 6(1): 99-123.

production of parts and components can easily be separated in time and space.[31] In the past twenty years, ASEAN countries' components trade has generally increased, particularly in the electronics industry, in the face of China's rise as a major player in world electronics trade.

When it comes to understanding the fragmentation of the production process for electronic goods, some kinds of parts and components should be chosen and analyzed. As listed in Table 5, the categories 84714100-6000, 84716070-8000, 8517 and 8542-8543 are classified into electronics inputs, and are involved in the different stages and in different countries.

The emergence of East Asia as a powerful force in the global electronics industry is shown in the trade imbalance between China and ASEAN. We find that China's export/import ratio was only 10.91 percent in these four categories of electronics with the four countries during the survey period. Actually, ASEAN countries have regained their competitiveness in electronics component trade due to their early-bird strategy involving the attraction of FDI from U.S. and Japanese enterprises.

First, as can be expected, Singapore and Malaysia have kept their surplus in categories 84714100-6000. Total bilateral trade in intermediate goods among China, Malaysia and Singapore has rapidly increased since 2000. Singapore and Malaysia have surpluses of RMB 932.66 million and RMB 449.15 million, respectively. However, Thailand's trade with China has fluctuated and currently is in a downward trend (Figure 3 (a)). In fact, a trade deficit for Thailand emerged in this category in 2006.

[31] Nordas, H.K. (2005) "International Production Sharing: A Case for a Coherent Policy Framework," *WTO Discussion Papers,* No. 11.

Second, in trade of categories 84716070-8000, there is a clear gain for the three countries except Vietnam. Thailand has the biggest surplus at RMB 8.69 billion, while Malaysia and Singapore won surpluses of RMB 2.33 billion and RMB 2.69 billion, respectively. Vietnam engages in less activity in electronics production with almost no exports to China over the survey period.

Table 7: Trade Profile of Electronics Goods, 2000-2006, RMB million

	Malaysia	Singapore	Thailand	Total Three	Vietnam
84714100-6000					
Exports	59.38	360.32	60.15	505.37	25.52
Imports	508.53	1292.98	41.16	1842.76	0.09
Balance	-449.15	-932.66	18.99	-1337.39	25.43
Ex/Im ratio	11.68%	27.87%	146.14%	27.43%	283.56%
84716070-8000					
Exports	637.86	2176.46	188.20	3027.00	24.48
Imports	2965.00	4863.67	8878.57	16707.24	/
Balance	-2327.14	-2687.21	-8690.37	-1368.24	24.48
Ex/Im ratio	21.51%	44.75%	2.12%	18.12%	/
8517					
Exports	401.69	715.95	644.52	1887.93	125.77
Imports	1199.56	319.77	480.15	3891.47	4.06
Balance	-797.87	396.18	164.37	-2003.54	121.71
Ex/Im ratio	33.49%	233.90%	134.23%	48.52%	3097.78%
8542-8543					
Exports	2895.34	688.55	527.44	4111.33	26.26
Imports	37412.21	16486.80	7118.64	61017.65	9.70
Balance	-34516.87	-15798.25	-6591.20	-56906.32	16.56
Ex/Im ratio	7.74%	4.18%	7.41%	6.35%	170.72%

Source: China Customs.

Third, category 8517 covers telecommunication facilities and related components. There is evidence of a strong relationship between China's import growth and its subsequent rate of export growth. A more detailed examination shows that Malaysia's exports to China have increased the fastest among the four countries. The total surplus for Malaysia has accumulated to RMB 797.87 million. In trade for this category, Singapore has not kept pace with its neighboring countries such as Malaysia and Thailand (Figure 3 (c)). It is worth noting that there is a surplus of RMB 396.18 million for the China side in category 8517.

Fourth, category 8542-8543 is well-known as being (ICs), regarded as the core parts of the electronics industry. China's imports of ICs from these countries reportedly accumulated to RMB 61.02 billion. Somewhat unexpected is that the imports from Malaysia increased as rapidly as those from Singapore. Therefore, Malaysia's trade surplus in ICs accounted for 60.66 percent of the combined surplus of these three countries with China. Singapore's was 27.76 percent and Thailand's only 11.58 percent. The three countries have consistently increased their exports of ICs to China.

Fifth, Vietnam was the only country reporting a very small share in most electronics in its trade with China over the survey period.

Interestingly, among these countries, Vietnam still maintains a massive deficit position in the trade of electronics intermediate goods with China. Excluding category 8542-8543, Vietnam's capacity of exports in these electronics products to China has been very weak compared to that of Malaysia, Singapore and Thailand. The deficit of China's trade in selected electronics products with Malaysia, Singapore and Thailand can be listed as follows: RMB 34.52 billion to Malaysia, RMB 15.80 billion to Singapore and RMB 6.59 billion to Thailand.

Figure 3 : Trade between China and Each Country in Electronics

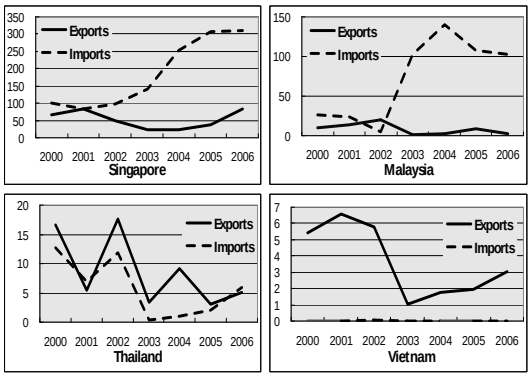


Figure 3（a）：84714110-6010

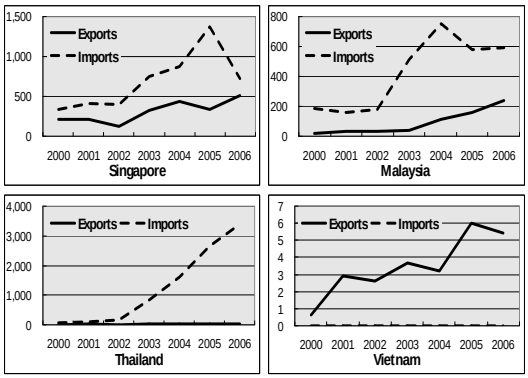


Figure 3（b）：84716070-8000

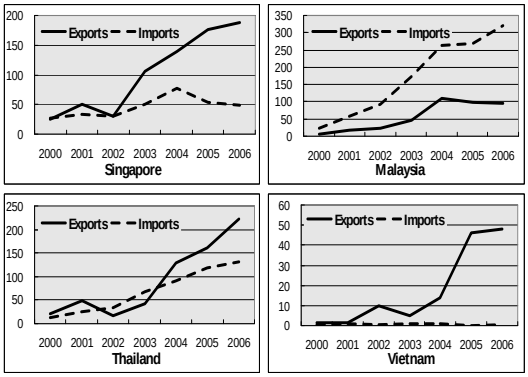


Figure 3（c）：8517

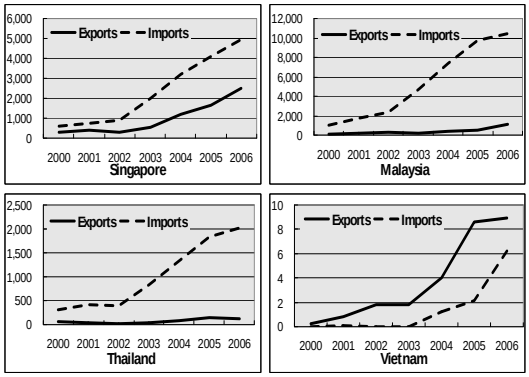


Figure 3（d）：8542-8543

Between 2000 and 2006, China's intermediate goods exports as a ratio to its imports was remarkably low, stemming largely from the ICs category that accounted for 74.38 percent of China's deficits with the four countries. Greater vertical intensity in category 84716070-8000 also emerged, as China's exports to imports ratio was 18.12 percent and its trade deficit reached RMB 1.37 billion.

4.2.3. Summing up

As a whole, China's machinery and electronics industries significantly increased their use of imported inputs in production and exports, from USD 91.39 billion in 2000 to USD 441.77 billion in 2008. The export/import ratio of inputs increased dramatically across countries and categories. In categories 8517 and 84714100-6000, the combined export/import ratio of the three countries was 48.52 percent and 27.43 percent, respectively. By and large, category 8542-8543 maintained a very low level with a combined ratio of 6.35 percent. The sharpest contrast between export and import curves in category 84716070-8000 can be described in Figure 3(b). The presence of imported inputs continued to increase in China. As a result, the export/import ratio remained below 20 percent for China's electronics trade. But the difference in the export/import ratio across countries and categories with low and medium proportions has significantly widened over the 2000-2006 period (Table 7 and Figure 3).

All in all, it appears clear that intra-industrial trade between China and ASEAN countries in electronics has expanded rapidly. In electronics, the impact of China's trade with ASEAN countries appears to be more favorable for ASEAN, presumably reflecting supply-side complementarities with East Asian regional production networks, which have been dominated by MNEs. A major part of electronics exports comes from final products, and a substantial trade deficit can be found in Table 7 and Figure 3. Generally, China's electronic components industry is still lagging behind in international competitiveness.

4.3. A Supplementary Discussion on Recent Data

In order to assess the magnitude and patterns of trade arising from cross-border production networks, it is necessary to choose some categories of parts and components from intermediate goods in reported trade data. I do this through a careful selection of three to four-digit-level data based on Revision 3 of the Standard International Trade Classification (SITC. Rev.3) of the United Nations trade data reporting system. Data for the 2000-2009 period, from which China-ASEAN data is available, will be discussed.

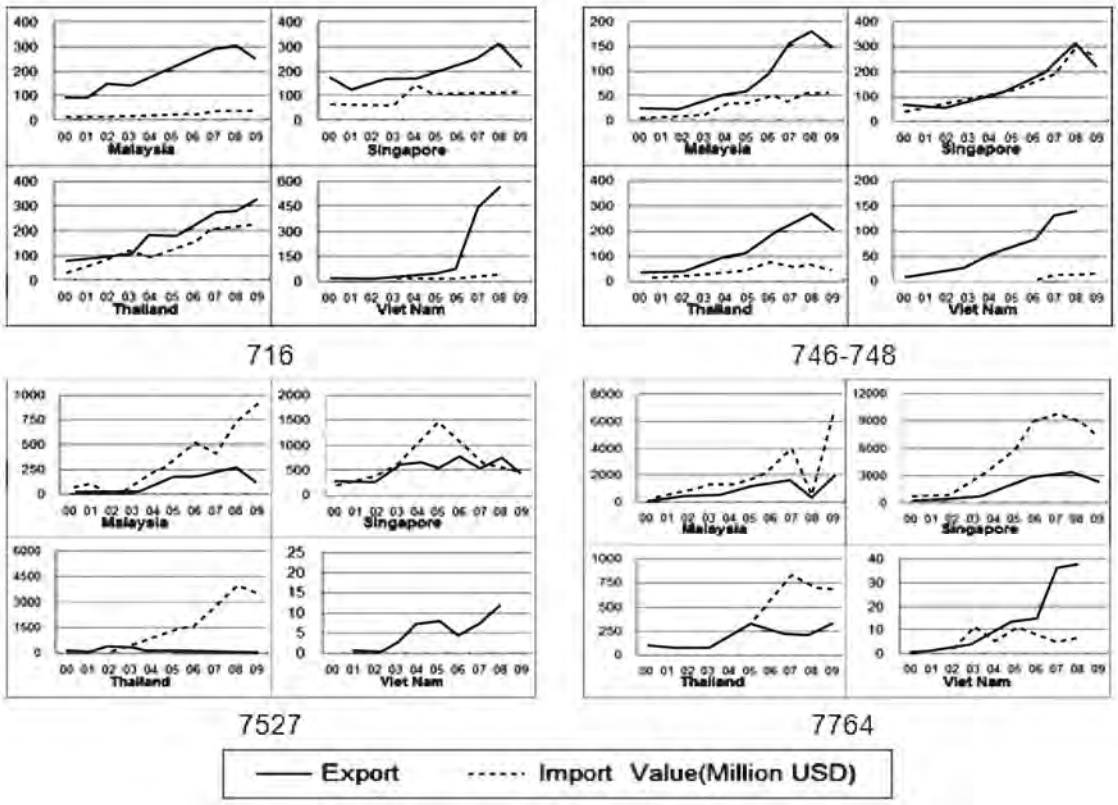
Table 8 provides trade of three categories between China and the four countries. Categories 716 and 746-748 are classified as the metal fabricated industry, 7527 refers to storage units, and category 7764 is the ICs and parts of the articles. These categories are the most dynamic products in machinery and electronics. Due to falling prices and more global demand, these products could expand their share in world trade of manufactured intermediate goods.

Table 8: Metal Fabricated and Electronics Goods, 2000-2009, USD million

	Malaysia	Singapore	Thailand	Three Countries	Vietnam
746-748					
Exports	791.90	2195.85	1229.36	4760.68	543.57
Imports	291.66	1272.80	384.96	1956.77	7.35
Balance	500.24	923.05	844.40	2803.91	536.22
716					
Exports	2029.32	2232.56	1868.73	7347.19	1216.58
Imports	231.86	1004.84	1421.99	2778.58	119.89
Balance	1797.46	1227.72	446.74	4568.61	1096.69
7527					
Exports	1062.89	5071.42	1219.78	7394.74	40.65
Imports	3290.52	6578.35	14224.18	31310.48	22.69
Balance	-2227.63	-1506.93	-13004.40	-24115.70	17.96
7764					
Exports	10400.85	15965.75	2212.55	28706.57	127.42
Imports	20715.85	52849.63	4321.82	77934.69	47.39
Balance	-10314.70	-36883.90	-2109.27	-49228.10	80.03

Source: UN Comtrade.

Figure 4: Trade between China and Each Country in Machinery and Electronics Based on Recent Data



Adding to the discussion of Table 8, Figure 4 shows plots of exports and imports in the four categories between China and the four countries over the past ten years. These four panels confirmed our previous findings on special features of China's trade with ASEAN countries.

First, the upper panels indicate that China's exports have a clear gap over the imports, except for categories 746-748 with Singapore. Those two categories belong to the metal fabricated industry. The export expansion of machinery such as categories

746-748 and 716 to the four countries shows that China has consistently gained a trade surplus. China accumulated a surplus of USD 500 million in category 746-748 with Malaysia, USD 923 million from Singapore and USD 844 million with Thailand. As for category 716, China's trade surplus reached USD 1,798 million with Malaysia, USD 1,228 million from Singapore, USD 1,097 million from Vietnam and USD 447 million with Thailand. In sum, the mere fact of rapid growth in intermediate goods of the machinery industry implies that China has a strong advantage in this industry over the four countries.

Second, the lower panels show that China's imports increased more rapidly than the exports, excluding ICs of Vietnam. The category 7764 indicates that the volumes of China's imports of ICs from Malaysia, Singapore and Thailand have been very large, and confirms that Singapore has the greatest part, followed by Malaysia and Thailand. Singapore plays an important role as East Asia's entrepôt in electronics trade with the rest of the world. Surprisingly, China clearly increased its imports of ICs and parts from Malaysia even in the face of the global economic downturn in 2009, while China's imports from Singapore and Thailand experienced a decline. This is probably reflective of the use of China as an integrated production base in the regional electronics industry. As such, greater intra-industry trade with ASEAN reflects those countries being a source of components for China's assembly purposes.

As shown in Figure 4, generally the graphs of actual growth in China's exports to each of these countries are similar to the graphs on intermediate goods imports in the electronics industry, excluding Vietnam. Therefore, Malaysia, Singapore and Thailand appear to exhibit a much greater power than does China for their exports of parts and components in electronics. In contrast, Vietnam's exports have been too small to

discuss. Vietnam has not increased its exports of machinery parts and components to China, largely due to the lower level of metal fabrication. However, due to the lower capacity of cross-border trade, it is entirely possible for Vietnam to benefit from China's increasing ties with ASEAN from the launch of the free trade agreement in January 2010. Another study revealed that there is a close similarity between the country composition of China's component imports and exports, with East Asia accounting for the lion's share of both. This reflects the multiple border-crossing of components between China and the other countries in the region at different stages of the production process.[32]

Indeed, in the past five years, China has become an engine of intra-regional trade growth for ASEAN and is one of the major export markets of countries such as Malaysia, Singapore and Thailand. For instance, Singapore exported USD 52.85 billion to China in comparison with its imports of USD 15.97 billion over the survey period. This suggests that the three countries are well-integrated with the region in terms of industrial production output growth. Between 2000 and 2009, Singapore's surplus with China in trade of category 7764 reached USD 36.88 billion, and its deficit with China in category 746-748 was only USD 0.92 billion. The same picture emerged for Malaysia's surplus of USD 10.31 billion versus a deficit of USD 0.5 billion with China. Thailand's trade with China gained a surplus of USD 2.11 billion in category 7764 and saw a deficit of USD 0.84 billion in category 746-748. In contrast, Vietnam experienced deficits in its trade of parts and components in both the machinery and electronics industries.

[32] Prema-Chandra Athukorala (2009) "The Rise of China and East Asian Export Performance: Is the Crowding-Out Fear Warranted?" *The World Economy*, 32(2), February, p. 254.

Today, China's industrial output growth is more dependent on East Asia, particularly as a source of inputs in electronics. We find that in these countries, excluding Vietnam, electronics account for three-quarters of the trade in intermediate goods.

As regards industrial capacity, ASEAN countries have not established a strong production base in machinery products such as boilers, steam-turbines, internal combustion piston engines, hearings, valves, rotating electric plant and electrical transformers. In the electronics industry, which is characterized by modular architecture, closing the technology gap can be achieved by focusing on specific components in the global supply chain. Obviously, vertical specialization in electronics is growing, and accounting for a major portion of overall vertical specialization share growth. It is clear from the above discussion that ASEAN's trade advantage in intermediate goods with China has been narrowly concentrated in electronics and related parts, while its disadvantage is still locked in the machinery industry. However, the trade balance between China and ASEAN in intermediate goods seems to favor the ASEAN forerunners due to their industrial connection to the global production chain.

5. CONCLUSIONS

This paper has reviewed the size and composition of China's trade of intermediate inputs with ASEAN countries, particularly Malaysia, Singapore, Thailand and Vietnam. There are important differences in the trade of intermediate goods across industries and countries. The similarities or differences in trade patterns in machinery and electronics across countries and over time are captured using data from China Customs and the

United Nations. These statistics measured the collaboration between exports and imports in the selected categories of intermediate inputs. The results have many potential applications.

First, the ASEAN forerunners remained China's largest trading partners in intermediate goods throughout the 2000-2009 period, accounting for 82.56 percent of China's exports and 95.77 percent of its imports. The latecomers, however, accounted for only 17.44 percent and 4.23 percent, respectively. Excluding Vietnam, China's intermediate goods trade with Cambodia, Laos and Myanmar has been negligible.

Second, using the BEC code, our results indicated that there are some differences when taking a simple average of sector composition over the four countries detailed above. Generally, China's exports of category 22 have been diversified into these countries. Malaysia and Singapore together make up the lion's share of category 42. Vietnam accounts for only a tiny share in categories 42 and 53.

Third is the context where international fragmentation of production in machinery and related metal fabrication is less active compared to the electronics industry. In reality, China's deficits in trade of intermediate goods with ASEAN are largely originated in electronics. The bulk of these products are simply "mass-market commodities" produced in huge quantities and at a relatively low unit cost using imported high-tech parts and components. Our study showed China's trade balance in electronics with these four countries, Singapore being number one in terms of volume and balance. Overall, the trade surplus in electronic parts and components overwhelms the deficit in machinery trade with China.

Fourth, the two-way trade implied by this special pattern in electronics is consistent with the concept of vertical specialization advanced by many studies as discussed above, whereby the input trade of metal fabricated industries between China and the four countries shows a fundamental difference in accordance with each country's technological capability.

Hence, for the industrialization of the ASEAN region, industrial development may need to be considerably deeper than the attraction of FDI both in the machinery and electronic sectors. In the fast-growing trade of intermediate inputs, continued improvement both in ASEAN's and China's industrial capacities is likely to yield better results in the rapid integration into the global production networks.

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