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Trade-FDI-Technology Linkages in East Asia

Drafted by
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I. Introduction

East Asia is characterized by intricate production and distribution relationships, constituting part of a global triangular trading network. Very generally speaking, Japan, Korea, and Taiwan and MNCs located in ASEAN produce sophisticated technology-intensive intermediate goods and capital goods and ship them to China and ASEAN for assembly by relatively low skilled workers. The finished products are then exported throughout the world, not only to the U.S. and Europe but also to the rest of Asia. These production and distribution networks have promoted economic efficiency and helped to make East Asia as a whole (not just China) the manufacturing center of the world.

FDI flows and MNCs (multinational companies) have played an important part in these triangular trading patterns. As Gaulier *et al.* (2005) discuss, FDI flows and MNC activities have reduced costs in host countries, transferred technological and managerial know how, increased local procurement, multiplied trade in intermediate goods, and strengthened distribution networks.

While networks are common in other parts of the world (e.g., parts and components exported from the U.S. for assembly in Mexico), fragmentation in East Asia is particularly sophisticated and well-developed. It involves complicated combinations of intra-firm trade, arms-length transactions, and outsourcing (Kimura and Ando, 2005). One definition of these production networks has been provided by

Borrus *et al.* (2000, 2):

> By a lead firm's "cross-border production network" (CPN) we mean the inter- and intra-firm relationships through which the firm organizes the entire range of its business activities: from research and development, product definition and design, to supply of inputs, manufacturing (or production of a service), distribution, and support services. We thus include the entire network of cross-border relationships between a lead firm and its own affiliates and subsidiaries, but also its subcontractors, suppliers, service providers, or other firms participating in cooperative relationships, such as standard setting or R&D [research and development] analysis.[1]

These networks have allowed firms to exploit comparative advantage by slicing up long production processes and allocating the production blocks created in this way throughout Asia. Such trade-FDI linkages have established production-distribution networks in East Asia that can be characterized as vertical intra-industry trade (VIIT).

This VIIT differs both from the exchange of final goods emphasized by traditional trade theory for vertical inter-industry trade between the North and the South (e.g., between capital goods and apparel) and for horizontal intra-industry trade between the North and the North (e.g., between two differentiated types of automobiles). As Fukao *et al.* (2002) discuss, the production processes of an industry (e.g., the electronics industry) has been split into fragmented production blocks that can be located in different countries and the new VIIT is essentially based on differences in factor endowments in the fragmented production blocks between developing, emerging, and developed economies in the region.

[1] Also quoted in Yusuf *et al.* (2003).

To promote these trade-FDI-technology linkages it is important to lower the service link costs between production blocks (Kimura and Ando, 2005). This can be done by strengthening physical and ICT infrastructure across the region, increasing the knowledge base, enforcing high standards of corporate governance, and providing legal remedies when firms within a network relationship violate intellectual property rights agreements (Yusuf *et al.,* 2003).

The rapid development of such value-added chain in the region has been accompanied by massive volumes of exports from East Asia (particularly China) to the rest of the world and also by growing trade imbalances. The trade imbalances are particularly large for East Asian trade with the U.S. The East Asian surplus with the U.S. equaled $300 billion in 2004 and $350 billion in 2005, while the overall U.S. deficit amounted to $650 billion and $770 billion, respectively.[2]

Many policy questions follow from the above considerations but only some are mentioned in this Introduction. What practical steps can each country in the region take to lower service link costs? What policy coordination will be necessary among countries in the region in order to strengthen service linkages and lower related costs? How can each economy upgrade its technological and industrial structure in the context of the production networks developed in the region? Do production networks in East Asia have an export bias? Do overall imports by East Asia grow less rapidly than overall exports by the region? Does

2 More than half of this surplus was recorded as being with China. If exports were measured on a value-added basis rather than on a gross basis, however, the deficit with China would have been far less and the deficit with the rest of Asia far more.

the accumulation of foreign reserves that has accompanied the global imbalances reflect an inefficient allocation of domestic resources within each of the Asian countries? Are there better ways at present to allocate resources in order to stimulate demand than by relying on export expansion? If so, what policy mix would be appropriate? (See our own NEAT Working Group Policy Recommendation 2005).

This paper is organized as follows. The next Section presents an analytical description of the global triangular trading patterns. Section III considers whether East Asian economies are comrades or competitors. Section IV discusses implications for exchange rates of triangular trading patterns and global imbalances. Section V identifies the main issues (both analytical and empirical) that need to be addressed. Section VI concludes.

II. Global Triangular Trading Patterns in East Asia

A. Determinants of FDI Flows

FDI has brought benefits to both the home and the host countries. It enabled home countries' firms to significantly lower costs and to use developing Asia more and more as a production platform for less technology-intensive industrial inputs as well as labor-intensive final goods.[3] It enabled host countries' firms to acquire engineering and managerial skills and to facilitate technological assimilation. These firms were able to reap the efficiency gains associated with exporting and competing in world markets. In addition, as foreign affiliates

[3] ASEAN countries were not merely assembly platforms for labor-intensive goods. As discussed below, MNCs in ASEAN also produced and exported sophisticated intermediate goods.

increased their tenure in the host countries, they procured more and more intermediate inputs from host country firms (see Kiyota, Matsuura, Urata, and Wei, 2006).

Starting in the 1990s, China also became an important recipient of FDI. After the Asia Financial Crisis of 1997-98, new flows to Southeast Asia slowed. Meanwhile, China's accession to the WTO in 2001 increased investor confidence and resulted in a surge of investment. The lion's share of FDI to developing East Asia now goes to China (see Figures 1A and 1B).

There are several ways in which the development of FDI-trade linkages have been associated with technological upgrading in host countries (see Yusuf *et al.*, 2005). Recently, for instance, lead brand name firms in Asia have started requiring suppliers to become involved in the engineering and design aspects of the production process. As suppliers in host countries enhance their R&D capabilities, they can attempt to progress from original equipment manufacturing (OEM) to original design manufacturing (ODM) and finally to original brand manufacturing (OBM), though the last step is difficult to achieve by local firms in host countries[4]

Because of the benefits arising from foreign direct investment it is important to know the factors that affect FDI flows. Instead of exploiting external markets directly by exporting, why do firms choose to undertake FDI? When firms are deciding on the optimal degree of fragmentation they need to weigh benefits and costs along several dimensions (Kimura and Ando, 2005). One such dimension is

[4] This process of upgrading technology in host countries is often associated with local procurement by MNCs and the resultant development of supporting industries.

location. Another is ownership. A third is internalization. Locational considerations and advantages include wage levels, factor endowments, technology transferability, physical and human infrastructure, and market-supportive institutions and political regimes. Ownership advantage is based upon technological and managerial superiority of home country firms relative to host country firms. Such superiority should be sufficient enough to overcome the extra costs incurred due to differences in business customs, formal and informal norms, languages, etc. Thus ownership is linked with control, and control becomes weaker as ownership becomes more diluted. Of course firms that outsource or subcontract may retain some control if they are involved in long-term relations. There may also be benefits to relinquishing ownership if the business partner has better managerial or technological ability in a particular product. Internalization advantage refers to the net benefits obtained by FDI firms through more captive and more integrated business activities conducted by parent firms. The optimal degree of internalization revolves around how to balance the costs of asymmetric information, incomplete contracts, and ineffective dispute settlement mechanisms with the efficiency gains of complete outsourcing and deverticalization.

An important question is whether the surge in FDI flows to China has come at the expense of other Asian countries. On the one hand, Yusuf *et al.* (2003) documented cases where FDI inflows into China have come at the expense of Southeast Asia. These FDI flows were motivated by lower labor costs in China than in places like Penang, Malaysia. On the other hand, Eichengreen and Tong

(2005) reported that increases in FDI flows to China are associated with increases in FDI flows to other Asian countries but with decreases in FDI flows to OECD countries. The authors do not discuss why there should be a complimentary relationship between FDI flows to China and other Asian countries. Mercereau (2005) found that only two Asian countries, Singapore (and Myanmar), faced decreases in inward FDI due to China's success in attracting FDI. He argues that Singapore might be affected because overseas Chinese living in Singapore may have channeled funds that previously went elsewhere to China because they have family connection or linguistic and cultural ties with the mainland. Appendix 1 provides more detail on these and other studies that investigate whether FDI flows to China have crowded out FDI flows to other countries.

How exchange rates affect FDI flows and production networks is yet another important issue for East Asia. Kiyota and Urata (2004) reported that exchange rate volatility reduces FDI. They also find that an exchange rate regime that is flexible but not highly volatile attracts the most FDI. These results make sense in light of Kimura and Ando's (2005) model since volatility increases uncertainty and thus reduces the locational benefits of cross-border fragmentation. Bénassy-Quéré, Coupet, and Meyer (2005) reported that the higher the quality of a country's institutions (including transparency, property rights protection, prudential standards, and the extent of corruption), the more FDI the country is able to attract. These findings also make sense in light of theoretical considerations since the locational costs of shifting production across borders decreases as a country's institutions improve. Kamaly (2003) also found that exchange rate volatility reduces FDI flows and that more democratic institutions are associated with larger flows.

B. Intermediate Goods Trade in East Asia

Matsunaga (2006) showed that increases in FDI into a country are associated with increases in intermediate goods exports to that country.

Triangular trading patterns involve Japan, South Korea, Taiwan, and MNCs in ASEAN exporting sophisticated intermediate goods to China and ASEAN for processing and export of the final products all over the world. Examining the flow of intermediate goods can shed light on the evolution of production networks in Asia.[5]

Figure 2 (and Table 2) show Japan's exports of intermediate goods to East Asia. China received 38% of Japan's exports for processing. Large quantities also flowed to ASEAN countries and the East Asian NIEs (South Korea and Taiwan). Figure 3 shows the level of technological intensity of Japanese exports to East Asia.[6] Not surprisingly, over 75% of these exports are either high-tech or

[5] We differentiate between intermediate goods exports and parts and components exportsbut we consider both. The difference between the two categories is that intermediate goods include parts and components and semi-finished goods. We focus on intermediate goods for two reasons: 1) data for these (obtained from the CEPII-CHELEM database) are available until 2004 while data for parts and components (from the RIETI-TID database) are only available until 2003, and 2) the results are very similar using intermediate goods data or parts and components data. The data are described in detail in Appendix 2 and the parts and components data are presented in Appendix 3.

[6] Technological intensity is calculated by the Centre D'Etudes Prospectives et D'Information Internationale (CEPII) based on the type of goods exported measured at the HS 6 digit level. For instance, 252 products at the HS 6 digit level are classified as high-tech. See Gaulier *et al.* (2005).

medium high-tech goods. In addition, almost none of these exports are low-tech goods.

Figure 4 (and Table 3) show the NIEs' exports of intermediate goods to East Asia. China receives half of the NIEs' exports of intermediate goods to the region. Figure 5 shows that 46% of the NIEs' exports to the region are high-tech goods and 70% are either high-tech or medium high-tech goods. 10% of these exports are low-tech goods.

Figure 6 (and Table 4) indicate the back and forth nature of intermediate goods trade in East Asia (see Kimura and Ando, 2005). Not only do ASEAN countries receive large quantities of intermediate goods from East Asia, they also export large quantities back. To see that ASEAN countries play an important role in exporting intermediate goods note that in 2004 ASEAN's exports of intermediate goods to the rest of the region equaled about 60% of Japan's intermediate goods exports to China. Figure 7 shows that 23% of the goods exported by ASEAN to East Asia as a whole are low-tech goods. On the other hand, Figure 8 shows that 75% of the goods exported by ASEAN to China are either high-tech or medium high tech goods. These data highlight the importance of MNCs operating in ASEAN countries.

Figure 9 (and Table 5) show China's exports of intermediate goods to East Asia. They indicate that China exported over $20 billion of intermediate goods to East Asia in 2004. By contrast Japan's intermediate goods exports to China that year equaled $70 billion. While Japan was the largest single recipient of China's exports for processing, 60% of these exports went to other countries in the region.

Figure 10 shows that over 30% of the goods that China exports to East Asia are low-tech goods.

Figure 11 (and Table 6) report results for East Asia aggregated together. They indicate that intermediate goods exports from East Asia to China exploded after 2001. Exports from the region to ASEAN 4 and the NIEs nevertheless remained strong. As would be expected, intermediate goods exports from East Asia to Japan were the smallest. Even so, the rest of Asia exported $30 billion of intermediate goods to Japan in 2004.

Given the multiplication of intermediate goods exports from East Asia to China, the next section investigates Chinese processing trade in more detail.

C. China's Role in the Global Triangular Trading Patterns

Table 7 shows China's role in this triangular trading structure. The data are taken from China's Customs Statistics, which distinguish between imports and exports linked to processing trade and ordinary imports and exports. Imports for processing are goods that are brought into China for processing and subsequent re-export. Processed exports, as classified by Chinese customs authorities, are goods that are produced in this way. Imports for processing are primarily intermediate goods but also include some primary goods and some final goods.[7] They are imported duty free and neither these imports nor the finished goods

[7] In 2003 36% of imports for processing were semi-finished goods, 42% were parts and components, 3% were primary goods, 5% were consumption goods, and 13% were capital goods. We are indebted to Deniz Unal-Kesenci for this information.

produced using these imports normally enter China's domestic market. By contrast, ordinary imports are goods that are intended for the domestic market and ordinary exports are goods that are produced using local inputs.

Table 7 shows that in 2005 42% of China's imports were for processing. Of this 42%, seven-tenths came from other East Asian countries. By contrast, less than one-twentieth each came from the U.S. and from the EU. This indicates that the U.S. and the E.U. do not produce many intermediate goods demanded by China for processing. It is worth noting that China imports more goods for processing from ASEAN countries than from the U.S. and Europe combined. As stated above in Section II-B on intermediate goods trade in East Asia, this partly reflects the influence of MNCs located in ASEAN that export sophisticated technology-intensive parts and components to China.

Table 7 also shows that in 2005 55% of China's exports were processed exports. Of this 55% one quarter went to the U.S., another one quarter went to East Asia (excluding Hong Kong), one-fifth went to Hong Kong (largely as entrepôt trade), and one fifth went to Europe. It is worth noting that China's processed exports go all over the world, not only to the U.S. and the E.U. but also to the rest of Asia. In fact, the share of U.S. imports of China's processed exports (including through Hong Kong) corresponds more or less to the share of U.S. GDP in the world economy.

Reflecting the triangular trading structure where the U.S. and Europe largely do not export many intermediate goods to China but China exports processed goods to the U.S. and Europe corresponding to their respective GDP share in the world economy, China runs large trade surpluses with the U.S. and Europe. However, China runs trade deficits with East Asia. According to China's official statistics its surplus with the U.S. equaled $114 billion in 2005 ($195 billion including Hong Kong, as explained below) and its surplus with Europe equaled $61 billion. Its deficit with East Asia (excluding Hong Kong) equaled $140 billion.

Because the size of China's bilateral trade surplus with the U.S. is a politically-charged issue, it is important to measure it accurately. Kwan (2006) discusses how to correct for the distortionary effects of entrepôt trade through Hong Kong. He argues that in the face of entrepôt trade import data are much more accurate than export data. When Chinese firms transship goods through Hong Kong, the Chinese government often does not know the final destination of the goods. Thus they record these goods as being exported to Hong Kong. On the other hand, when the goods arrive at their ultimate destination (e.g., the U.S.) the importing country records the goods as coming from China. Thus Kwan advocates using import data from both countries to calculate the trade balance. Using this approach, the U.S. deficit with China in 2005 increases from $114 billion to $195 billion.[8] This implies that the lion's share of China's surplus with Hong Kong in Table 7 actually represents an important part of China's surplus with the U.S.

It is also instructive to examine how processing trade has evolved over time. Figure 12 (and Table 8) show that China's imports for processing from East Asia

[8] Of course, a more sophisticated analysis would have to take account of adjustments for c.i.f. – f.o.b factors and the value-added by Hong Kong middlemen. See Fung and Lau (2003).

exploded after 2001. The Figure and Table also show that imports for processing from the U.S. and Europe were not large. Since imports for processing from Hong Kong were also small, this conclusion would continue to hold if U.S. and European imports transshipped through Hong Kong were included.

Figure 13 (and Table 9) show China's processed exports. Processed exports to the U.S. and Europe also surged after 2001. Figure 14 then shows that China's surplus in processed trade with the U.S. and Europe has ballooned in recent years.

Figure 15 measures China's value-added in processed trade. Value-added is defined as the difference between the value of China's processed exports and the value of China's imports for processing, divided by the value of China's processed exports. It shows that 30-35% of the value-added comes from China since the late 1990s, as compared with about 20% in earlier years..

III. East Asia Countries: Comrades or Competitors?

At first blush one would expect a complementary relationship between developed and developing East Asian economies, and a competitive relationship between developing economies in the region. Figures 17-20 present a modified version of Belassa's revealed comparative advantage measure.[9] Broadly speaking, the Figures indicate that Japan and the NIEs have a comparative advantage in intermediate and capital goods and that China and ASEAN in consumption goods. Given the international slicing up of the value-added chain, Japan and the NIEs

[9] The data are constructed for 71 individual products using shares of the overall trade balance rather than relative export structure as in Balassa (1965). Values for stages of production are then calculated by summing. See www.cepii.fr for a detailed description of how the data are constructed.

should be partners with China and ASEAN while China and ASEAN should compete with each other.

Some evidence is consistent with this scenario. Eichengreen *et al.* (2004) report results from a gravity model indicating that an increase in China's exports to third markets tends to reduce the labor-intensive consumption goods exports of other Asian countries. These results thus imply that there is essentially a complementary relationship between China and developed Asia in sophisticated intermediate and capital goods and largely a competitive relationship between China and less developed Asian countries in labor-intensive consumer products.

Kwan (2002) also found evidence of a complementary relationship between China and Japan and a competitive relationship between China and ASEAN countries by using U.S. customs data and 1100 product items. He compared the value of exports from China to the U.S. in a product category with the value of exports from another Asian country to the U.S. in the same product category, as a percentage of the other country's total exports to the U.S. His work thus sheds light on the extent to which China's exports to the U.S. and other Asian countries' exports to the U.S. are in similar product categories. The results, reported in Table 12, indicate that there is not much overlap between China's exports to the U.S. on the one hand and those of Japan and South Korea on the other hand.[10] There is considerably more overlap, however, between China's exports to the U.S. and those of ASEAN countries. Thus there should be much more competition

[10] This overlap would be even less if one took account of the fact that in many cases much of the value-added of goods recorded as being produced in China actually came from Japan and South Korea.

between China and ASEAN in third markets than between China and developed Asia.

Bénassy-Quéré and Lahrèche-Révil (2003) also reported evidence of a competitive relationship among Asian economies. Using panel data techniques and annual data from 1984 to 2001, they reported that a 10% real appreciation in one East Asian country (other than Japan) reduced real exports to other East Asian countries by 8%. Thus individual East Asian economies may fear a loss of competitiveness relative to neighboring countries.

Other evidence indicates that the relationship between East Asian countries may be more nuanced. As discussed above, some evidence indicates that FDI flows to China have not in most cases reduced FDI flows to other Asian countries. The results in Table 12 indicate that there is a complementary relationship between China and MNCs located in ASEAN that export sophisticated technology-intensive parts and components there for processing. Ahearne *et al.* (2003) report a positive relationship between China's exports and the exports from emerging Asian economies. They interpreted this to mean that China and emerging Asia are comrades, not competitors. Finally, as Gaulier, Lemoine, and Nal-Kesenci (2006) report, ASEAN has not been crowded out of world export markets nor lost market share in dynamic products such as electronics goods. Figure 18 and Table 17 show that while final goods exports from China have exploded, final goods exports from ASEAN countries have nonetheless remained solid.

Yet another way of analyzing whether China may be benefiting and harming other East Asian economies is through observing effects on the terms of trade. China imports large quantities of technology-intensive goods and primary commodities and exports large quantities of labor-intensive final goods. In the process it has raised prices for the former goods and lowered prices for the latter goods. This has improved the terms of trade for developed countries like Japan and worsened the terms of trade for other developing countries specializing in labor-intensive exports but not necessarily primary commodities. This effect is likely to continue into the future.

IV. Exchange Rates and Production Networks in East Asia

How would exchange rate changes affect global triangular trading patterns? Kamada and Takagawa (2005), controlling for imported inputs by including current and future exports in regressions using quarterly data from 1990 to 2003, found that in most cases the price elasticity of imports for East Asian countries was not statistically significant. Ahearne *et al.* (2003), using a vector autoregression and annual data from 1981 to 2001, found that income growth in importing countries was a much more significant determinant of exports from East Asia than exchange rate changes. Ito and Yoshida (2005), seeking to explain East Asian exports in the context of a triangular trading model using annual data from 1990 to 2000, found that exchange rate volatility did not help to explain East Asian exports to the U.S.

Thorbecke (2006a) disaggregated exports into intermediate goods, capital goods, and consumption goods. Disaggregating by stages of production should shed light on how exchange rate changes affect trade within Asia, given the importance of fragmented production blocks in the region. Using panel data techniques and data between 1982 and 2003 he found that bilateral real exchange rates appreciations in Japan, South Korea, and Taiwan relative to other East Asian countries caused a small drop in intermediate goods exports and a large drop in capital goods exports to East Asian trading partners. He also reported that exchange rate volatility, as measured by the annual coefficient of variation calculated using quarterly data, deterred intermediate goods exports but not capital goods exports in the region. This evidence suggests that intermediate goods exports, which play a key role in intra-firm exchanges, are not affected that much by the level of the exchange rate but are affected by exchange rate volatility. On the other hand capital goods exports, which are often part of arm's length transactions, are affected by the level of the exchange rate but not by exchange rate volatility. These results indicate that 1) relative exchange rate stability would facilitate the flow of intermediate goods through regional production networks, and 2) appreciations in developed Asia relative to developing Asia would hamper the flow of sophisticated capital goods that are difficult to procure elsewhere.

It is also necessary to consider how an appreciation of the RMB would affect China's trade balance. Marquez and Schindler (2006), using data from 1997 to 2004, regressed the share of China's exports and imports relative to rest of the world exports and imports on the multilateral RMB exchange rate and other variables. They reported that a ten percent appreciation of the RMB reduces the share of China's exports in world exports by half a percentage point and the share of China's imports in world imports by a tenth of a percentage point. Thus an appreciation of the RMB would cause a noticeable decline in China's surplus.

Thorbecke (2006b) investigated how a bilateral appreciation of the RMB against the dollar would affect China's trade balance with the U.S. Using cointegration techniques and quarterly data from 1987 to 2005 he found that the sum of the price elasticities of exports and imports exceeded unity. These results indicate that an appreciation of the RMB would reduce China's surplus with the U.S.

V. Policy Issues and Recommendations

A. Promoting Production Networks, FDI Flows, and Technology Transfer

1) How to Lower Service Link Costs

Lowering service link costs between geographically separated production blocks can facilitate the functioning of the sliced value chain. These costs can be lowered along two dimensions, "distance" and "controllability" (Kimura and Ando, 2005). Our focus is on the former.

Costs along the distance dimension include transport costs, telecommunication costs, and intra-firm coordination costs. Costs along the controllability dimension include the costs of imperfect information, lack of credibility, and loss of stable contracts. To lower service link costs policymakers should focus on strengthening physical infrastructure such as 1) the network of highways, ports, and airports, 2) the ICT infrastructure, 3) container yards, and also market-supportive institutional infrastructure such as 1) enforcement of the legal system, 2) information on vendors, 3) enforcement of the stability of private contracts, 4) corporate governance, and 5) legal remedies when firms violate intellectual property rights agreements.

Lowering service link costs can lead to many firms locating in one area. There are then economies of scale attached to the resulting agglomeration. Service link costs are lowered because the large number of firms in close proximity makes it easier for firms to procure parts and components and to handle frequent specification changes. In addition, the many business partners and different skills and technologies in close proximity help reduce costs associated with uncontrollability.

Developing countries seeking to promote trade-FDI-technology linkages through agglomeration might do well to learn from the model of Shenzhen and the Pearl River Delta and more recently the Yangtze River Delta. It is hard to implement the necessary policy and infrastructural changes for a whole country but probably easier to do for a city or province.[11] In these Deltas there are superb networks of modern highways, ports, and airports. Many firms have located there, leading to economies of scale and profitable interactions between upstream and downstream industries. If such infrastructure has to be built across countries, regional coordination and cooperation will become indispensable.

[11] Kimura and Ando (2005).

For instance, 80% of the international production of notebook PCs is now produced in the Yangtze River Delta by a dozen Taiwanese Original Design Manufacturers (ODMs). They form part of a network consisting of the makers of OS (Microsoft) and MPU (Intel), branded makers (HP, Apple, Toshiba, etc.), suppliers of key parts and components, and producers of basic industrial materials. Both digital and human networks enable these producers to react efficiently in real time to changes in consumer preferences and technology (see Yoshitomi, 2006).

2) How to Facilitate Technology Transfer Leveraged by Networks

For developing countries in the region to reap the full benefits of the trade-FDI-technology networks, it is necessary for their economies to move up the value chain and not remain engaged only in labor-intensive assembling activities. Technology transfer and upgrading is an essential element of this process.

The intra-firm transfer of managerial technology from foreign affiliates to indigenous workers can be expedited if workers in the host country are highly educated.[12] Thus human capital formation is a prerequisite for technology transfer.

Similarly, a strong local knowledge base is essential for supplier firms to become involved in the engineering and even design aspects of production.[13] To build the knowledge base, students need a high quality education in science and

[12] Urata (2006).
[13] Yusuf *et al.*, 2003.

math at the secondary school level and scientific training at the university level (see Yusuf *et al.*, 2003).

Appropriate R&D policy should take into account each country's level of technological innovation.[14] Countries at early stages of development typically imitate imported technology. R&D at this stage largely takes the form of learning, doing, using, failing (LDUF). Since imported technology is expensive, a careful selection is necessary for assimilation rather than just imitation. In this case, domestic R&D supported by public research institutes can help indicate what technologies are most appropriate to import.

Countries then advance from the imitation to the assimilation stage to begin innovating and leveraging new technological capabilities. Public-private cooperation, such as happened with Taipei, China's industrial technology research, can help at this stage.

Developing economies also receive technology spillovers when foreign affiliates increase local procurement in the host countries. Local procurement increases with the length of time the affiliate has operated in the host country. To facilitate their long tenure it is necessary to sustain FDI-friendly environments including consistent and coherent enforcement of laws and regulations at all governmental levels as well as stable macroeconomic fundamentals. FTAs for trade and FDI liberalization and facilitation are thus important.

3) How to Enlarge the Scope of FTAs

[14] See Yoshitomi, Azis, and Thorbecke (1993).

Even if your trading partners do not liberalize, your country will reap the gains from trade by liberalizing unilaterally. This basic message of liberalization is often forgotten, particularly when negotiating FTAs. Global liberalization would produce even greater gains by leading to a more efficient allocation of resources in the international economy along the lines of comparative advantage, as compared with the case of FTAs between a limited number of countries. FTAs represent one step towards global free trade. There are losers in particular sectors from liberalization, however. It is thus necessary to facilitate labor mobility and the movement of firms from losing to gaining sectors by providing retraining and upgrading for workers displaced through trade liberalization and by reducing entry barriers to new firms and facilitating exit through structural reform. Sector-specific protectionist policies should be abandoned as much as possible, while competition policy should be strengthened.

FTAs between developing and developed economies benefit different sectors depending on the level of development. In general, agricultural liberalization in developing countries benefits the agricultural sector in developing economies. On the other hand manufacturing and service liberalization benefits these sectors in developed economies. To enhance the benefits and quality of agreements, it is important to reduce the scope of these sensitive items in both economies and to enlarge the coverage of countries such as implementing a FTA for ASEAN+3 as a whole. The broader the coverage and the lower the tariffs on both external and internal trade, the more the “noodle” effects of FTAs caused by the rules of origin can be mitigated.

4) How to Enhance the Quality of Bilateral Investment Treaties[15]

High quality bilateral investment treaties (BITs) help attract and retain foreign investors in the host country. They can thus contribute to trade-FDI-technology linkages in East Asia.

Ideally, BITs should provide three substantive clauses and one procedural component. The three substantive clauses are investment protection, investment facilitation, and investment liberalization and the procedural component is dispute settlement. Investment protection provides compensation in the case of expropriation and mandates fair and equitable treatment of foreign investment to avoid wrongful termination of government contracts. Investment facilitation requires transparency (i.e., that all relevant laws be publicly proclaimed). Investment liberalization emphasizes freer market access of investment (i.e., no restrictions on ownership). Along this line, national treatment, that is, that foreign firms should receive the same treatment as domestic firms, should be mandated. Dispute settlement involves state parties providing a "standing" offer to arbitrate with individuals or states in the case of a disagreement.

Minimum standard BITs provide only for investment protection and dispute settlement while high standard BITs also include an investment liberalization clause.

High standard BITs are required to further promote Trade-FDI-Technology linkages, but even the minimum standards are not met by some BITs in the region including the China-Japan BIT of 1988.

B. The Appropriate Policy Mix for the Region[16]

[15] This Section draws on Kotera (2006).
[16] We are very grateful to participants at both the 2005 and 2006 NEAT Working Group Meetings in Tokyo for their valuable and constructive comments concerning the issues discussed in this Section.

In recent years Asian monetary authorities have accumulated large quantities of foreign reserves and sterilized these purchases through issuing central bank bills. The objectives of Asian central banks in accumulating these reserves have been: 1) to be prepared for another capital account crisis which would drain foreign reserves due to massive reversals of short-term capital flows, and 2) to maintain competitive exchange rates in order to sustain the export-oriented thrusts of their economies.[17]

While Asian economies have maintained their export dynamism, problems are emerging. The massive quantity of central bank bills in bank balance sheets has eroded the profitability of commercial banks and interfered with the allocation of credit through the financial system. In addition, the real return measured in domestic terms on the more than one trillion dollars of external reserves is likely to be zero, far below the private and social rates of return that could be earned if investments were channeled into the domestic economy (Summers, 2006).

It might thus be an opportune time for Asian countries to begin weaning themselves away from foreign reserve accumulation and instead to allow their currencies to appreciate. A free floating regime, however, would probably be inappropriate for developing countries in the region. Given their shallow and narrow domestic capital markets, a free float would generate excessively volatile exchange rates and disrupt the flow of FDI and intermediate goods. Instead, greater exchange rate flexibility in the context of a multiple currency basket-based reference rate with a band would be preferable.[18]

[17] Observers agree that reserves are far in excess of those needed to meet a capital account crisis (see, e.g., Summers, 2006).

[18] Greater flexibility would benefit China because it will begin to increasingly face de facto capital account convertibility with the free entry of foreign banks for renminbi-based financial activities

There are currently a variety of exchange rate systems in the region. Japan and South Korea have essentially free floating regimes; Thailand uses a managed float; Indonesia has a dollar peg; and China has a *de facto* fixed exchange rate regime.[19] Under the current system, if the trade imbalances documented above triggered appreciations in the region, currencies in developed Asia would appreciate relative to currencies in developing Asia. This would harm firms in Japan, South Korea, and Taiwan by causing large drops in intermediate and capital goods exports to the rest of Asia. In addition, this would harm firms in developing Asia since it is difficult for them to procure vital imported inputs elsewhere. This problem could be mitigated if countries with less flexible exchange rate regimes adopted more flexible regimes.

In addition, countries should consider seeking higher returns on their existing excess reserves (those above what are needed to be prepared for a capital account crisis). Singapore has invested excess foreign reserves in stocks, bonds, and other assets since 1981. These reserves, managed by the Government of Singapore Investment Corporation, have earned a nominal return in Singapore dollars of 8.2% per annum on average since 1981. Other countries in the region with large quantities of excess reserves should consider a similar strategy.

If Asian countries allowed their currencies to appreciate instead of accumulating additional reserves, it would have a recessionary impact. This could be

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due to the terms of her WTO accession commitments. In this case wider bands would enable her to maintain greater monetary policy autonomy in the face of volatile capital flows. In addition, increased flexibility would provide Chinese banks and traders with experience in managing exchange rate risk

[19] China made the first step towards moving away from a fixed exchange rate system on 21 July 2005. More changes are likely to follow.

offset by appropriate macroeconomic and structural policies. Switching policies such as exchange rate appreciations thus need to be combined with absorption-increasing policies.

Absorption-increasing policies include employing fiscal and structural policies to build both physical and human infrastructure (particularly in rural areas), using deregulation to promote competition and productivity growth in the non-tradable sector, and strengthening social safety nets so that consumers would have less need for precautionary saving. These policies could promote production for domestic markets and thus rely more on domestic markets rather than exports to create jobs.

Combining expenditure-increasing policies with expenditure-switching policies would thus be the appropriate policy mix for Asian countries that had previously accumulated massive reserves. On the one hand, without exchange rate appreciations, policies aimed simply at increasing domestic demand could produce overheated economies. On the other hand, without policies to increase domestic demand, exchange rate appreciations would be contractionary. By combining these two, namely by implementing an appropriate policy mix, could Asian economies move away from excessive reserve accumulation and simultaneously achieve external and internal equilibria.

VI. Conclusion

This paper has provided an analytical description of production networks in East Asia. These networks have enabled firms to slice up long production processes and allocate fragmented production blocks across developing, emerging, and developed economies in the region based on comparative advantage as determined by relative endowments of capital, skill, and labor and by physical and institutional infrastructure. The resulting efficiency gains have been enormous.

Two sets of policy recommendations have emerged from the discussion in this paper. The first concerns promote production networks, FDI flows, and technology transfer. The second concerns the appropriate policy mix for the region.

In the first area lowering service link costs between fragmented production blocks can facilitate the functioning of the sliced value chain. These costs can be lowered by strengthening both the physical and the institutional infrastructure. Developing countries can also facilitate technology transfer by investing in education and public research institutes that indicate what technologies are most appropriate to import. FTAs can also generate gains from trade, especially when they are a stepping stone towards global liberalization. Finally, bilateral investment treaties that guarantee a minimum standard under international law can help attract and retain foreign investment in a country.

In the second area it is argued that continued reserve accumulation by Asian central banks is becoming problematic. The accumulation of central bank bills on bank balance sheets has eroded the profitability of commercial banks and interfered with the allocation of credit. In addition, the real return in domestic terms on the excess reserves is far below the private and social rates of return that could be earned if investments were channeled into the domestic economy. Now might be an opportune time for Asian countries to wean themselves away from continued foreign reserve accumulation and instead to allow their exchange rates to appreciate. Such exchange rate appreciations would be recessionary, however, and should be combined with absorption-increasing policies (e.g., investing in physical and human infrastructure).

Finally, governments in the region should consider seeking a higher return on external reserves in excess of those needed to be prepared for a capital account crisis. Singapore, for imstance, has invested excess foreign reserves in stocks, bonds, and other assets and earned a nominal return in Singapore dollars of 8.2% per annum on average since 1981. If other East Asian countries were to receive comparable returns on their massive reserves, the gains could equal $100 billion per year (see Summers, 2006).

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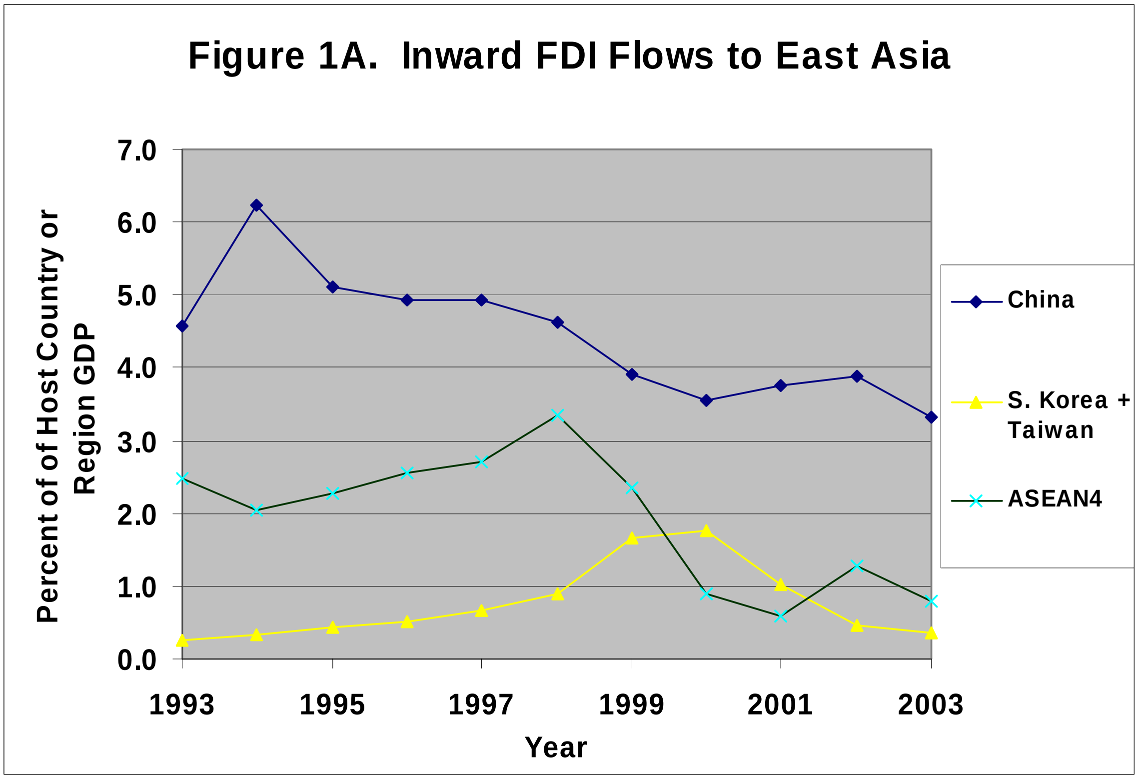


Table 1A. Inward FDI Flows to East Asia (Percent of GDP)

Regions	1993	1996	1999	2000	2001	2002	2003
China	4.6	4.9	3.9	3.6	3.8	3.9	3.3
ASEAN 4	2.5	2.5	2.4	0.9	0.6	1.3	0.8
S. Korea + Taiwan	0.3	0.5	1.7	1.8	1.0	0.5	0.4

Source: CEPII-CHELEM Database.

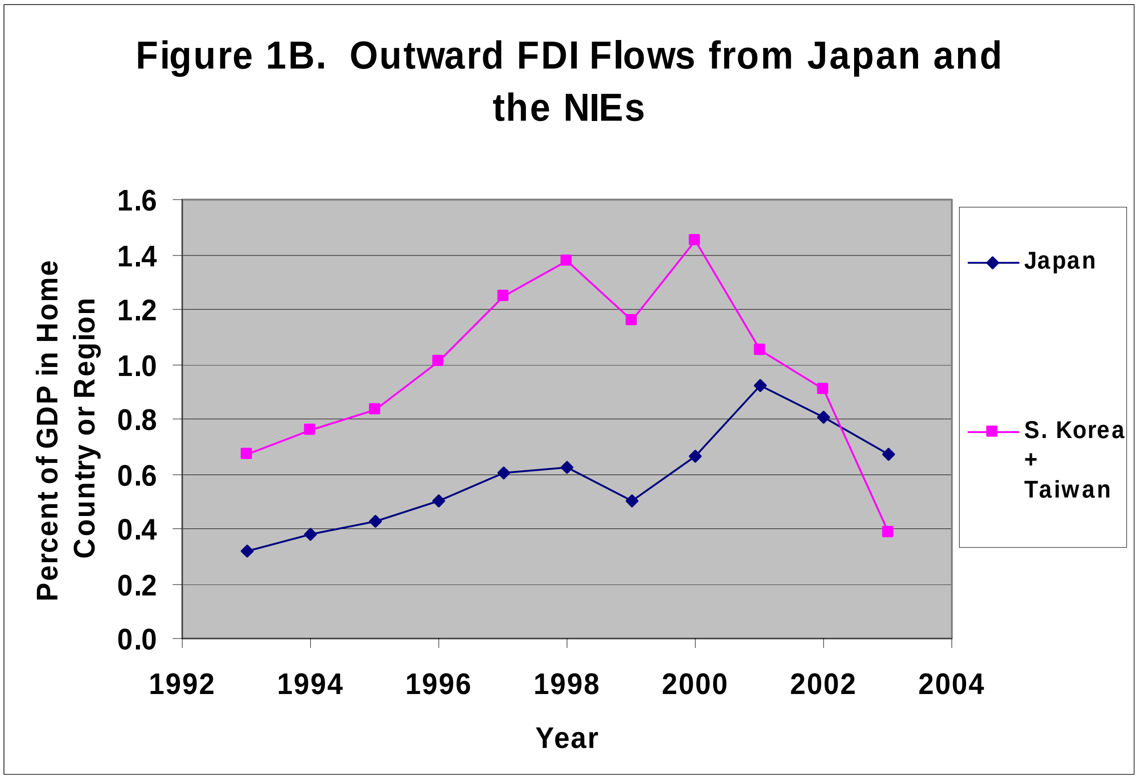


Table 1B. Outward FDI Flows from Japan and the NIEs (Percent of GDP)

Regions	1993	1996	1999	2000	2001	2002	2003
Japan	0.3	0.5	0.5	0.7	0.9	0.8	0.7
S. Korea + Taiwan	0.7	1.0	1.2	1.5	1.0	0.9	0.4

Source: CEPII-CHELEM Database.

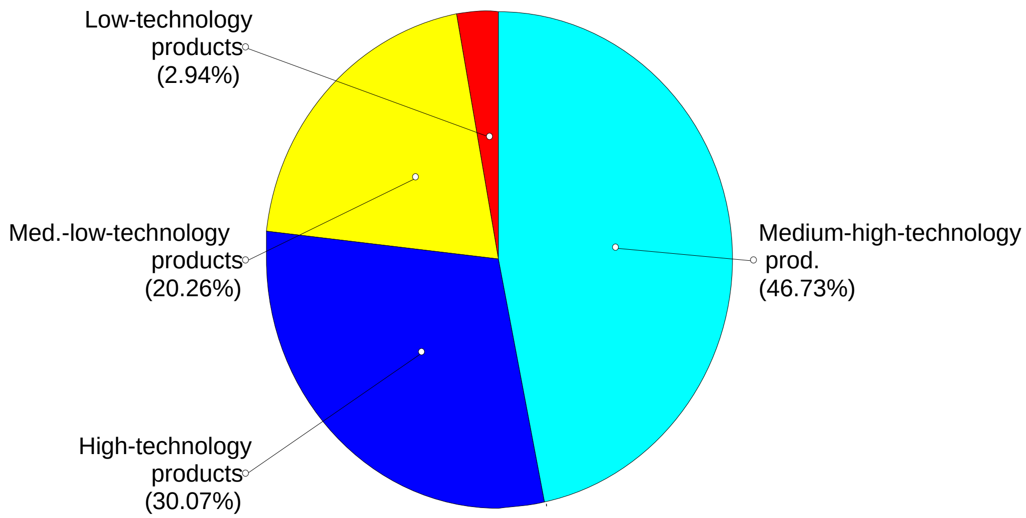
Table 2. Japanese Intermediate Goods Exports to East Asia (Billions of U.S. Dollars)

Regions	1993	1996	1999	2000	2001	2002	2003	2004
China	6.2	9.2	10.1	12.1	12.6	15.6	21.1	25.7
ASEAN 4	12.0	20.0	14.3	18.4	15.5	15.8	17.3	19.7
S. Korea + Taiwan	14.5	19.5	16.3	20.1	15.0	16.6	19.3	22.9

Note: The data are defined in Appendix 2.

Source: CEPII-CHELEM Database

Figure 3. Exports from Japan to East Asia by Technological Intensity



Source: CEPII-CHELEM Database

Note: Technological intensity is calculated based on the type of goods exported measured at the HS 6 digit level. For instance, 252 products at the HS 6 digit level are classified as high-tech. See Gaulier *et al.* (2005).

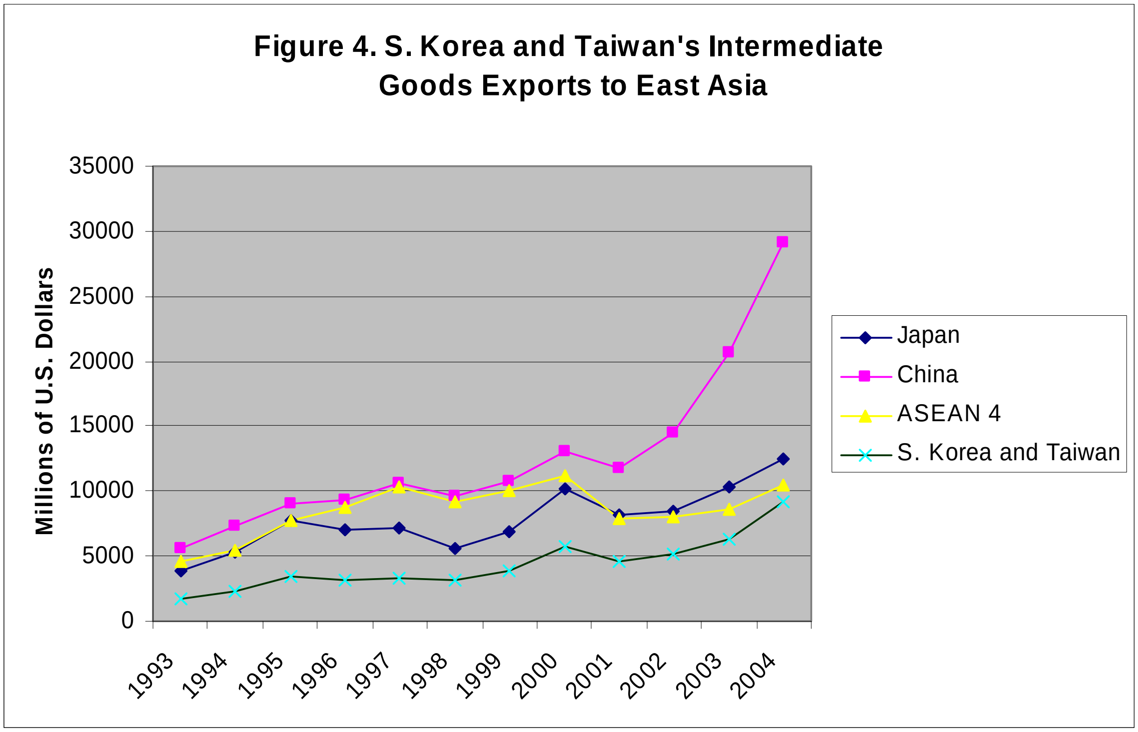


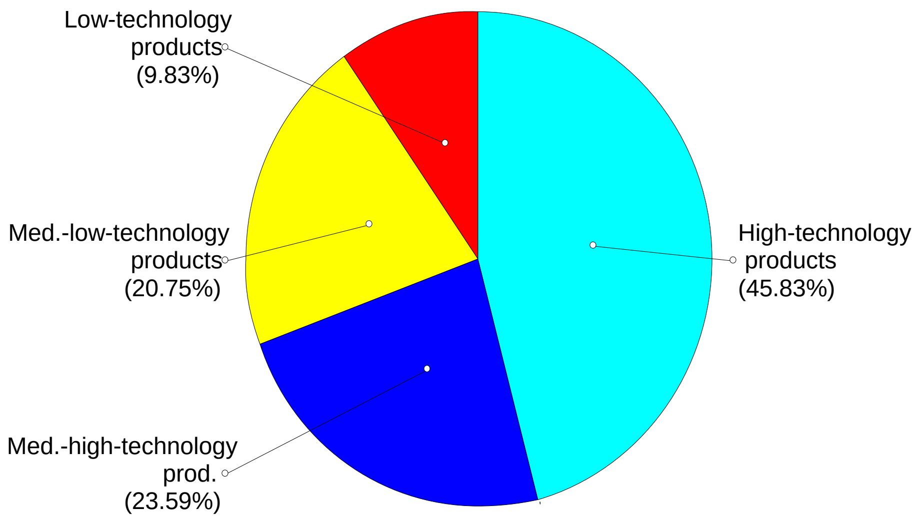
Table 3. S. Korea's and Taiwan's Intermediate Goods Exports to East Asia (Billions of U.S. Dollars)

Regions	1993	1996	1999	2000	2001	2002	2003	2004
Japan	3.8	7.0	6.9	10.3	8.1	8.4	10.4	12.5
China	5.6	9.3	10.7	13.1	11.8	14.4	20.7	29.1
ASEAN 4	4.6	8.7	10.1	11.2	7.8	8.0	8.6	10.5
S. Korea + Taiwan	1.7	3.1	3.9	5.8	4.6	5.2	6.4	9.2

Note: The data are defined in Appendix 2.

Source: CEPII-CHELEM Database.

Figure 5. Exports from the NIEs to East Asia by Technological Intensity



Source: CEPII-CHELEM Database

Note: Technological intensity is calculated based on the type of goods exported measured at the HS 6 digit level. For instance, 252 products at the HS 6 digit level are classified as high-tech. See Gaulier *et al.* (2005).

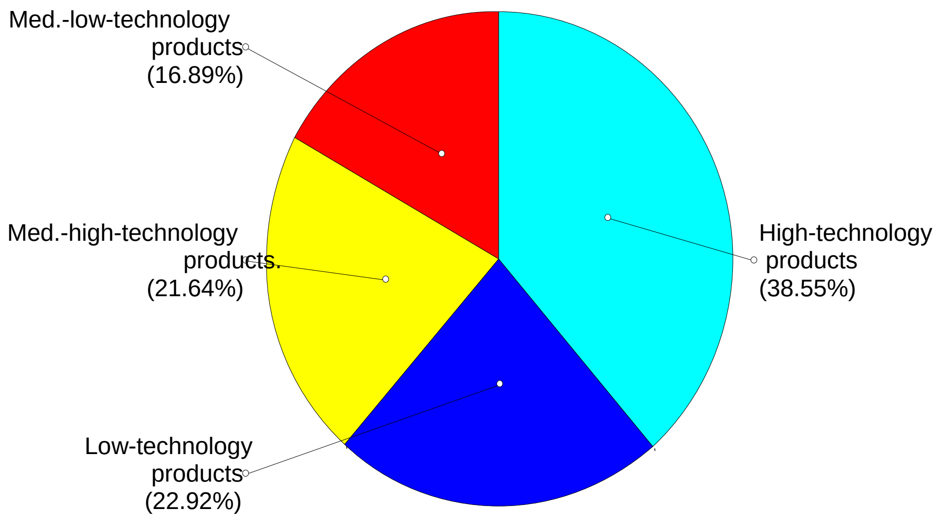
Table 4. ASEAN 4's Intermediate Goods Exports to East Asia (Billions of U.S. Dollars)

Regions	1993	1996	1999	2000	2001	2002	2003	2004
Japan	4.5	7.5	7.2	8.7	8.1	8.5	9.7	10.2
China	1.0	1.6	2.9	4.2	4.4	7.0	10.9	14.2
ASEAN 4	1.2	3.3	4.9	6.1	5.4	6.7	8.2	8.7
S. Korea + Taiwan	2.3	4.8	7.8	7.5	6.4	7.6	8.3	6.2

Note: The data are defined in Appendix 2.

Source: CEPII-CHELEM Database

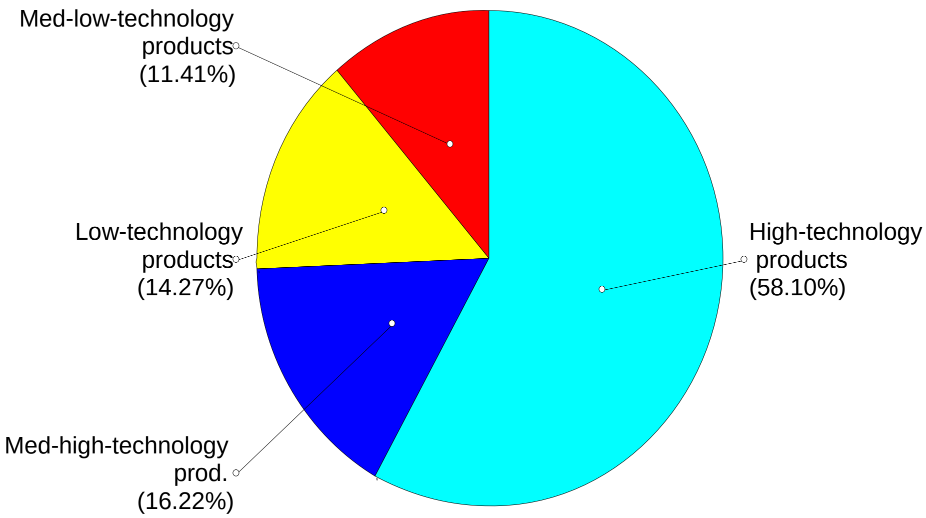
Figure 7. Exports from ASEAN to East Asia by Technological Intensity



Source: CEPII-CHELEM Database

Note: Technological intensity is calculated based on the type of goods exported measured at the HS 6 digit level. For instance, 252 products at the HS 6 digit level are classified as high-tech. See Gaulier *et al.* (2005).

Figure 8. Exports from ASEAN to China by Technological Intensity



Source: CEPII-CHELEM Database

Note: Technological intensity is calculated based on the type of goods exported measured at the HS 6 digit level. For instance, 252 products at the HS 6 digit level are classified as high-tech. See Gaulier *et al.* (2005).

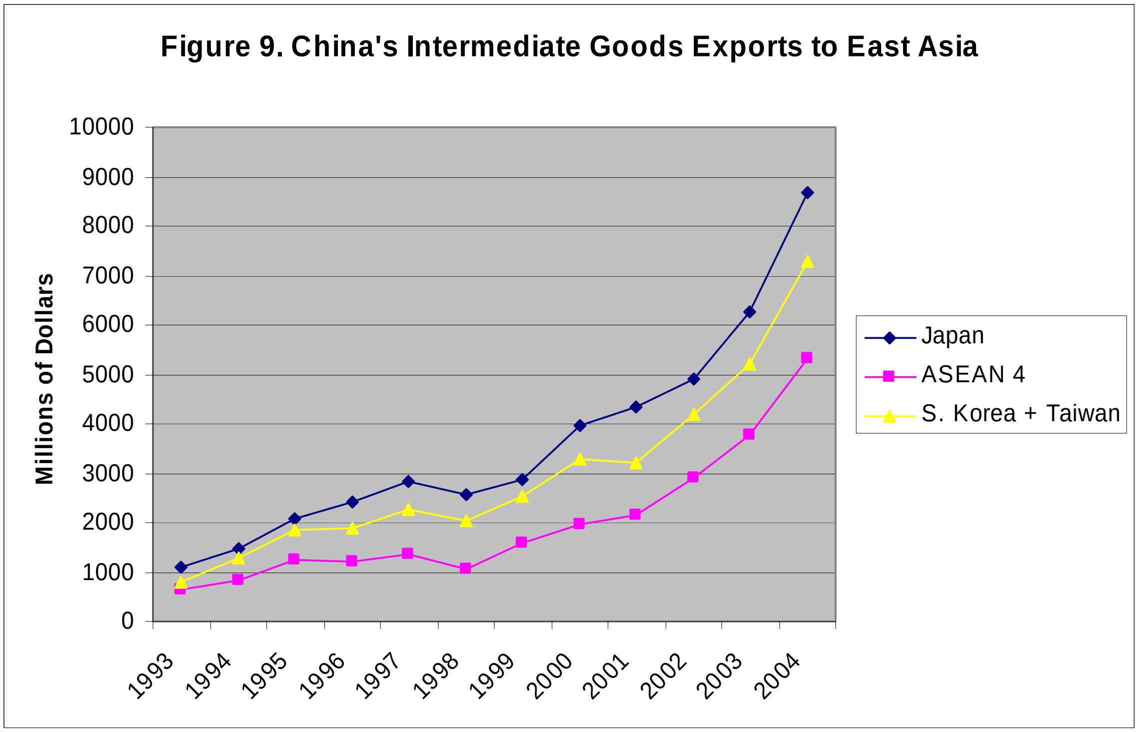


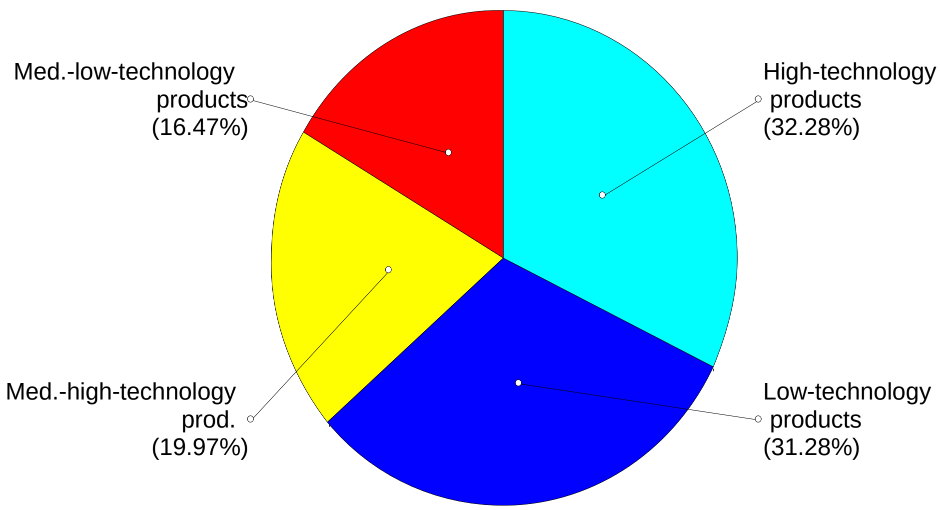
Table 5. China's Intermediate Goods Exports to East Asia (Billions of U.S. Dollars)

Regions	1993	1996	1999	2000	2001	2002	2003	2004
Japan	1.1	2.4	2.9	4.0	4.3	4.9	6.3	8.7
ASEAN 4	0.7	1.2	1.6	2.0	2.2	2.9	3.8	5.3
S. Korea + Taiwan	0.8	1.9	2.5	3.3	3.2	4.2	5.2	7.3

Note: The data are defined in Appendix 2.

Source: CEPII-CHELEM Database

Figure 10. Exports from China to East Asia by Technological Intensity



Source: CEPII-CHELEM Database

Note: Technological intensity is calculated based on the type of goods exported measured at the HS 6 digit level. For instance, 252 products at the HS 6 digit level are classified as high-tech. See Gaulier *et al.* (2005).

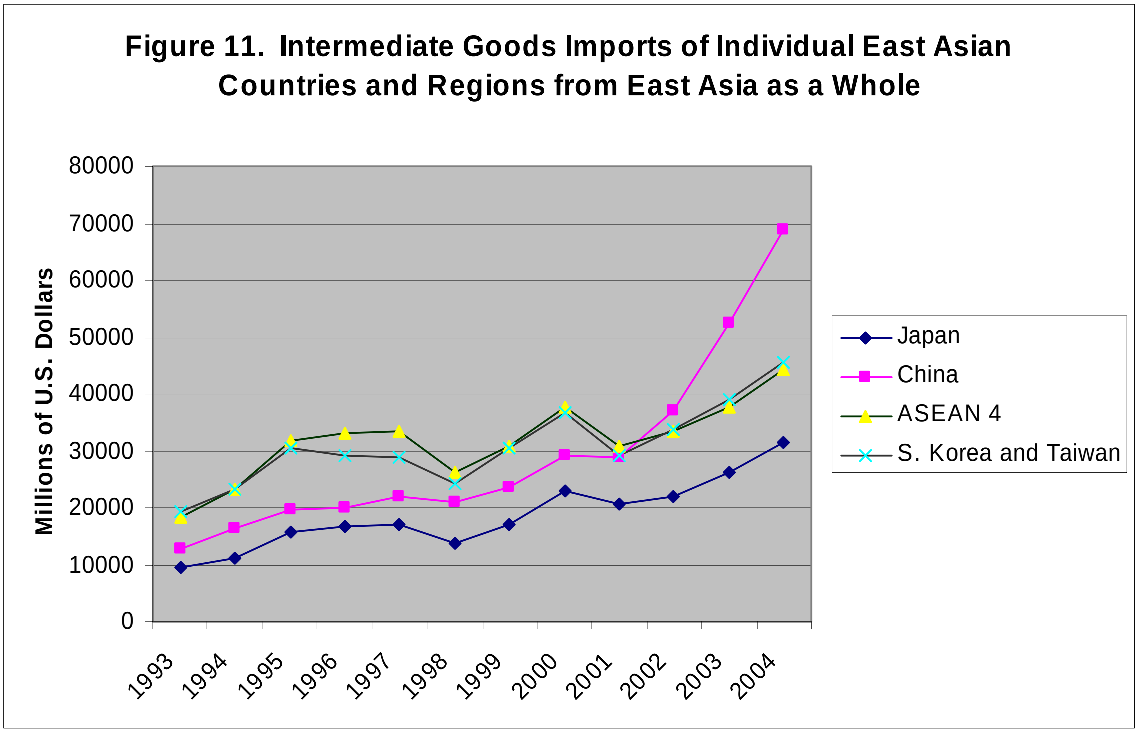


Table 6. Intermediate Goods Imports of Individual East Asian Countries and Regions from East Asia as a Whole (Billions of U.S. Dollars)

Regions	1993	1996	1999	2000	2001	2002	2003	2004
Japan	9.4	16.8	16.9	22.9	20.5	21.8	26.3	31.4
China	12.8	20.2	23.7	29.3	28.8	37.0	52.6	67.0
ASEAN 4	18.4	33.2	30.9	37.6	30.9	33.4	37.8	44.2
S. Korea + Taiwan	19.3	29.3	30.6	36.7	29.2	33.6	39.2	45.5

Note: The data are defined in Appendix 2.

Source: CEPII-CHELEM Database

Table 7.

China's Processing Trade – 1993 and 2005

Imports (%)								
	World	S. Korea & Taiwan	Japan	ASEAN 5	Hong Kong	United States	Europe	Rest of World
1993								
Total Imports	100	18	22	6	10	10	15	19
Normal Imports	37	2	8	3	1	5	8	9
Imports for Processing	35	11	8	2	7	2	2	3
Others	28	5	7	1	2	3	6	5
2005								
Total Imports	100	23	15	11	2	7	11	31
Normal Imports	42	6	5	3	1	4	6	17
Imports for Processing	42	14	7	6	1	2	2	10
Others	16	3	3	2	0	2	2	4

Exports (%)								
	World	S. Korea & Taiwan	Japan	ASEAN 5	Hong Kong	United States	Europe	Rest of World
1993								
Total Exports	100	5	17	5	24	18	13	18
Normal Exports	47	2	10	4	10	6	7	9
Processed Exports	48	2	7	1	14	13	7	4
Others	5	0	0	0	0	0	0	5
2005								
Total Exports	100	7	11	6	16	21	17	21
Normal Exports	41	3	4	3	3	7	7	13
Processed Exports	55	3	7	3	12	14	10	6
Others	4	0	0	0	1	1	0	2

Table 7 (continued).

China's Processing Trade – 1993 and 2005

Balance of Trade (billions of US Dollars)								
1993	World	S. Korea &Taiwan	Japan	ASEAN 5	Hong Kong	United States	Europe	Rest of World
Balance of trade	-12.2	-14.0	-7.5	-1.3	11.60	6.3	-3.5	-3.8
Normal trade	5.2	0.3	0.7	-0.1	7.7	0	-2	-1.5
Processing trade	7.9	-9.5	-1.3	-0.6	5.7	9.7	4.2	-0.3
Others	-25.2	-4.9	-6.9	-0.6	-1.7	-3.4	-5.8	-1.9
2005								
Balance of trade	102.00	-99.84	-16.42	-23.81	112.25	114.27	61.37	-45.81
Normal trade	35.43	-12.91	-2.45	1.95	21.59	26.91	14.36	-14.01
Processing trade	142.46	-69.25	4.49	-13.31	85.05	92.94	60.42	-17.88
Others	-75.88	-17.69	-18.46	-12.44	5.61	-5.58	-13.41	-13.91

Notes: Source: Gaulier, Lemoine, and Nal-Kesenci (2005), China's Customs Statistics, and calculations by the authors. Europe includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Luxembourg, Netherlands, Italy, Portugal, Spain, and Sweden.

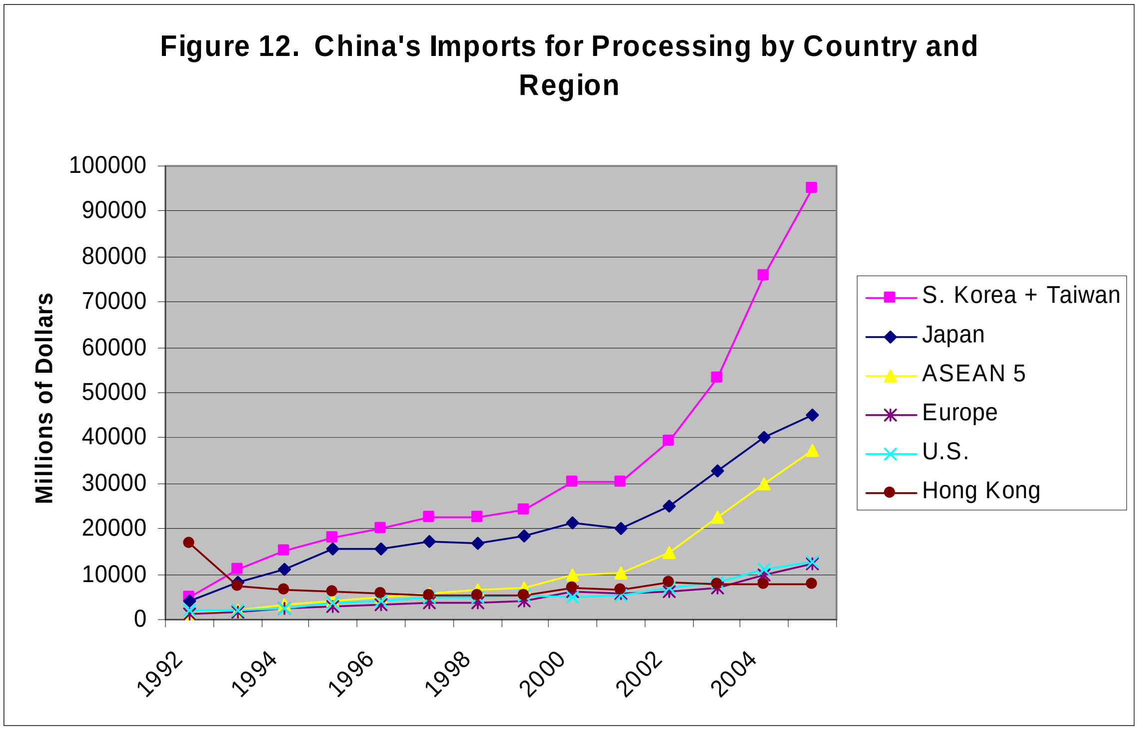


Table 8. China's Imports for Processing by Country and Region (Billions of U.S. Dollars)

Regions	1992	1995	1998	2001	2002	2003	2004	2005
Japan	3.9	15.6	16.7	19.9	25.0	32.8	40.2	45.2
S. Korea + Taiwan	5.0	17.9	22.7	30.4	39.3	53.3	75.9	94.9
ASEAN5	1.3	4.2	6.7	10.4	14.9	22.6	30.0	37.4
U.S.	2.0	3.7	4.9	5.5	6.9	8.1	11.0	12.8
Europe	1.1	2.9	3.6	5.9	6.3	6.9	9.8	12.1
Hong Kong	16.6	6.3	5.2	6.6	8.0	7.7	7.8	7.7

Source: China Customs Statistics (2006)

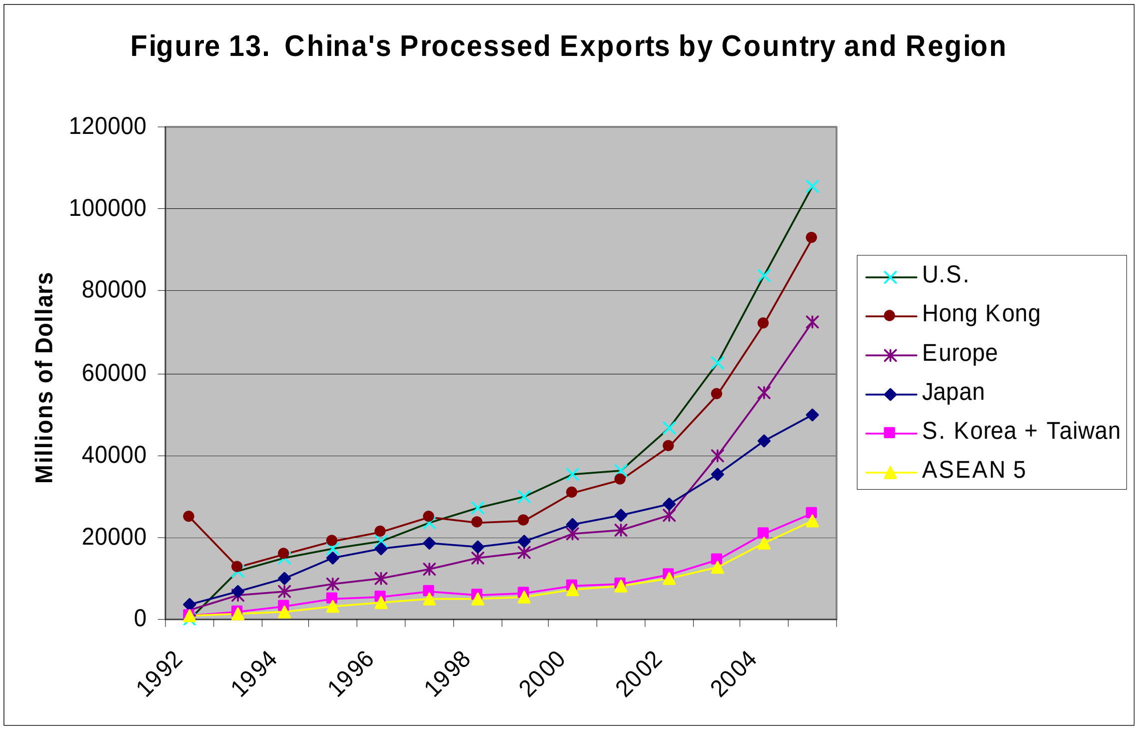


Table 9. China's Processed Exports by Country and Region (Billions of U.S. Dollars)

Regions	1992	1995	1998	2001	2002	2003	2004	2005
Japan	3.5	14.8	17.5	25.3	28.2	35.1	43.5	49.7
S. Korea + Taiwan	0.8	5.0	5.9	8.7	10.9	14.5	21.0	25.7
ASEAN5	0.9	3.4	5.1	8.0	10.2	12.8	18.4	24.1
U.S.	27.1	17.2	23.4	36.3	46.8	62.4	83.7	105.7
Europe	2.4	8.5	12.2	21.9	25.5	39.9	55.5	72.6
Hong Kong	24.9	18.9	24.8	34.2	42.3	54.6	72.2	92.7

Source: China Customs Statistics (2006)

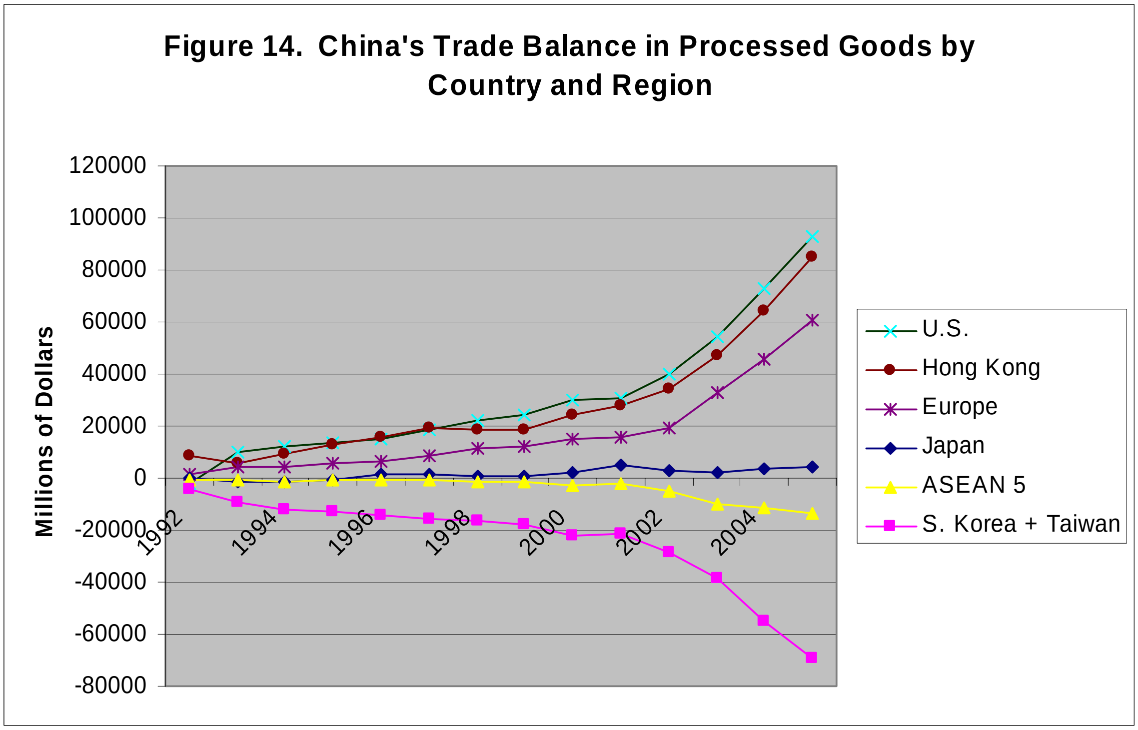
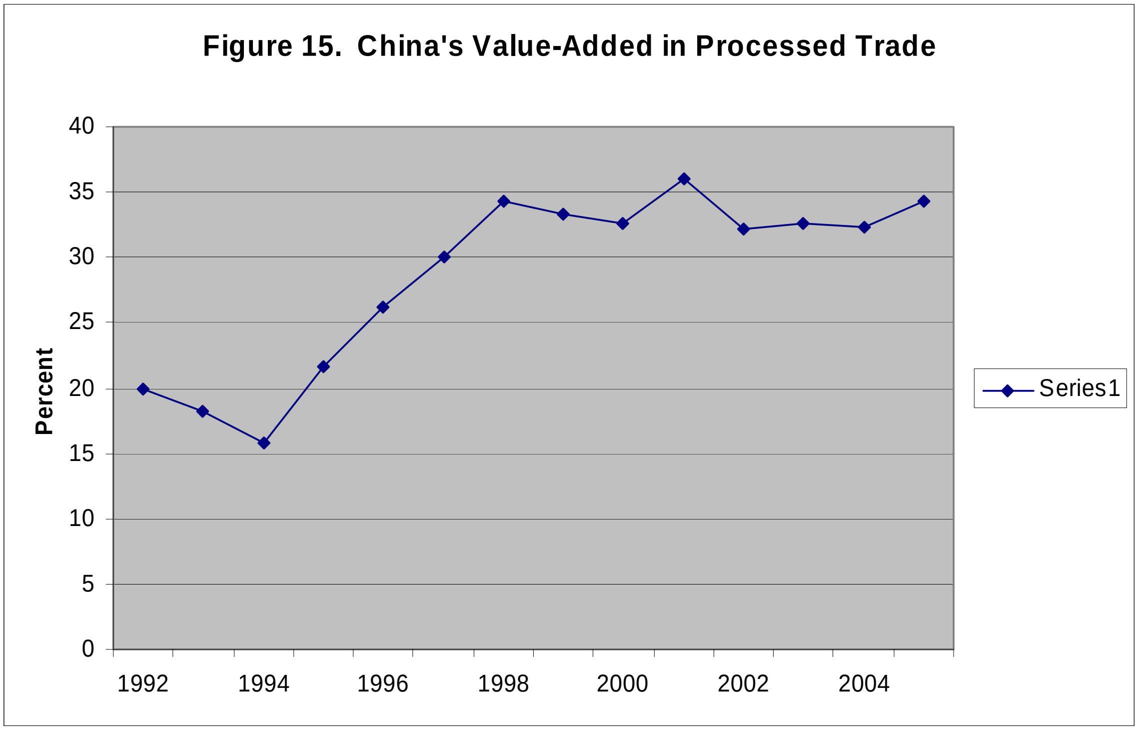


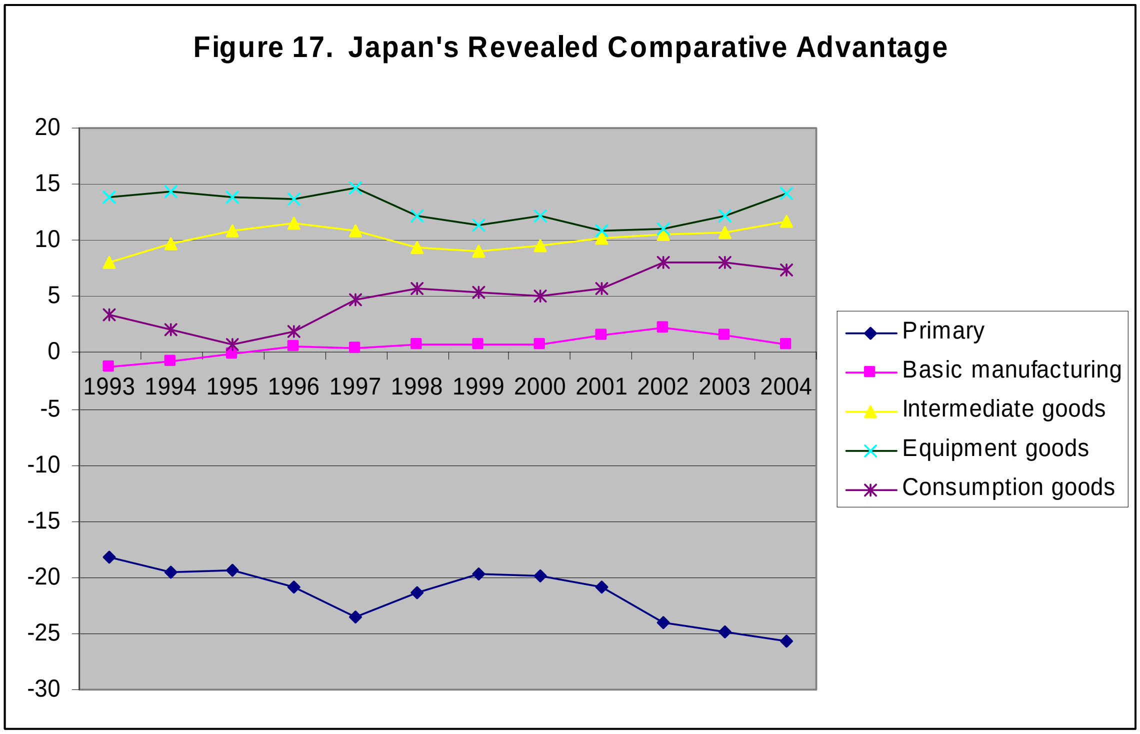
Table 10. China's Trade Balance in Processed Goods by Country and Region (Billions of U.S. Dollars)

Regions	1992	1995	1998	2001	2002	2003	2004	2005
Japan	-0.4	-0.7	0.9	5.3	3.1	2.4	3.3	4.5
S. Korea + Taiwan	-4.2	-12.9	-16.8	-21.8	-28.4	-38.7	-54.9	-69.3
ASEAN5	-0.4	-0.8	-1.6	-2.4	-4.7	-9.9	-11.7	-13.3
U.S.	-2	13.5	22.3	30.8	40.0	54.3	72.7	92.9
Europe	1.4	5.6	11.5	15.9	19.2	33.0	45.7	60.4
Hong Kong	8.3	12.6	18.6	27.5	34.3	46.9	64.3	85.1

Source: China Customs Statistics (2006)



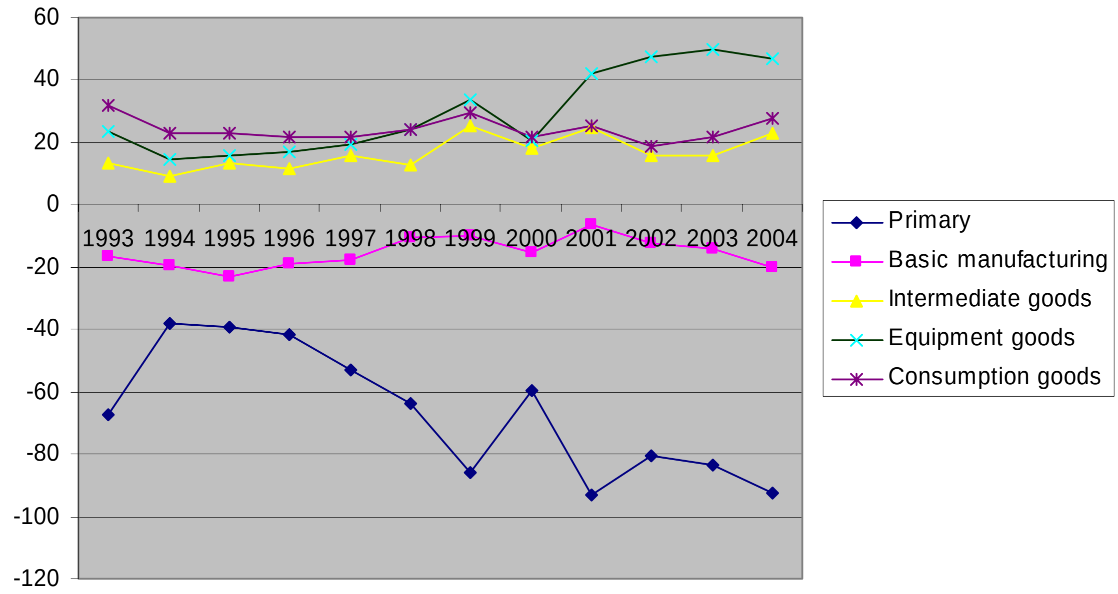
Note: Value-added is defined as the difference between the value pf China's processed exports and the value of China's imports for processing, divided by the value of China's processed exports.
Source: China Customs Statistics (2006)



Note: The data are constructed for individual products using shares of the overall trade balance rather than relative export structure as in Balassa (1965). Values for stages of production are then calculated by summing. See www.cepii.fr for a detailed description of how the data are constructed.

Source: CEPII-CHELEM database

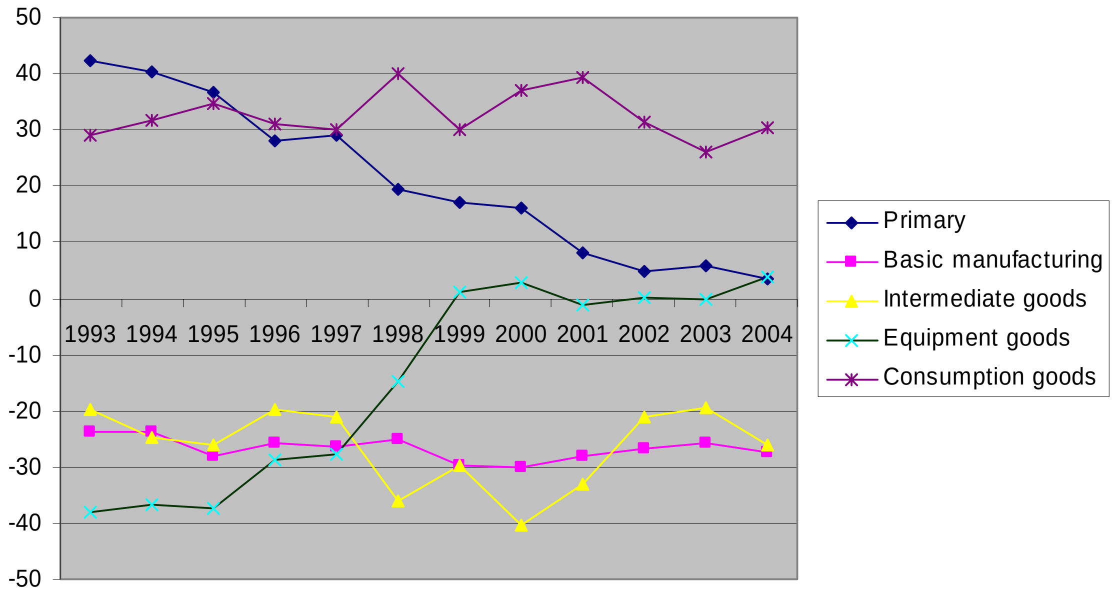
Figure 18. The NIEs' Revealed Comparative Advantage



Note: The data are constructed for individual products using shares of the overall trade balance rather than relative export structure as in Balassa (1965). Values for stages of production are then calculated by summing. See www.cepii.fr for a detailed description of how the data are constructed.

Source: CEPII-CHELEM database

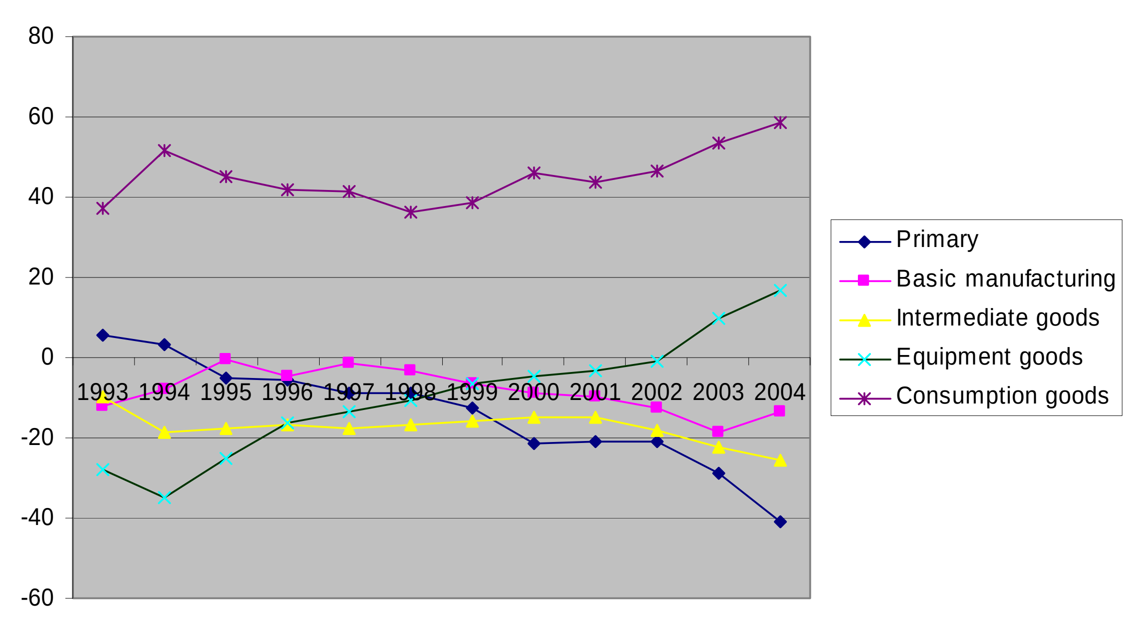
Figure 19. ASEAN's Revealed Comparative Advantage



Note: The data are constructed for individual products using shares of the overall trade balance rather than relative export structure as in Balassa (1965). Values for stages of production are then calculated by summing. See www.cepii.fr for a detailed description of how the data are constructed.

Source: CEPII-CHELEM database

Figure 20. China's Revealed Comparative Advantage



Note: The data are constructed for individual products using shares of the overall trade balance rather than relative export structure as in Balassa (1965). Values for stages of production are then calculated by summing. See www.cepii.fr for a detailed description of how the data are constructed.

Source: CEPII-CHELEM database

Table 12. The Degree of Competition between Asian Countries' Exports to the U.S. and China's Exports to the U.S. in 2003*

Japan	21.9%
South Korea	40.9%
Taiwan	68.8%
Singapore	40.1%
Indonesia	66.8%
Malaysia	65.0%
Philippines	60.7%
Thailand	69.8%

* A higher number indicates greater competition in individual product categories.
Source: Updated from Kwan (2002).

Appendix 1. Studies Investigating Whether FDI Flows to China Have Crowded Out FDI Flows to Other Asian Countries[20]

1. Kamaky, Ahmed. 2003. "Behind the Surge of FDI to Developing Countries in the 1990s: An Emprical Investigation," *Working Paper of Department of Economics,* American University of Cairo, Egypt.

Kamaly (2003) adopted a fixed-effects formulation with a lagged dependent variable, which is (FDI/GDP) ratio. More specifically, the model takes the form of:

$$y_{it} = \alpha + \mu_i + \delta y_{it-1} + x'_{it}\beta + u_{it,} \qquad u_{it} \sim iid\left(0, \sigma_u^2\right)$$

In line with Arrelano and Bond (2003), a set of explanatory variables of the model has been used as instruments on the condition that $E\left(x_{it}u_{is}\right) = 0,$ where $s < t$, for correcting the bias that would arise from usual OLS or fixed effects (within) estimator. Using the moment conditions involving the matrix of instruments, the paper obtained two variant of GMM estimators of the parameters δ and β. The first estimation has been done in line with Arrelano-Bond two step GMM-IV estimators, while the second estimation was based on extended GMM-IV estimators, what the paper termed as GMM-SYS estimators. The second approach has the benefit of no need of first differencing, since GMM-SYS incorporates additional moment conditions by including additional instruments that are not correlated with the country fixed effects, μ_i.

The estimation results of the base regression (as reported in Table-6) show that the lagged dependent variable has statistically significant large coefficient of 0.73 exhibiting a high degree of inertia in FDI flows. The second largest coefficient is -0.041 for 'bond yield in G7 countries' as against 0.024 and 0.010 for 'lagged real GDP growth rate' and 'openness' variables respectively. A very high magnitude of lagged FDI/GDP combined with relatively small quantitative effects of the explanatory variables has been attributed to the persistence of FDI flows. The paper argued that the international interest rate has also been more important driving force behind FDI flows, as against country specific factors such as openness and economic growth. Overall, the past value of FDI largely determines the current level of FDI flows, probably explaining observed stability in FDI flows to some countries.

Controlling for other regressors such as exchange rate variability (as a proxy for uncertainty), democracy, capital control and financial deepening, the study shows that GMM-SYS estimators are found more consistent compared to other competing estimators as derived OLS, between or within estimators or GMM_IV (Please see Table-8).

2. Mercereau, Benoit. 2005. "FDI Flows to Asia: Did the Dragon Crowd out the Tigers?" *IMF Working Paper WP/05/189.*

Mercereau questioned use of log(FDI) as it assumes percentage change in FDI instead of the changes in the levels of FDI flows and thus not capturing the very notion of crowding

[20] This Appendix was written by Mizanur Rahman.

out effects. The paper rather used FDI to China relative to total GDP of other countries of the region and also FDI to China relative to total FDI to the region and then estimated the impact of China on FDI flows to other countries by the flowing equation: $fdi_{jt} = \delta fdi_{jt-1} + \beta X_{jt} + \alpha China_t + \mu_j + \varepsilon_{jt}$, where fdi_{jt} is FDI to GDP ratio of country j at time t and $China_t$ is FDI flows to China scaled by either total GDP of the region or total FDI flows to the region. The findings show that a 10 percent increase in China's FDI market share (i.e., China's FDI relative to total FDI to the region) appears to have lowered, on average, annual flows to other nations by about 0.4 percent of GDP. Given that China's market share rose from an average of 26 percent in the pre-reform period (1984-91) to one of 56 percent in the post-reform period, 1992-2002, China's negative impact on flows of FDI to other countries was around 1.3 percent a year on average. When the estimation is done with the interaction term $(China_t * country\_dummy)$, only two coefficients (Singapore and Myanmar) come out to be statistically significant. The paper argued that the role of overseas Chinese might explain the effect on Singapore, as the overseas Chinese account for a significant share of foreign investment in China. They invest in China because they have family connection or linguistic and cultural ties in the mainland China. Here the paper further argued that since Taiwanese investors channel their funds through Hong Kong and Singapore, a significant negative coefficient for Singapore while a statistically insignificant coefficient for Taiwan appear plausible. For Myanmar, the paper argued Singapore is the second largest investor to the country, while the traditional large suppliers such as the US and the EU stopped investing there. The study explained that a very restrictive investment and trading regime in Myanmar might divert Singapore's FDI from Myanmar to China.

However, it seems that FDI flows to countries are little correlated with their macroeconomic fundamentals, rather much to factors such as country's strategic position in the international trade. For example, East Asian countries received stable flows of substantial share of FDIs, because these nations are the center of the gravity of international organization of production. They belong to a cross-border integrated production network where each country has its industrial organization in line with comparative advantage in international trade. If this is true, technological development and industrial upgrdation in those nations are endogenized by their dynamic position in the international production networks. Flows of FDIs are then an outcome of this integrated production relationship, much less due to their idiosyncratic macroeconomic policies and also factors such as GDP growth rate, exchange rate volatility, democracy etc. The existing literature (e.g., Kamaly, 2003) documented that FDI flow shows a pattern of long term inertia as the coefficient of lagged FDI/GDP ratio has outweighed cumulative magnitudes of other impacts by a multiple of four.

3. Eichengreen and Tong (2005) estimated gravity model in an instrumental variable (IV) regression framework to examine impact of Chinese FDI inflows on regional FDI inflows to Asia, Latin America, Central and Eastern Europe, and OECD countries. The findings show that Chinese FDI has a significant positive impact on FDI inflows to Asia, but a significant negative impact on FDI flows to OECD countries. The paper also shows that there is little evidence on the impact of China's FDI on other regions such as Latin America, and Central & Eastern Europe. The paper argues that in addition to relative costs of production, market-size considerations may have affected investors' decisions to bring in FDI to China. However, the paper fails to address any issues surrounding the evidence of complimentary pattern FDIs in Asia. In further desegregation to examine impact of China's FDI on other Asian countries, they included interaction terms of $country\ \mathrm{i} * ChinaFDIfitted$. They find significant positive coefficients for all Asian countries—coefficients for Japan and Singapore are largest in magnitude, while they are smallest for Korea, Pakistan and Bangladesh. The study explained Japan and Singapore are two major producers of capital goods and electronic components that are used in Chinese manufacturing and therefore are main originating countries of Chinese FDI. Though the study attributed smaller coefficients for Bangladesh and Pakistan to their weak link in the supply-chain of China, smaller coefficient for Korea has been labeled as a "hollowing out" effect of Korean domestic industry. This reasoning is likely to be misplaced as we see a very wider trading relationship between Korea and China, which has been along the line value-chain of international production organization in East Asia. If it is so, positive impact of Chinese FDI on all Asian countries may not be robust if time effect is properly accounted for. As Kalamly (2003) found that FDI flows exhibit a high degree of inertia to its observed pattern.

Appendix 2. The definition of intermediate goods and parts and components.

1) CEPII Data

CEPII Classification of Intermediate Goods
(SITC Equivalents in Parentheses)

Intermediate Goods

1. Engines, Turbines and Pumps

   (See note 1)

2. Electric Components

   (See note 2)

3. Vehicle Components

   (Parts and accessories of motor vehicles)

4. Tubes & 1st stage processing products

   (Iron and steel wire, tubes, pipes, and pipe fitting)

5. Yarns and Fabrics

   (See note 3)

6. Wood Articles

   (Cork and wood manufactures, excluding furniture)

7. Paper and Pulp
   (Pulp, waste paper, paper, paperboard, Articles of paperboard or paper)

8. Metallic structure

   (Iron, steel, aluminum structures and

parts, metal containers for storage and
transport)

9. Miscellaneous Hardware
(See note 4)

10. Fertilizers

(See note 5)

11. Paints

(See note 6)

12. Plastics, Fibers and Synthetic resins

(synthetic rubber, reclaimed rubber ,
waste of unhardened rubber, synthetic
and man made fibers for spinning)

13. Rubber Articles

(Rubber manufactures)

Source: CEPII-CHELEM database
Notes:

1.

- 741 - Heating and cooling equipment, and parts thereof, n.e.s.
- 742 - Pumps for liquids, whether or not fitted with a measuring device; liquid elevators; parts for such pumps and liquid elevators
- 743 - Pumps (other than pumps for liquids), air or other gas compressors and fans; ventilating or recycling hoods incorporating a fan, whether or not fitted with filters; centrifuges; filtering or purifying apparatus; parts thereof
- 71 - Power-generating machinery and equipment

2.

- 776 - Thermionic, cold cathode or photo-cathode valves and tubes (e.g., vacuum or vapour or gas-filled valves and tubes, mercury arc rectifying valves and tubes, cathode-ray tubes, television camera tubes); diodes, transistors and similar semiconductor devices; photosensitive semiconductor devices; light-emitting diodes; mounted piezoelectric crystals; electronic integrated circuits and microassemblies; parts thereof

3.

- 651 - Textile yarn
- 652 - Cotton fabrics, woven (not including narrow or special fabrics)
- 653 - Fabrics, woven, of man-made textile materials (not including narrow or special fabrics)
- 654 - Other textile fabrics, woven
- 655 - Knitted or crocheted fabrics (including tubular knit fabrics, n.e.s., pile fabrics and openwork fabrics), n.e.s.
- 657 - Special yarns, special textile fabrics and related products

4.

- 693 - Wire products (excluding insulated electrical wiring) and fencing grills
- 694 - Nails, screws, nuts, bolts, rivets and the like, of iron, steel, copper or aluminium
- 695 - Tools for use in the hand or in machines
- 696 - Cutlery
- 697 - Household equipment of base metal, n.e.s.
- 699 - Manufactures of base metal, n.e.s.
- 746 - Ball- or roller bearings
- 747 - Taps, cocks, valves and similar appliances for pipes, boiler shells, tanks, vats or the like, including pressure-reducing valves and thermostatically controlled valves
- 748 - Transmission shafts (including camshafts and crankshafts) and cranks; bearing housings and plain shaft bearings; gears and gearing; ball screws; gearboxes and other speed changers (including torque converters); flywheels and pulleys (including pulley blocks); clutches and shaft couplings (including universal joints); articulated link chain; parts thereof
- 812 - Sanitary, plumbing and heating fixtures and fittings, n.e.s.

5.

- 591 - Insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant-growth regulators, disinfectants and similar products, put up in forms or packings for retail sale or as preparations or articles (e.g., sulphur-treated bands, wicks and candles, and fly-papers)
- 56 - Fertilizers (other than those of group 272)

6.

- 598.1 - Wood- and resin-based chemical products
- 598.3 - Artificial waxes and prepared waxes
- 598.4 - Mixed alkylbenzenes and mixed alkylnaphthalenes, n.e.s.
- 598.5 - Chemical elements doped for use in electronics, in the form of discs, wafers or similar forms; chemical compounds doped for use in electronics
- 598.6 - Organic chemical products, n.e.s.
- 597.2 - Anti-knock preparations, oxidation inhibitors, gum inhibitors, viscosity improvers, anti-corrosive preparations and other prepared additives for mineral oils (including gasoline) or for other liquids used for the same purposes as mineral oils

- 53 - Dyeing, tanning and colouring materials

1) RIETI-TID Data

Parts and Components are defined based on the Broad Economic Classification (BEC) of the United Nations. They include 1) parts and components of capital goods (BEC code 42) and parts and accessories of transport equipment (BEC code 521)

Appendix 3. Parts and Components Exports from East Asian Countries.

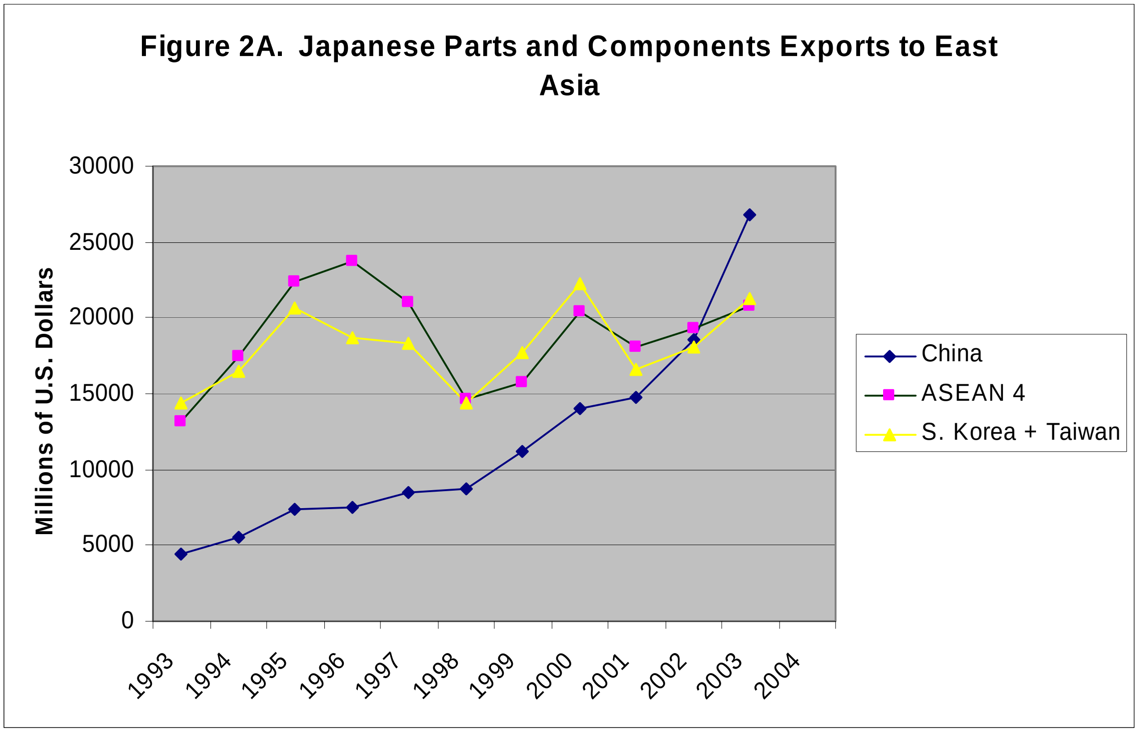


Table 2A. Japanese Parts and Components Exports to East Asia (Billions of U.S. Dollars)

Regions	1993	1996	1999	2000	2001	2002	2003
China	4.5	7.6	11.2	14.1	14.8	18.6	26.8
ASEAN 4	13.2	23.8	15.8	20.4	18.1	19.4	20.7
S. Korea + Taiwan	14.4	18.7	17.7	22.2	16.5	18.1	21.2

Note: The data are defined in Appendix 2.

Source: RIETI-TID database.

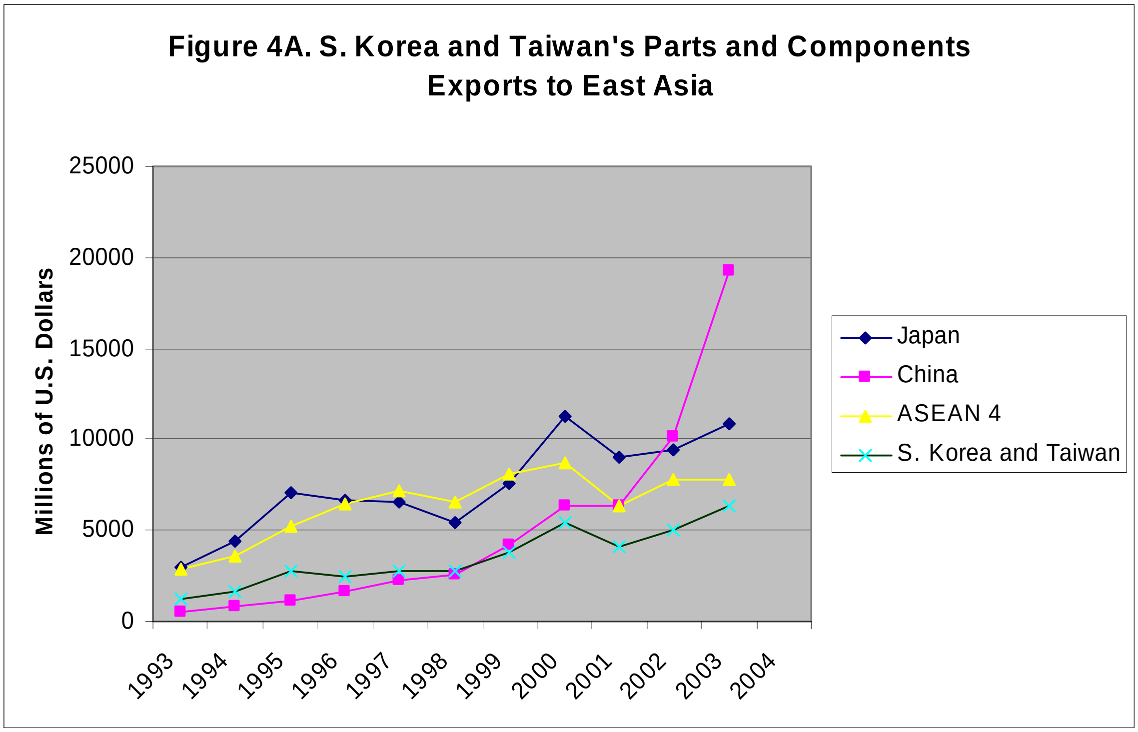


Table 4A. S. Korea's and Taiwan's Parts and Components Exports to East Asia (Billions of U.S. Dollars)

Regions	1993	1996	1999	2000	2001	2002	2003
Japan	2.9	6.6	7.5	11.3	9.0	9.4	10.9
China	0.5	1.7	4.2	6.3	6.4	10.2	19.2
ASEAN 4	2.9	6.5	8.1	8.7	6.3	7.7	7.8
S. Korea + Taiwan	1.2	2.5	3.7	5.5	4.1	5.0	6.4

Note: The data are defined in Appendix 2.

Source: RIETI-TID database.

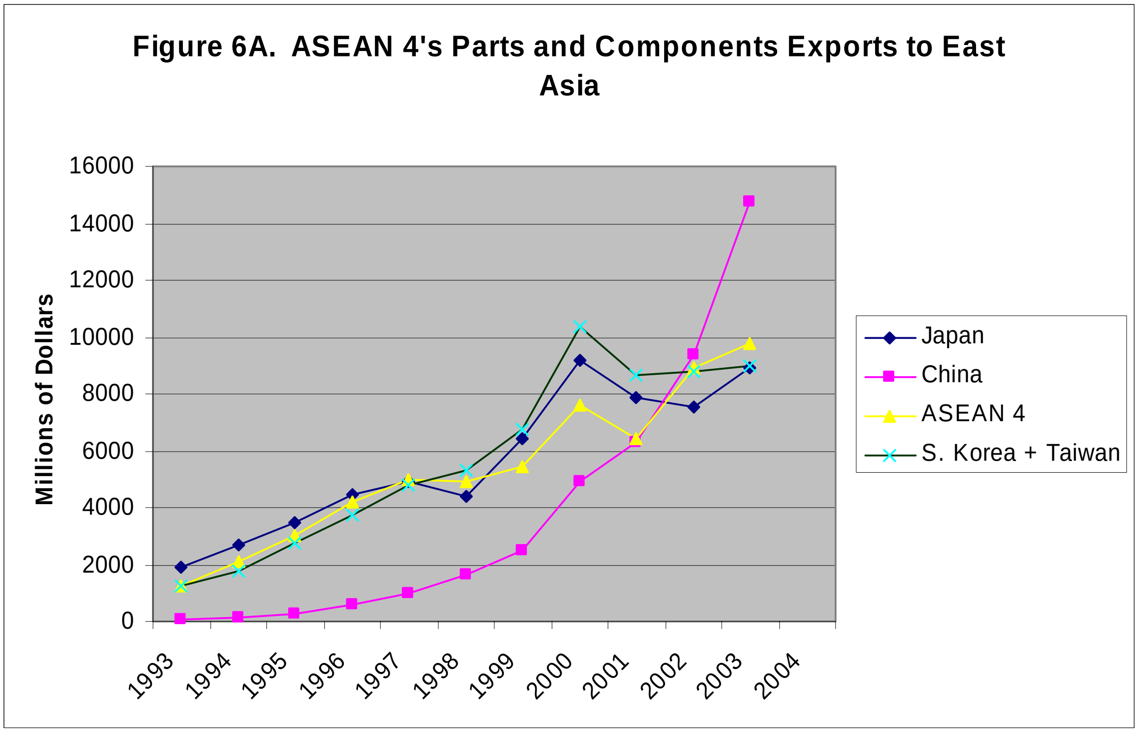


Table 4A. ASEAN 4's Parts and Components Exports to East Asia (Billions of U.S. Dollars)

Regions	1993	1996	1999	2000	2001	2002	2003
Japan	1.9	4.4	6.4	9.2	7.9	7.5	8.9
China	0	0.6	2.5	4.9	6.3	9.4	14.8
ASEAN 4	1.3	4.2	5.5	7.6	6.5	8.9	9.8
S. Korea + Taiwan	1.3	3.7	6.8	10.4	8.7	8.8	9.0

Note: The data are defined in Appendix 2.

Source: RIETI-TID database.

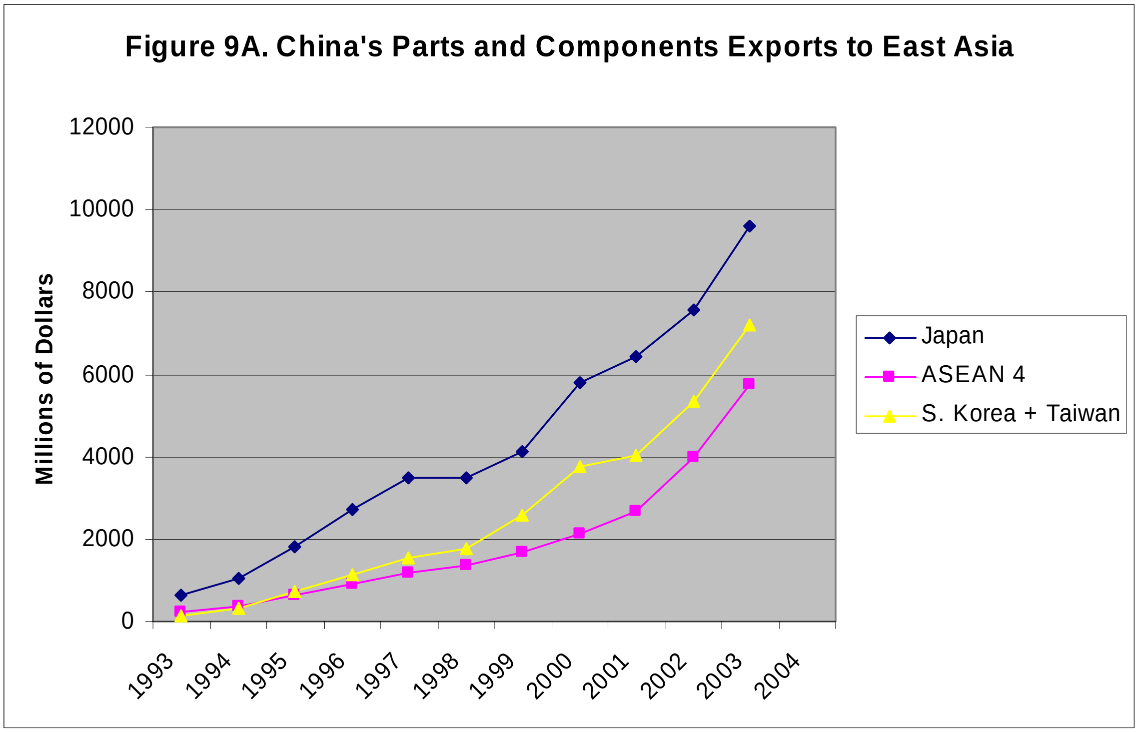


Table 6A. China's Parts and Components Exports to East Asia (Billions of U.S. Dollars)

Regions	1993	1996	1999	2000	2001	2002	2003
Japan	0.7	2.7	4.1	5.8	6.5	7.6	9.6
ASEAN 4	0.2	1.2	1.7	2.2	2.7	4.0	5.7
S. Korea + Taiwan	0.2	1.6	2.6	3.8	4.0	5.3	7.2

Note: The data are defined in Appendix 2.

Source: RIETI-TID database.

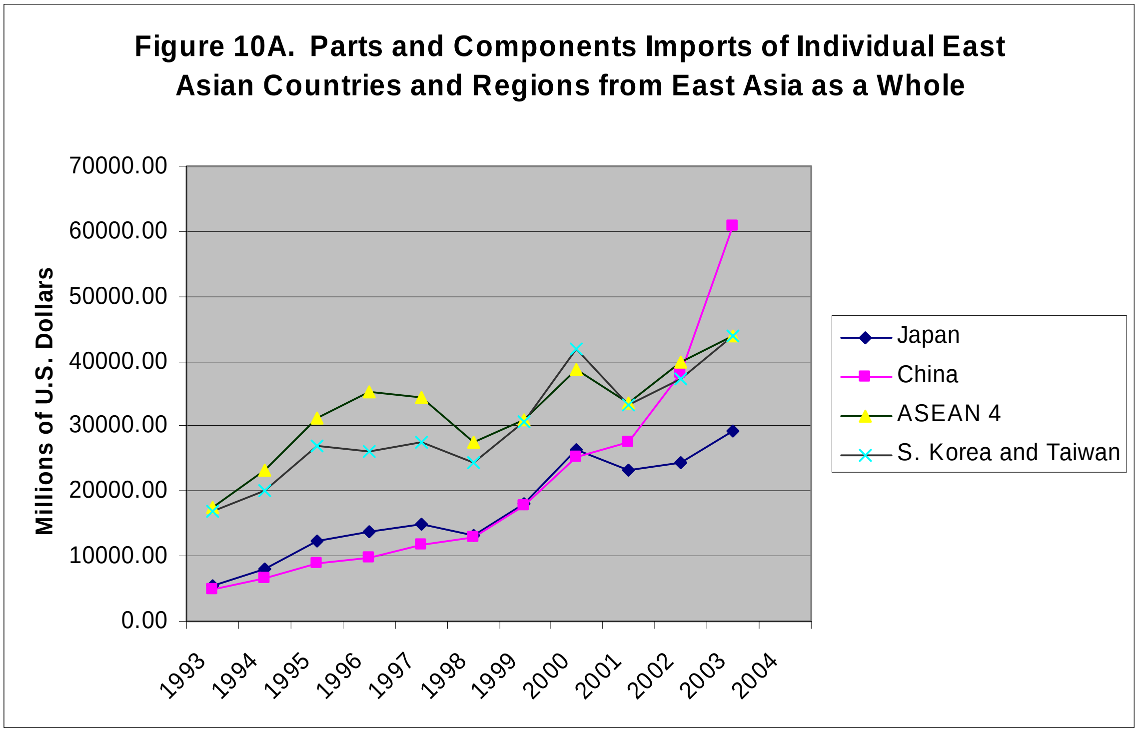


Table 6A. Parts and Components Imports of Individual East Asian Countries and Regions from East Asia as a Whole (Billions of U.S. Dollars)

Regions	1993	1996	1999	2000	2001	2002	2003
Japan	5.4	13.8	18.1	26.2	23.3	24.5	29.4
China	5.0	9.9	17.9	25.3	27.4	38.2	60.8
ASEAN 4	17.5	35.4	31.0	38.9	33.5	40.0	44.0
S. Korea + Taiwan	17.0	26	30.8	41.8	33.3	37.2	43.8

Note: The data are defined in Appendix 2.

Source: RIETI-TID database

NEAT Working Group Workshop on
"Trade-FDI-Technology Linkages in East Asia"

7 July 2006, RIETI, Tokyo

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