
**ADBI Working Paper Series**

# Understanding Foreign Direct Investment in East Asia

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No. 290
June 2011

**Asian Development Bank Institute**

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Suggested citation:

Thorbecke, W., and N. Salike. 2011. Understanding Foreign Direct Investment in East Asia. ADBI Working Paper 290. Tokyo: Asian Development Bank Institute. Available: http://www.adbi.org/working-paper/2011/06/23/4616.foreign.direct.investment.east.asia/

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**Abstract**

We recount East Asia's experience with foreign direct investment (FDI). We document that, contrary to the Rybczynski theorem, capital flows in the region cause the host country's labor-intensive industry to expand and its capital-intensive industry to decline. We also present narrative evidence that sheds light on how FDI is affected by the host's country's locational advantages, whether Asian FDI is footloose, and how the PRC has become the center of Factory Asia. Finally, we show that the evolution of production networks in the region can be explained partly by changes in the service cost of linking geographically separated production blocks relative to the cost saving arising from slicing up the value chain.

**JEL Classification: F21, F23, O53**

# Contents

# 1. INTRODUCTION

What determines foreign direct investment (FDI) in East Asia? What are the distinguishing characteristics of FDI in the region? How is FDI related to the intricate production networks that have exploded over the last ten years? How does FDI benefit the host country? This paper addresses these and related questions.

Dunning (1988) has explained why firms undertake FDI rather than exploiting external markets directly by exporting. He focuses on firms' ownership, location, and internalization advantages and on the internalization of intangible assets. Kojima (1973) modeled East Asian FDI by focusing on flows from the capital exporting country's disadvantaged industry to the host country's advantaged industry. As wages in the investing country increase and as its products become more capital and knowledge intensive, it becomes profitable for firms in the investing country to transfer production to lower wage countries. Home country firms then export sophisticated parts and components to the host country, so that there is a complementary relationship between exports and FDI in this framework. Both Dunning's and Kojima's models are useful for understanding Asian FDI.

East Asian FDI began in earnest after the yen appreciated 60% following the Plaza Accord in September 1985. Japanese firms lost their price competitiveness and responded by shifting labor-intensive activities to other Asian countries. Japan then focused on producing technology-intensive parts and components and exporting these to factories in the region for assembly and re-export. There was thus a complementary relationship between Japanese FDI and Japanese exports to East Asia.

After the Plaza Accord, Japanese multinational enterprises (MNEs) transferred factories to Republic of Korea (henceforth, South Korea) and Taipei,China. However, in the late 1980s both wages and exchange rates in these economies skyrocketed. The locational advantage of assembling labor-intensive goods in the newly industrialized economies (NIEs) declined, and Japanese firms transferred production to the Association of Southeast Asian Nations **(**ASEAN) countries. Surplus labor in ASEAN held wages down, and exchange rates in these countries were pegged at competitive levels relative to the US dollar. Japanese MNEs provided ASEAN firms with detailed engineering and managerial instructions and specifications, facilitating the assimilation of the new technologies.

A virtuous circle of learning and growth developed that continued until the Asian Economic Crisis of 1997–1998. With the crisis, new Japanese FDI to ASEAN collapsed. As documented below, however, the flow of parts and components from Japan to ASEAN continued unabated and Japanese firms did not pull out. Thus, Japanese investment in the region was not footloose.

After the People's Republic of China (henceforth, PRC) joined the World Trade Organization (WTO) in 2001, there was a surge in FDI and parts and components from East Asian countries to the PRC. The PRC's WTO accession gave foreign investors confidence that the PRC would sustain an FDI-friendly environment. The PRC quickly became the final assembly point of intricate production and distribution networks. It imported hundreds of billions of dollars of parts and components from East Asia and exported the final assembled products throughout the world.

Modeling this trade within East Asian production networks has proven difficult. Traditional theories emphasize trade in final goods driven by differences in technology

and factor endowment. Production fragmentation, on the other hand, involves trade in intermediate goods. Kimura and Ando (2005) have proposed a conceptual framework to explain the slicing up of the value chain. In their model firms decide to fragment production when the production cost saving arising from fragmentation exceeds the cost of linking geographically separated production blocks (the service link cost).

The service link cost is useful for explaining the development of production networks in East Asia. For example, the global value chain for notebook personal computers (PCs) centered in the Yangtze River Delta of the PRC developed in response to a reduction in the service link costs. These costs were lowered when the government of Taipei,China deregulated outgoing FDI for notebook PC companies seeking to invest in the PRC and when the government of the PRC established a superb network of modern highways, ports, and airports in the Delta. This caused many firms to locate in this area and led to economies of scale. Service link costs fell because the large number of firms in close proximity made 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 reduced costs associated with uncontrollability.

This paper recounts East Asia's experience with FDI. The next section provides a theoretical background. Section 3 highlights the evolution of FDI in the region between 1985 and 2011. Section 4 focuses on Asian production networks and the importance of the service link cost. Section 5 concludes.

# 2. THEORETICAL BACKGROUND

Why do firms engage in foreign production? According to Dunning (1988), the answer depends on a firm's OLI (Ownership, Location, and Internalization) configuration and its ability to exploit these OLI advantages in the target market. Ownership advantage is based upon technological and managerial superiority of home country firms relative to host country firms. Such superiority must be sufficient 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. Locational considerations and advantages include wage levels, factor endowments, technology transferability, physical and human infrastructure, and market-supportive institutions and political regimes. 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.

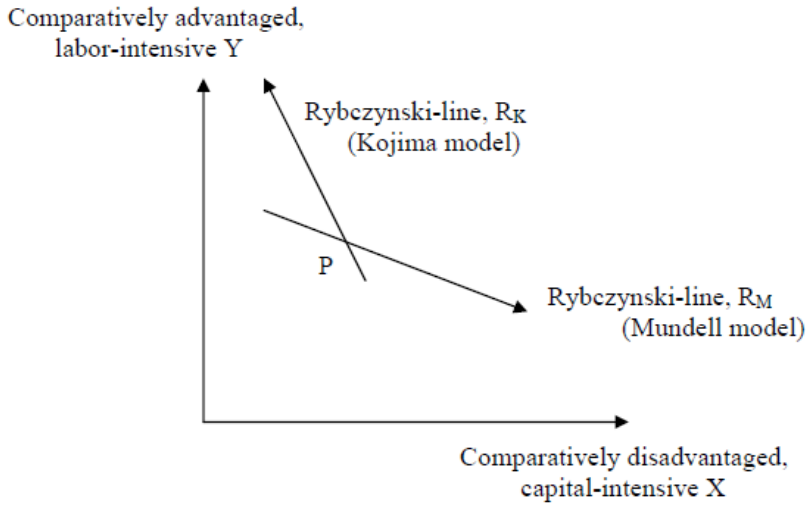
Mundell (1957) showed that capital movement occurs from a capital-abundant country to a capital-scarce country in search of a higher marginal rate of return when the latter impedes the importation of capital-intensive goods from the former. In the capital-receiving country, the capital inflow causes the equilibrium production point to shift in such a direction that the capital-intensive industry (i.e., that country's comparatively disadvantaged industry) expands, while the less capital-intensive industry (i.e., that country's comparatively advantaged industry) contracts. In the capital-transferring

country, exactly the opposite phenomenon occurs. As a consequence, the basis for trade (i.e., the existing pattern of comparative advantage between the two countries) is in the end eliminated by the movement of capital. In this model, FDI thus substitutes for exports.

In contrast Kojima (1973) presented a general equilibrium model where trade and FDI are complementary. In his model FDI originates from the capital exporting country's disadvantaged industry into the host country's advantaged industry and is therefore export-oriented in nature. In Mundell's model, FDI originates from the home country's advantaged industry into the host country's disadvantaged industry and is therefore export-substituting in nature. Kojima focused on foreign value-added activities that create capabilities in which the host country is comparatively well endowed relative to the home country. For instance, as wages in the investing country increase and as new products become more capital and knowledge intensive, it becomes profitable for firms in the investing country to transfer the location of production to lower wage countries. The investing country then exports sophisticated parts and components and technology to the assembly country, so that there is a complementary relationship between exports and FDI.

Figure 1 shows the variations in Mundell's and Kojima's models in terms of Rybczynski lines for the host economy.[1] The Rybczynski lines move away from each other in opposite direction in these models. For Kojima's model, it implies that the inflow of capital causes the labor intensive industry to expand and the capital-intensive industry to decline—a result opposite to that predicted by the original Rybczynski theorem.

**Figure 1: Directions for Capital Flows in the Kojima and Mundell Models**




*Source:* Ozawa (2007).

The conflicting results reflect different underlying assumptions. Mundell assumed that capital flows from countries with a low marginal productivity of capital to countries with a higher marginal productivity of capital. In contrast, Kojima viewed FDI as a vehicle for transplanting superior production technology to lesser developed countries through the training of labor and management.

Kojima (1973, 1975) thus analyzed the knowledge transplanted by MNEs onto developing countries' comparatively advantaged industries. FDI and trade have a

[1] The next three paragraphs draw on Ozawa (2007).

complementary relationship in his framework for two reasons. First, FDI involves the transmission of a 'package' of capital, managerial skill, and technical knowledge to the host country. Second, the foreign investment takes into consideration the present and potential pattern of comparative advantages between the investing and host countries and the FDI is undertaken from the investing country's comparative disadvantaged industry.

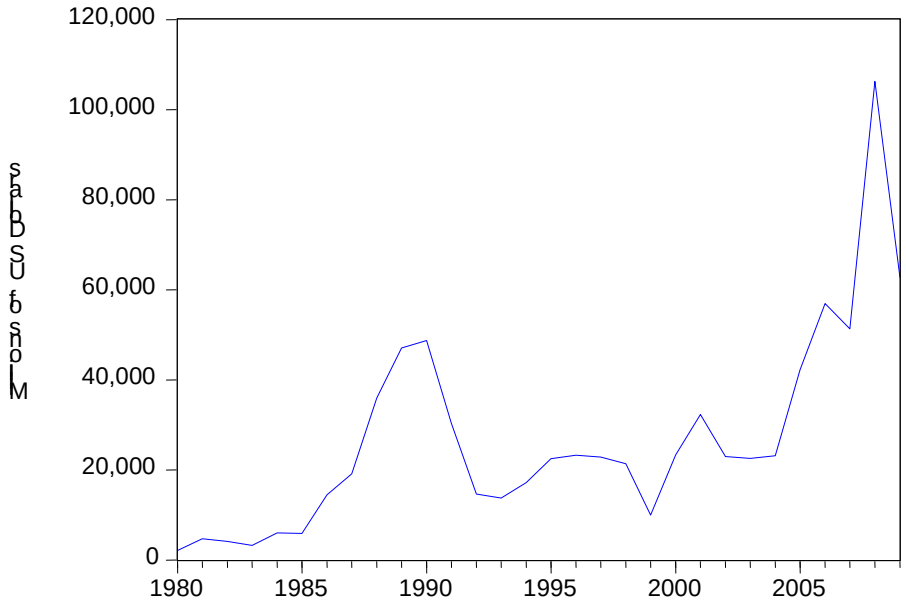
Kojima (1977) also focused on technology transfer to developing countries and argues that it differs from technology transfer to advanced economies. It is often given in the form of know-how or of general industrial experience covering a wide spectrum of production activities such as assembly techniques, material selection, combination, and treatment techniques, machine operation and maintenance techniques, provision of blueprints; and technical data, training of engineers and operator, plant lay-out, selection and installation of machinery and equipment, quality and cost controls, and inventory management. He argued that this type of technology transfer through FDI helps promote steady and balanced economic development and trade growth in developing and emerging economies.

# 3. FDI IN EAST ASIA FROM 1985–2011

Before 1985 Japan led East Asia in outward FDI, although its annual outflows were small. Japan's overseas investments were aimed at exploiting natural resources in resource-rich countries or at manufacturing labor-intensive products such as textiles and clothing in labor-abundant developing countries. Most outputs from the first type of FDI were shipped back to Japan, while the manufactures from the second type were either exported back to Japan or to third-country markets.

As Figure 2 shows, Japanese FDI began in earnest after the Plaza Accord in September 1985. The yen appreciated 60% against the dollar between September 1985 and September 1988. Japanese firms lost their price competitiveness and responded by shifting labor-intensive assembly operations to other Asian countries.

**Figure 2: Japanese Outward FDI to the World**

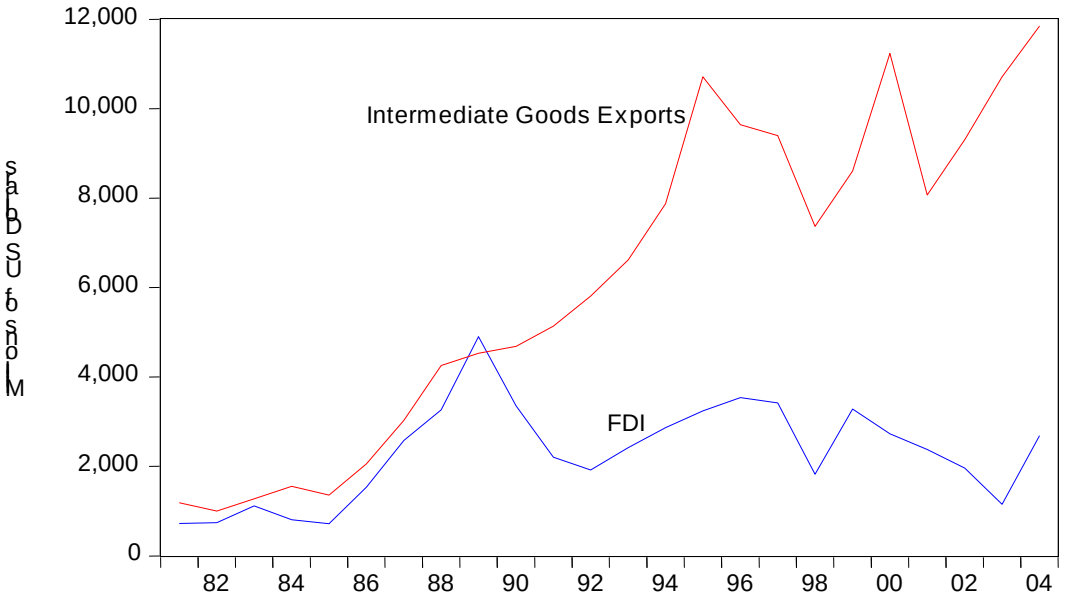



*Source*: CEPII-CHELEM Database.

Figure 3 shows that as Japanese FDI to Asian countries increased, its exports of intermediate goods to these countries increased in tandem. As Kojima (1973) posited, Japanese FDI and exports to Asia thus functioned as complements rather than substitutes.

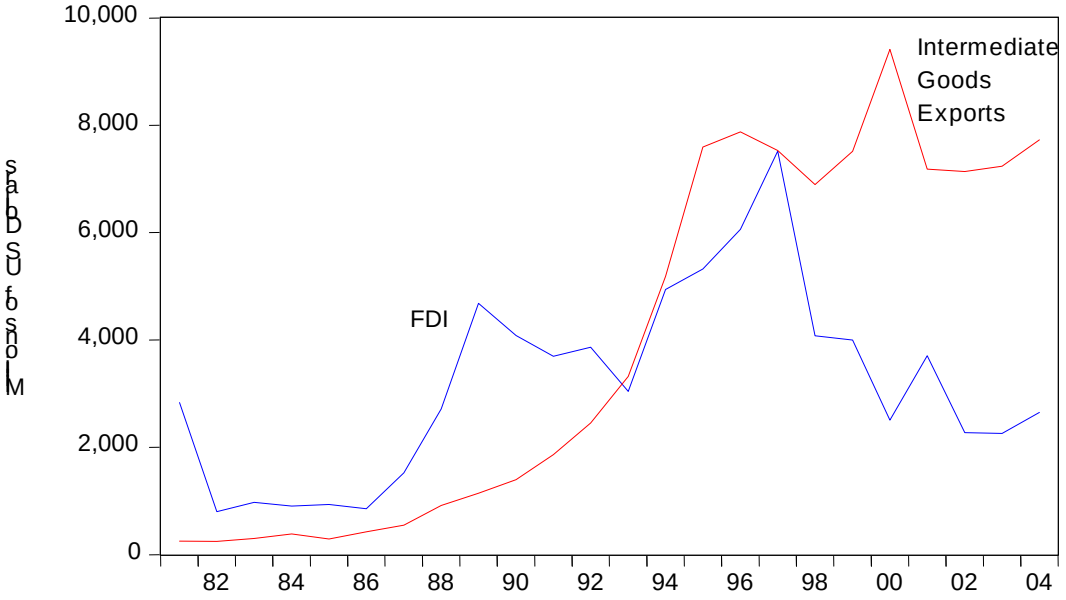
Panel A of Figure 3 shows that immediately after the Plaza Accord there was a surge of Japanese FDI to South Korea and Taipei,China. However, in the late 1980s the United States (US) Treasury named these countries as currency manipulators and they let their exchange rates appreciate. These countries also exhausted their supply of surplus labor in the agricultural sectors in the 1980s, causing their wage rates to increase (see Yoshitomi, 2003). Minggao (2011) noted that manufacturing labor costs in South Korea and Taipei,China remained stable between 1980 and 1987 and then skyrocketed.

**Figure 3a: Japanese FDI and Intermediate Goods Exports to Taipei,China and South Korea**




*Source:* Japanese Ministry of Finance and CEPII-CHELEM Database.

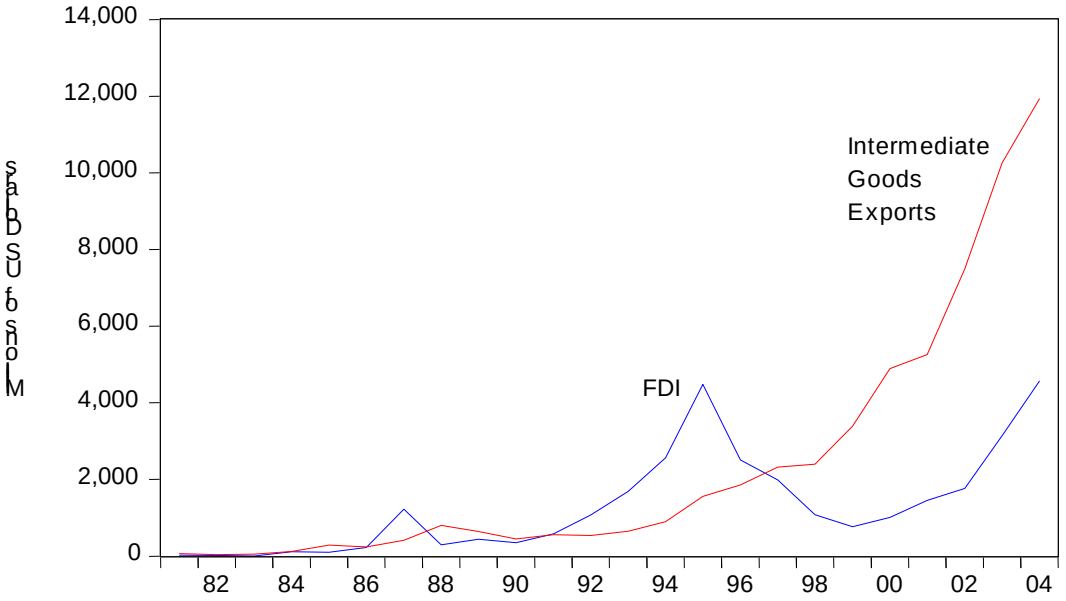
**Figure 3b: Japanese FDI and Intermediate Goods Exports to ASEAN[a]**




a ASEAN includes Indonesia, Malaysia, the Philippines, Singapore, and Thailand.

Source: Japanese Ministry of Finance and CEPII-CHELEM Database.

**Figure 3c: Japanese FDI and Intermediate Goods Exports to the PRC**




*Source*: Japanese Ministry of Finance and CEPII-CHELEM Database.

As the locational advantages of assembling labor-intensive goods in the NIEs declined, Japanese firms transferred production to the ASEAN countries.[2] This is clear in Panel B of Figure 3. Japanese FDI and intermediate goods exports to ASEAN countries trended steadily upwards until 1997. Surplus labor in ASEAN held wages down, and exchange rates in these countries were pegged at competitive levels relative to the US dollar.

Japanese FDI in Southeast Asia often began with a joint-venture system with more limited technology spillovers, before allowing stand-alone operations of greenfield subsidiaries of foreign multinationals.[3] FDI also produced a surge of capital goods imports in which new technologies were typically embodied. The MNEs initially provided ASEAN firms with detailed engineering and managerial instructions and specifications, facilitating assimilation of the new technologies.

Exporting was thus an important learning vehicle for ASEAN firms and a mechanism for achieving technology transfer. The ability of countries in the region to assimilate new technologies depended on their technological capabilites (see Wignaraja, 2008). Especially important in this regard was the quality of local engineers. Engineers were sent abroad to identify the state-of-the-art technology required to compete in world markets. Adoption of technology then led to a process of learning-by-doing for engineers and skilled workers, generating spillover effects within and among industries. Engineers and workers migrated among firms and sectors, bringing their accumulated human capital with them and dispersing it across the expanding economy. These positive externalities then contributed to a virtuous cycle of growth.

Researchers referred to this period as the East Asian Miracle, and it continued until the Asian Crisis of 1997–1998. Panel B of Figure 3 shows that flows of Japanese FDI to ASEAN countries collapsed during and after the crisis. Interestingly, though, Panel B shows that flows of parts and components from Japan to ASEAN continued unabated.

[2] This paragraph and the next two draw on portions of Yoshitomi (2003) that were written by Iwan Azis and Willem Thorbecke.

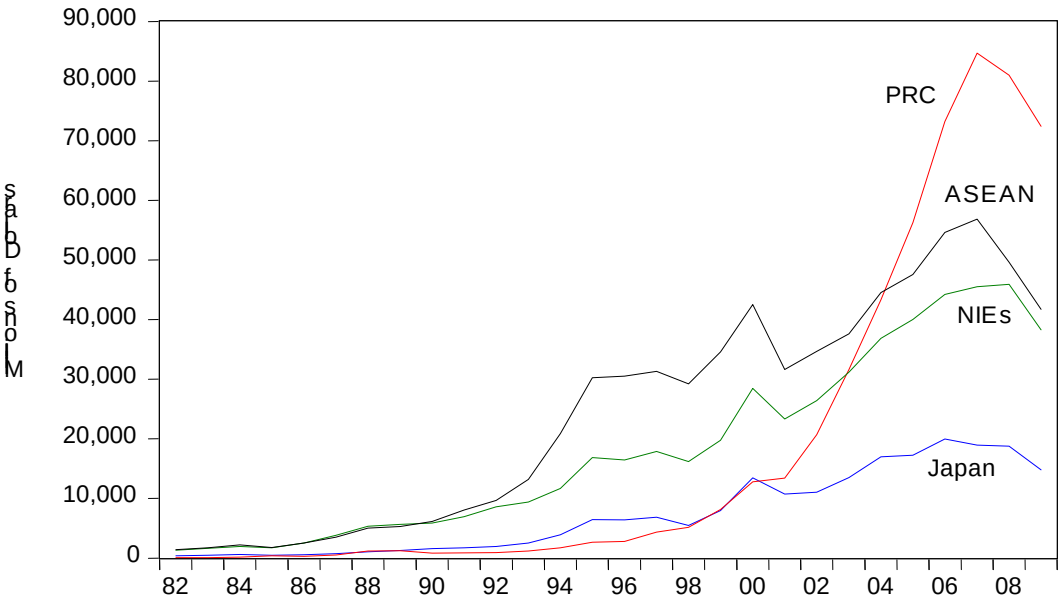
[3] The role of FDI in Southeast Asia is discussed in Hill (1994).

Thorbecke (2008) reported that, once a Japanese firm establishes a cross border production network in another country, it is reluctant to withdraw from that country. As Kimura and Obashi (2010) noted, firms pay high costs in identifying locational advantages and reliable business partners. Hence transactions within these networks tend to be stable. Obashi (2010a, 2010b) found that trade in parts and components between East Asian countries tends to be more resilient than trade in finished goods or trade with extra-regional partners. Thus, while the Asian Crisis reduced the locational advantages of channeling FDI to ASEAN, it did not cause the MNEs to break off existing relationships with Southeast Asian firms.

Panel C of Figure 3 shows that FDI and parts and components then began flowing to the PRC, especially after the PRC joined the WTO in 2001. Many have argued that the PRC's WTO accession gave foreign investors confidence that the PRC would sustain an FDI-friendly environment through fair and coherent enforcement of the relevant laws and regulations (see, e.g., Chen, 2008).

While Japanese firms were the first to shift labor-intensive assembly operations to lower-wage locations in Asia, other Asian firms soon followed. Producers in Taipei,China and South Korea, confronted with higher wages and stronger exchange rates in the late 1980s and 1990s, also shifted production to less costly regions in Asia.

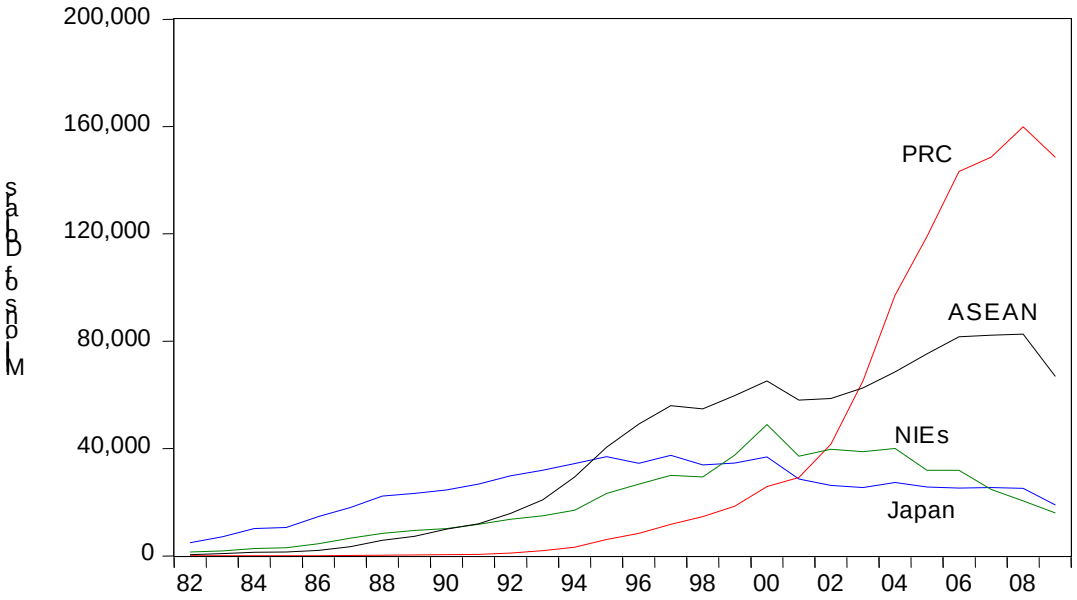
**Figure 4a: Value of Electronic Parts and Components Exports from East Asia to Individual East Asian Countries and Regions[a]**




a ASEAN includes Indonesia, Malaysia, the Philippines, Singapore, and Thailand. The NIEs include South Korea and Taipei,China.

*Source*: CEPII-CHELEM Database.

**Figure 4b: Value of Computer Exports from Individual East Asian Countries and Regions to the World[a]**




a ASEAN includes Indonesia, Malaysia, the Philippines, Singapore, and Thailand. The NIEs include South Korea and Taipei,China.

*Source*: CEPII-CHELEM Database.

Figure 4 presents data not only for Japan but also for other East Asian countries. It shows the flow of electronic parts and components within East Asia and the flow of final assembled computers from East Asia to the world. The category 'electronic parts and components' is the largest category traded within the region and the category "computers and office equipment" is the largest category exported from East Asia to the rest of the world. Electronic parts and components are also key inputs into computers.

Figure 4a shows that during the 1980s electronic parts and components from East Asia flowed in equal quantities to the NIEs and to ASEAN countries. Then in the 1990s, as the NIEs lost their locational advantages in assembly operations, flows to ASEAN far surpassed flows to the NIEs. Starting in 2001 there was a surge in electronic parts and components going to the PRC, and the PRC's imports of these imported inputs soon surpassed ASEAN's imports.

Figure 4b shows exports of final assembled computers from East Asian counties and regions to the world. While Japan was the leading exporter in the 1980s, ASEAN became the leading exporter in the 1990s. This reflects the large increase in electronic parts and components flowing into ASEAN in the 1990s. Then starting in 2001 computer exports from the PRC exploded, again reflecting the surge in parts and components imports into the PRC that began in 2001.

Intricate production and distribution networks developed in the region, involving complicated combinations of intra-firm trade, arms-length transactions, and outsourcing. FDI firms broke up the production processes for a good (e.g., a computer) into fragmented blocks, and allocated these blocks across countries in Asia based on differences in factor endowments and other locational advantages. In the case of

ASEAN's imports from East Asia, for instance, 33% in 2009 were electronics goods. In the case of ASEAN's exports to the PRC, almost 60% were electronics goods.

An example of this intra-regional trade in electronics goods comes from the hard disk drive (HDD) industry. As Hiratsuka (2010) documents, affiliates of Japanese MNCs in the Philippines make parts and components and ship them to Thailand to produce HDDs. These HDDs are then shipped to the PRC to assemble computers, and the final computers are exported throughout the world. Value chains such as these have mushroomed in East Asia. The next section analyzes these production networks in more detail.

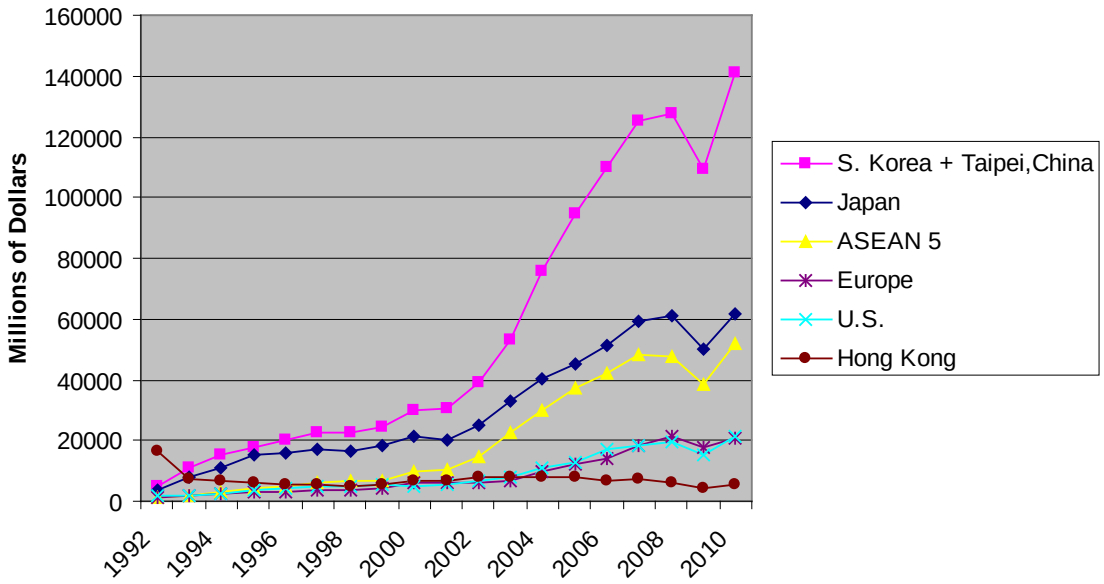
Up until recently the lion's share of goods produced within East Asian production networks have been exported outside of the region. However, as Gaulier et al. (2011) discussed, firms in Japan and the Asian NIEs have increasingly established enterprises within the PRC to cater to local demand. They then export parts and components and capital goods from the home countries to their affiliates in the PRC. These exports that are directed to the local PRC's market are classified as ordinary exports by the PRC's Customs Agency. These exported inputs from the home countries to foreign-invested enterprises in the PRC caused Japan and the NIEs to run ordinary trade surpluses in 2010 of $70 billion with the PRC.

# 4. PRODUCTION NETWORKS IN EAST ASIA

East Asia is characterized by intricate production and distribution relationships. Japan, South Korea, Taipei,China and MNCs located in ASEAN produce sophisticated technology-intensive intermediate goods and ship them to the PRC and ASEAN for assembly by relatively low skilled workers. The finished products are then exported throughout the world.

This pattern is clear in Figures 5a and 5b. These figures show the PRC's imports for processing and processed exports. Imports for processing are parts and components that are imported into the PRC duty-free on the understanding that they will be used to produce goods for re-export. Processed exports are the goods produced in this way. 85% of processed exports are produced by foreign-capital firms (Gaulier et al., 2011). Figure 5a shows that the lion's share of imports for processing comes from East Asian economies and Figure 5b shows that the major destinations for the PRC's processed exports are the US; Hong Kong, China; and Europe. Since most of the exports going to Hong Kong, China are trans-shipped to the rest of the world, the Western economies are the major consumers of the PRC's processed exports.

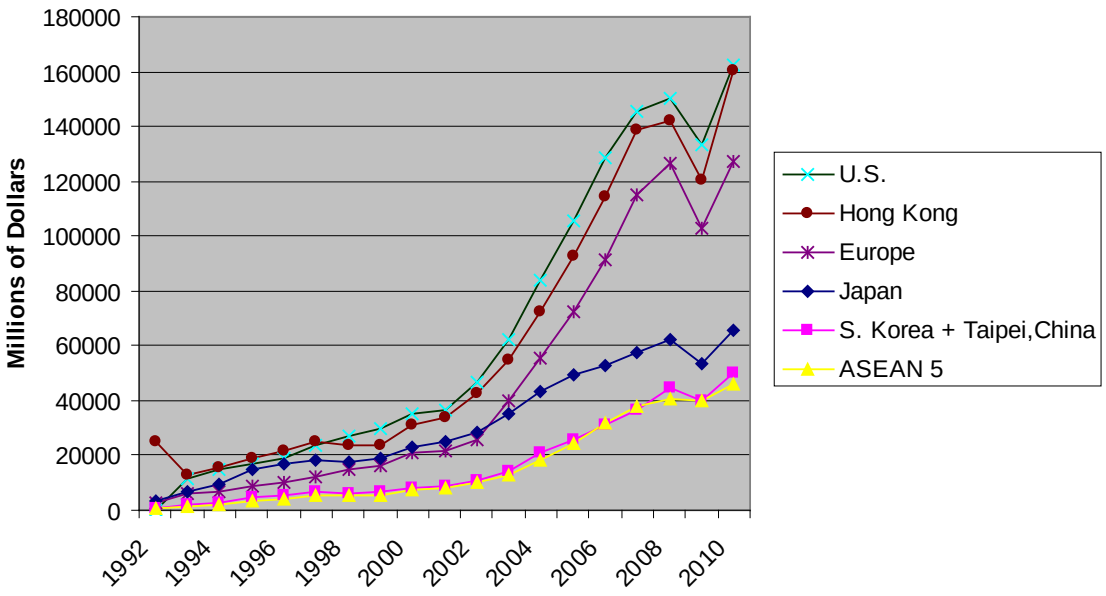
**Figure 5a:** China's Imports for Processing by Country and Region[a]




a Europe includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Luxembourg, Netherlands, Italy, Portugal, Spain, Sweden and United Kingdom. ASEAN includes Indonesia, Malaysia, the Philippines, Singapore, and Thailand.

*Source*: China Customs Statistics.

**Figure 5b:** China's Processed Exports by Country and Region[a]




a Europe includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Luxembourg, Netherlands, Italy, Portugal, Spain, Sweden and United Kingdom. ASEAN includes Indonesia, Malaysia, the Philippines, Singapore, and Thailand.

*Source*: China Customs Statistics.

Modeling this trade within East Asian production networks has proven challenging to economists. Traditional trade theories emphasize trade in final goods driven by differences in technology and factor endowment. Production fragmentation, on the other hand, involves trade in intermediate goods. Firms exploit comparative advantage by slicing up production processes and allocating the production modules to different locations based on differences in factor endowments across the fragmented production blocks.

Kimura and Ando (2005) have proposed a conceptual framework to explain the slicing up of the value chain. In their model firms decide to fragment production when the production cost saving arising from fragmentation exceeds the cost of linking geographically separated production blocks (the service link cost). The service link cost varies across two dimensions. The first is geographical distance and the second is managerial controllability. 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.

Lowering the service link cost facilitates the functioning of the sliced value chain. Some ways to lower service link costs include 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. Below we consider several examples from East Asia where the service link cost has influenced production fragmentation.

The first example comes from the global value chain for notebook PCs centered in the Yangtze River Delta of the PRC. There were two concrete actions that lowered the service link cost. First, in 2001 the government of Taipei,China deregulated outgoing FDI for notebook PC companies seeking to invest in the PRC. Taipei,China Original Design Manufacturers (ODMs) then moved production to the Yangtze River Delta. Second, the PRC's government established a superb network of modern highways, ports, and airports in the Delta. This induced many firms to locate in this area.

The resulting agglomeration produced economies of scale. Service link costs fell because the large number of firms in close proximity made it easier for firms to procure parts and components and to handle frequent specification changes. In addition, the many business partners with different skills and technologies in close proximity reduced costs associated with uncontrollability.

Kraemer and Dedrick (2006) documented how the Taipei,China ODMs established a network that includes branded firms such as HP, Apple, and Toshiba, suppliers of key parts and components, producers of basic industrial materials, and makers of operating systems and CPU. Local PRC's firms supply connectors, batteries, switches, and displays and are also active in molding, casting, forging, plating, and module-assembling. Both digital and human networks enable PC producers to react efficiently in real time to changes in consumer preferences and technology. Firms assembling the notebook PCs have also kept inventories lean by processing 98% of the orders within three days. Productivity growth within this value chain has been amazing.

A second example of the importance of service link costs comes from exchange rate volatility. In general the effect of exchange rate volatility on trade is ambiguous. Within East Asian production networks, however, exchange rate volatility may deter trade. This is because exchange rate volatility increases uncertainty and thus the service link cost associated with cross-border fragmentation.

Empirical evidence indicates that exchange rate volatility reduces the flow of parts and components in the region. Ito et al. (2008) surveyed Japanese MNCs and reported that intra-Asian exchange rate stability is essential for the uninterrupted flow of parts and components within regional production networks. Thorbecke (2008) found that exchange rate volatility caused a large decline in the flow of electronic parts and components within East Asian production networks. Hayakawa and Kimura (2009) reported that exchange rate volatility significantly reduced trade in intermediate goods within East Asian production networks. Carlos Ghosen, CEO of Nissan Motor Corporation, also stated that exchange rate volatility deterred the slicing up of the value chain because it militated against long-term planning (see Crooks, 2010).

A third example of how service link costs influence production fragmentation comes from the Philippines. Intel was the first semiconductor firm to open a factory in the Philippines in 1974. Moran (2011) reported that these foreign investments in the Philippines benefited all of the workers in the area by promoting health and safety standards, security, and better facilities.

However, the investment climate in the Philippines is plagued by corruption and poor infrastructure. The World Economic Forum surveyed 13,000 business executives from 133 countries between January and May 2009 to obtain their opinions on a wide range

of aspects of the business environment in which they operate (Global Competitiveness Report, 2009–10). Out of 133 countries, the Philippines ranked 130th in corruption, 128th in favoritism in government decision making, 123rd in inefficient legal framework for settling disputes and 122nd for diverting public funds. It also ranked above 100 for several infrastructure categories.

Intel Chairman Craig Barrett emphasized the importance of a favorable investment climate when making investment decisions and especially the public institutional environment.[4] Others focused on the high cost of electricity and other infrastructure related problems in the Philippines (see, e.g., Calimag, 2008). Intel moved production to the PRC and other locations in East Asia where the physical and institutional infrastructure was better and the service link cost was lower.

# 5. CONCLUSION

East Asian FDI has its own unique characteristics. MNCs in the region make FDI decisions partly based on the ownership, location and internalization advantages that Dunning (1988) emphasized. However, their behavior also follows Kojima's (1973) model, with FDI flowing from the capital exporting country's disadvantaged industry into the host country's advantaged industry. MNCs in the investing country then export sophisticated parts and components and technology to the assembly country, so that there is a complementary relationship between exports and FDI in the region.

East Asian FDI began in earnest after the yen appreciated 60% following the Plaza Accord in September 1985. Japanese multinational enterprises transferred factories to South Korea and Taipei,China. However, as wages and exchange rates in these countries increased, they transferred production to the ASEAN countries. Japanese MNEs provided ASEAN firms with detailed engineering and managerial instructions and specifications, facilitating the assimilation of the new technologies. They also exported parts and components to be used to produce final goods. When the Asia Crisis of 1997–98 hit, Japanese firms slashed new FDI but continued to export large quantities of intermediate goods to affiliates in ASEAN. Thus, in spite of a once in a generation crisis, Japanese MNEs did not break off existing relationships with Southeast Asian firms

FDI then migrated to the PRC. After the PRC joined the WTO in 2001, foreign investors gained confidence that the PRC would maintain an FDI-friendly environment. The PRC quickly became the final assembly point of intricate production and distribution networks. It imported hundreds of billions of dollars of parts and components from East Asia and exported the final assembled products throughout the world.

To understand this slicing up of the value chain it is helpful to compare the production cost saving arising from fragmentation with the service cost of linking geographically separated production blocks (Kimura and Ando, 2005). We show that changes in the service link cost help explain the development of the notebook PC industry in the Yangtze River Delta and the deleterious effects that exchange rate volatility and poor physical and institutional infrastructure have on production fragmentation in the region.

Up until now, production networks in Asia have been producing final goods primarily for Western consumers. As Asia develops, demand will migrate eastward. However, consumers in Asia may have different demand patterns than consumers in the US and

[4] Calimag (2008).

Europe. In particular, they may demand more basic goods and fewer luxury items. Assembling basic goods such as refrigerators may require less production fragmentation than assembling luxury goods such as expensive automobiles. Future research should consider how regional production networks will evolve as final output is increasingly redirected towards Asia.

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