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Impact of the ASEAN economic community on ASEAN production networks

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Impact of the ASEAN Economic Community on ASEAN Production Networks

Kornkarun Cheewatrakoolpong, Chayodom Sabhasri, and Nath Bunditwattanawong

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Kornkarun Cheewatrakoolpong, Chayodom Sabhasri, and Nath Bunditwattanawong are lecturer, assistant professor, and Ph.D. candidate, respectively, at the Faculty of Economics, Chulalongkorn University in Bangkok.

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Please contact the author for information about this paper.

Email: Chayodom.S@chula.ac.th; kornkarun.k@chula.ac.th

Asian Development Bank Institute
Kasumigaseki Building 8F
3-2-5 Kasumigaseki, Chiyoda-ku
Tokyo 100-6008, Japan

Tel: +81-3-3593-5500
Fax: +81-3-3593-5571
URL: www.adbi.org
E-mail: info@adbi.org

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Abstract

Empirical evidence suggests that the emergence of international production networks in East Asia results from market-driven forces such as vertical specialization and higher production costs in the home countries and institutional-led reasons such as free trade agreements. The growth in trade in parts and components since the 1990s, especially with the People's Republic of China (PRC), one of the important major assembly bases, confirms the existence of international production sharing in the region. Also, a decline in the share of parts and components trade in several members of the Association of Southeast Asian Nations (ASEAN) such as Indonesia and Thailand indicates the increasing importance of the ASEAN countries as assembly bases for Japanese multinational enterprises (MNEs). This paper examines two industries—autos and auto parts, and hard disk drives (HDDs)—to understand international production networks. The study examines the structure of vertical intra-industry trade among East Asian countries, especially members of the Association of Southeast Asian Nations, depicts international production sharing in the selected industries, namely HDD, and automobiles and automotive parts, in the region. The study also points out the importance of the People's Republic of China and Thailand as assembly bases. It concludes that investment promotion policies contributed more to the emergence of international production networks than free trade agreements.

JEL Classification: F14

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1. INTRODUCTION

International production networks play a key role in East Asian economies. Most industrial production in East Asia, especially in autos and auto parts, computers and computer parts, and electronics and electrical appliances, is in the form of international production networks (IPN), where production is fragmented into several stages and then conducted in various countries, according to their comparative advantages.

Trade statistics suggest that the trade exposure of East Asian economies has increased in intra-regional trade since the formation of several regional trade agreements such as the Association of Southeast Asian Nations (ASEAN) Free Trade Agreement and the People's Republic of China's (PRC) accession to the World Trade Organization (WTO) in 2000. Many experts believe that this reflects diversification in exports by East Asian possessing relatively high levels of independence from the Group of Three (G3) countries (European Union, United States, Japan) and higher destination diversification.

However, ADB (2007) finds that the increase in intra-Asian trade comes from the vertical integration of production networks among countries. An analysis of trade structure shows that more than 70% of intra-Asian trade is in intermediate goods while G3 countries are important markets for final goods. The Monetary Authority of Singapore (2003) estimated that only 22% of total Asian exports are consumed in the region.

This paper aims to analyze the production networks in East Asia by a review of trade and investment statistics of the region. Also, we calculate the intra-industry trade and vertical intra-industry trade index to understand the pattern of production networks of selected industries in East Asia.

The paper proceeds as follows. Section 2 reviews production networks in East Asia via literature and trade and investment statistics. Section 3 examines the pattern of production networks of select industries in East Asia, namely the HDD, and the auto and auto parts industries. The last section concludes the paper.

2. PRODUCTION NETWORKS IN EAST ASIA

International production networks, regional production networks, global production sharing, and production fragmentation are processes that break up the chain of production into several stages so that production can be done in different locations or countries. According to Abonyi (2006), the development of international production networks arises from specialization in a particular production process of a country. Once the production processes are located across countries, foreign direct investment (FDI) evolves. Multinational enterprises (MNEs) play crucial roles in FDI and high technology industries, or industries with long value chains, such as autos and auto parts, computers and computer parts, electronics and electrical appliances, machineries, and textiles and garments.

There are many ways to explain international production networks. The broader explanation would be a combination of market-led and institutional-led factors. The market-led international production networks result when industry fragments its value chains and places them into different locations and coordinates them into the production of final goods or services. Athukorala (2010) offers three factors to explain the development of production networks: advanced technology allows industries to break down the long production chain into a shorter one; communication technology and the development in transportation systems reduces costs while improving the speed and efficiency in coordinating the fragmented production processes;

and deregulation in trade and investment policies that reduce the cost of cross-border business activities. From the industrial management perspective, MNEs also seek cheaper natural resources, new production bases for producing parts and assembling the final products at lower cost, and new sources of assets and capacities for production. However, it is common for MNEs not to disseminate their unique technologies and management techniques to domestic firms in the host countries. Kimura and Ando (2005) discuss how the fragmentation of the production process will be commercially successful if the cost savings from the fragmented process is higher than the cost of integrating the fragmented parts. The cost savings come from production specialization and market efficiency, while the integrated process involves costs due to the management of distance and logistics costs.

The institutional-led production networks imply that trade and investment policies encourage in-bound FDI for the purpose of import-substitution, export-promotion, and the elimination of domestic gaps in the value chain of production. The PRC has also promoted out-bound FDI by creating overseas clusters of production aimed at using the PRC's technology and vast accumulated international reserves.

International production networks in East Asia are the result of the 1985 Plaza Accord, which triggered the appreciation of Japanese yen and a rise in Japanese production and labor costs. Consequently, Japanese MNEs sought to establish production bases in countries such as Malaysia, Singapore, and Thailand. The 1997 Asian financial crisis also spurred United States (US) and European MNEs to establish production bases in East Asia as asset prices in the region had dropped sharply.

Athukorala (2010) points out several factors as to why East Asia can perform as the center of a fragmented production network for regional and global investors. The following factors explain intra-industry trade and investment in East Asia.

1. Wage diversification across East Asia ranges from high wages in developed countries such as Japan and the Republic of Korea (henceforth, Korea), medium wages in Malaysia and Thailand, and relatively low wages in Indonesia and Viet Nam. Labor productivity varies from country to country. This diversification allows for a wider choice in the relocation of a production base to a more competitive location. Resource seeking strategies can then be applied.

2. Transaction costs have been reduced because of soft policies such as trade and investment regimes and trade facilitation measures, and hard policies such as the development of airports, seaports, domestic transportation systems, electricity and water supplies, and communication systems. All of the mentioned policies lead to a lower logistics cost structure. So, efficiency seeking is one factor in determining where MNEs invest in foreign markets.

3. "The second mover advantage," rather than the first mover advantage, is a key determination of production fragmentation and relocation. The first wave of investment moved to Southeast Asia, including Indonesia, Malaysia, and Thailand because of international specialization, and these initial investment flows set the foundation for later investors who had the benefit of supporting industries from the earlier investment and learned from the first wave's experiences. Additionally, the investors in the second wave and particularly the third wave, which invested in Viet Nam, enjoy the economic growth of Southeast Asia and benefit from its positive income effect.

Numerous empirical studies and evidence confirm international production networks in East Asia. Ng and Yeats (2003) find a significant increase in the East Asian export of machinery and transportation goods from 1985 to 2001, particularly by the PRC, Malaysia, Singapore, and

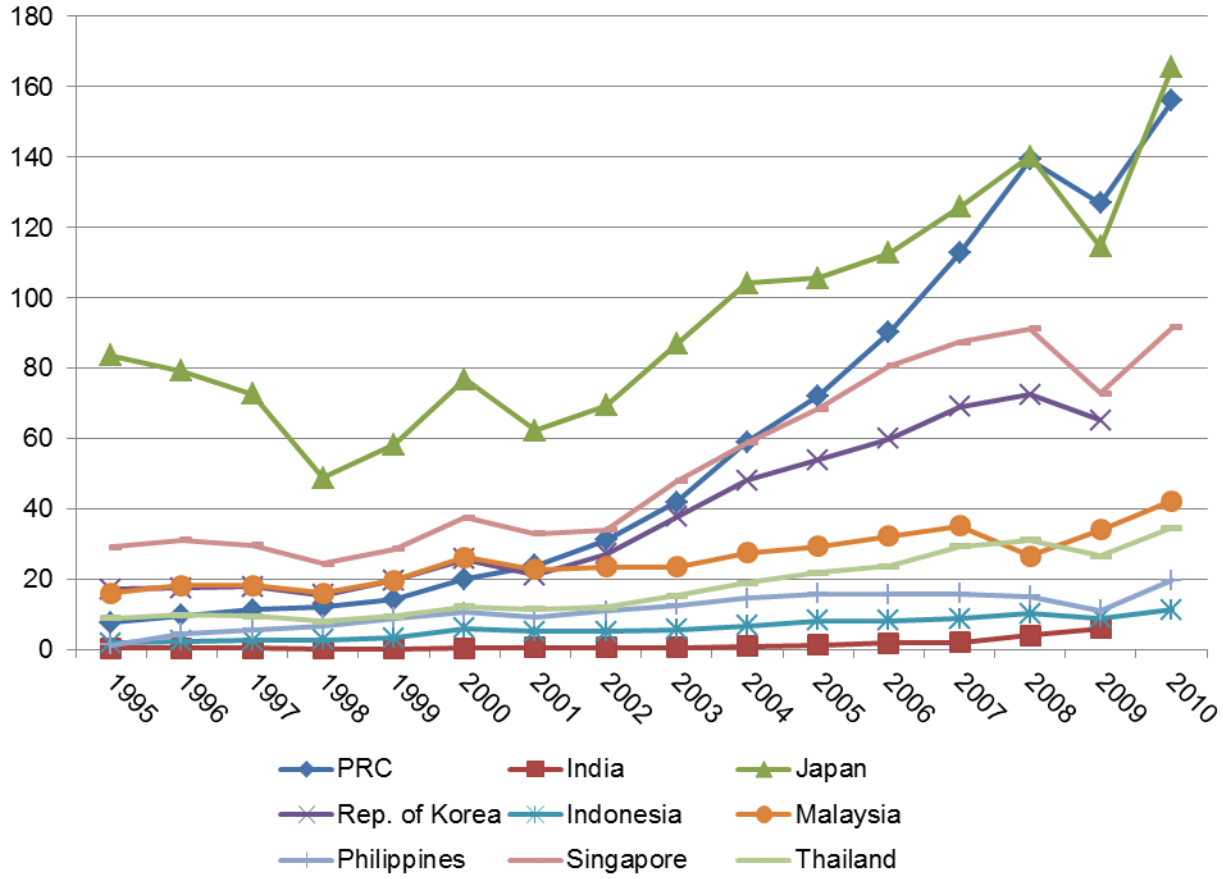
Thailand. Ando (2006) constructs a one-way trade index, a vertical intra-industry trade index, and a threshold-based index for the East Asian trade structure and finds the importance of a vertical intra-industry trade pattern in East Asia in the 1990s that confirms international production sharing in the region. The study also finds a massive increase in vertical intra-industry trade in the machinery and parts industry that confirms international production networks in the sector. ADB (2007) indicates that more than 70% of intraregional trade in East Asia is in parts and components that will be further assembled and exported outside the region.

Aminian et al. (2007) observe FDI flows from US MNEs in East Asia and finds that only 39.6% of their final products were consumed regionally. Similarly, 51.8% of Japanese MNE products produced in East Asia were sold elsewhere. The study shows the importance of East Asian countries as co-production bases for MNEs. ADB (2007) also points out the PRC's crucial role as an assembly base in East Asia. The PRC imports parts and components from several East Asian countries and exports final products to markets outside the region.

When considering trade statistics in the machinery and parts industry, which is a key sector with international production networks in East Asia, Figure 1 shows that the major exporters of machinery and parts in East Asia are the PRC, Japan, Korea, and Singapore. All countries show an increasing trend, particularly the PRC. Figure 1 illustrates the importance of machinery and parts in East Asian trade.

Figure 1: Export of Machinery and Parts from Select Countries to East Asia[1]

(US$ billion)



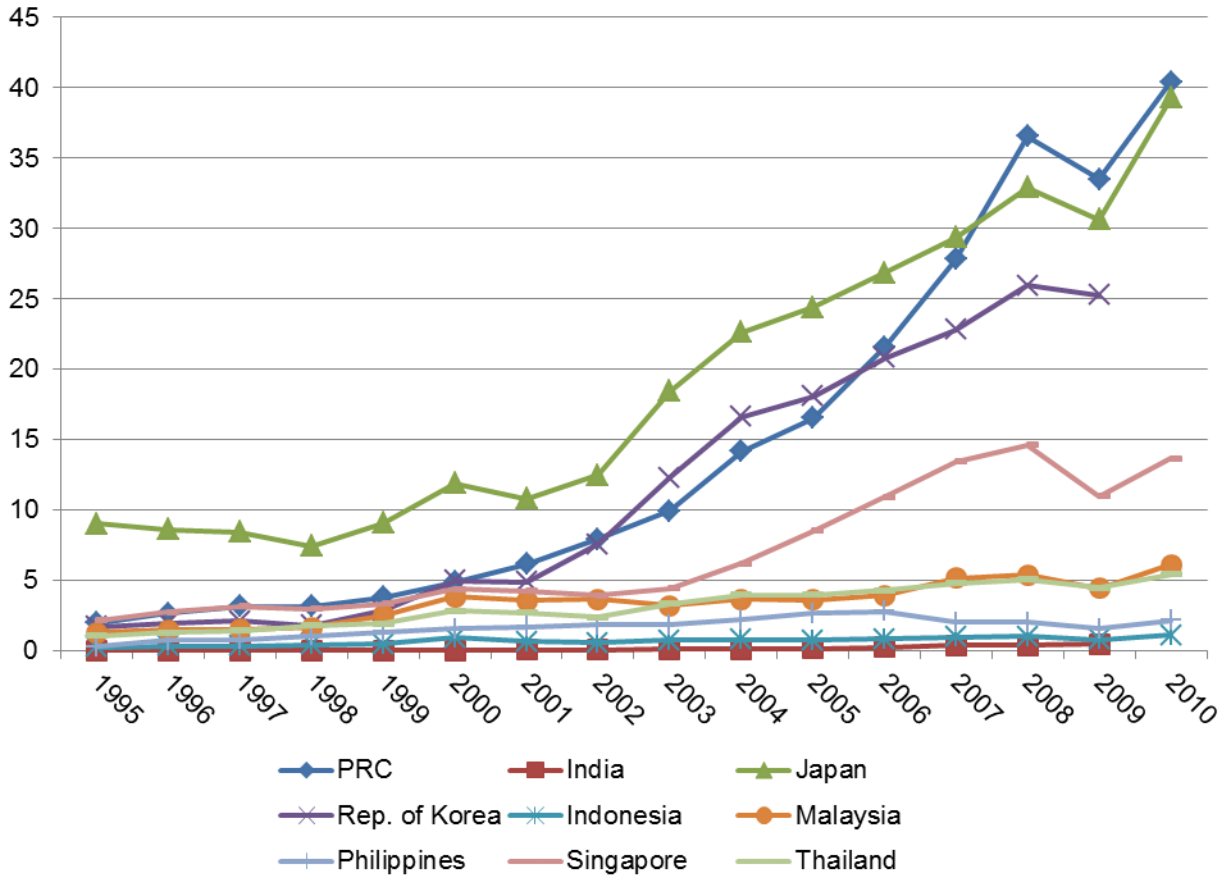
Source: Calculated from UN Comtrade Statistics

[1] The group of East Asian countries in this study includes ASEAN-5 (Indonesia, Malaysia, the Philippines, Singapore, and Thailand), the PRC, India, Japan, and Korea. India is included because it is an important production base for MNEs.

Figure 2 shows growing trade in parts and components in the machinery and parts industry in East Asia. The PRC, Japan, and Korea are the major exporters of parts and components. Japan and Korea are home countries for international production networks of machinery and parts and the PRC is the major manufacturing base as an assembler and producer of parts and components. Furthermore, Malaysia, Singapore, and Thailand are playing an increasingly important role as exporters of parts and components in the machinery and parts industry.

Figure 2: Exports of Parts and Components in Machinery and Parts Industry from Select Countries to East Asia[2]

(US$ billion)



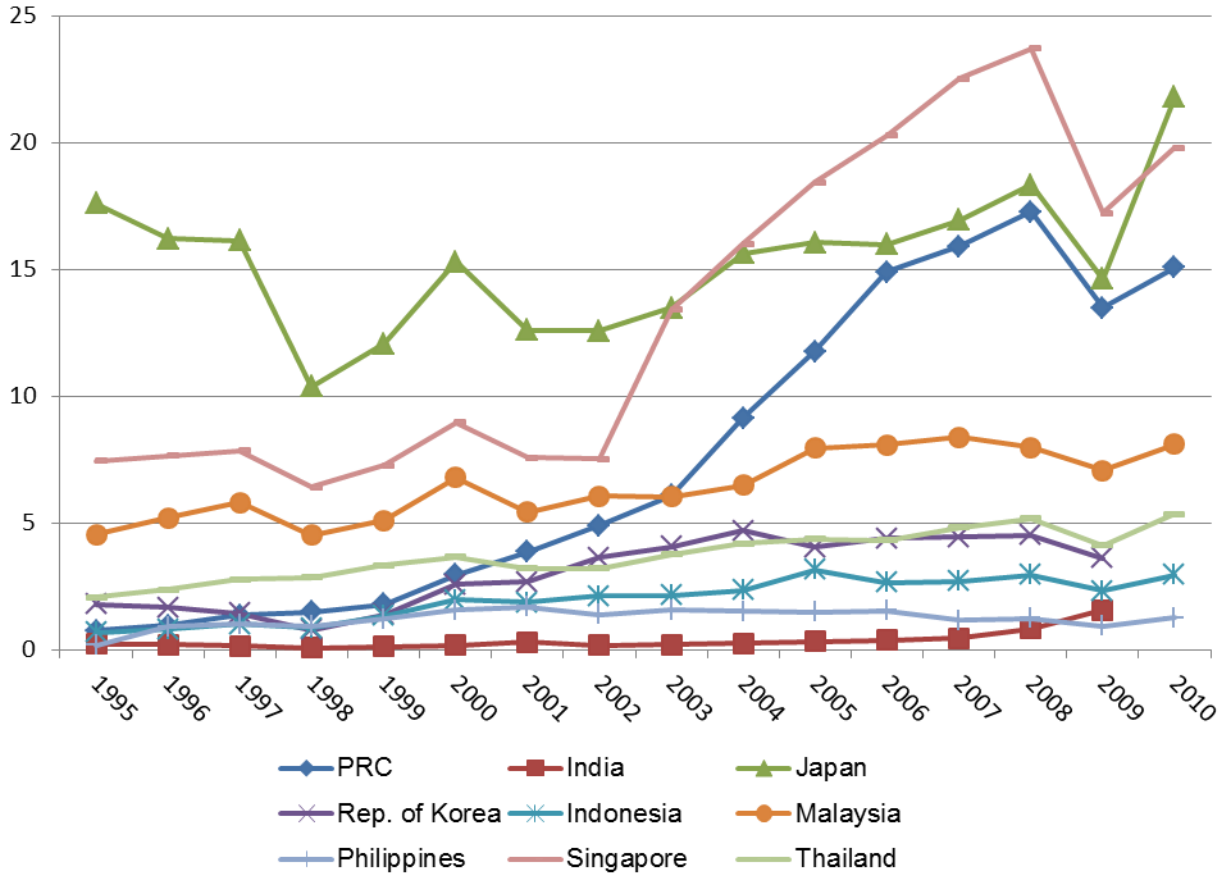
Source: Calculated from UN Comtrade Statistics

Figure 3 shows the export of parts and components in the machinery and parts industry to ASEAN. Similar to East Asia, the PRC and Japan play a vital role. However, Singapore is an important provider of parts and components to the ASEAN production base in machinery and parts. Korea, Malaysia, and Thailand show an increasing trend in parts and components trade with ASEAN countries.

[2] ASEAN includes ASEAN-5 countries, which are Indonesia, Malaysia, the Philippines, Singapore, and Thailand.

Figure 3: Exports of Parts and Components in Machinery and Parts Industry from Select Countries to ASEAN

(US$ billion)

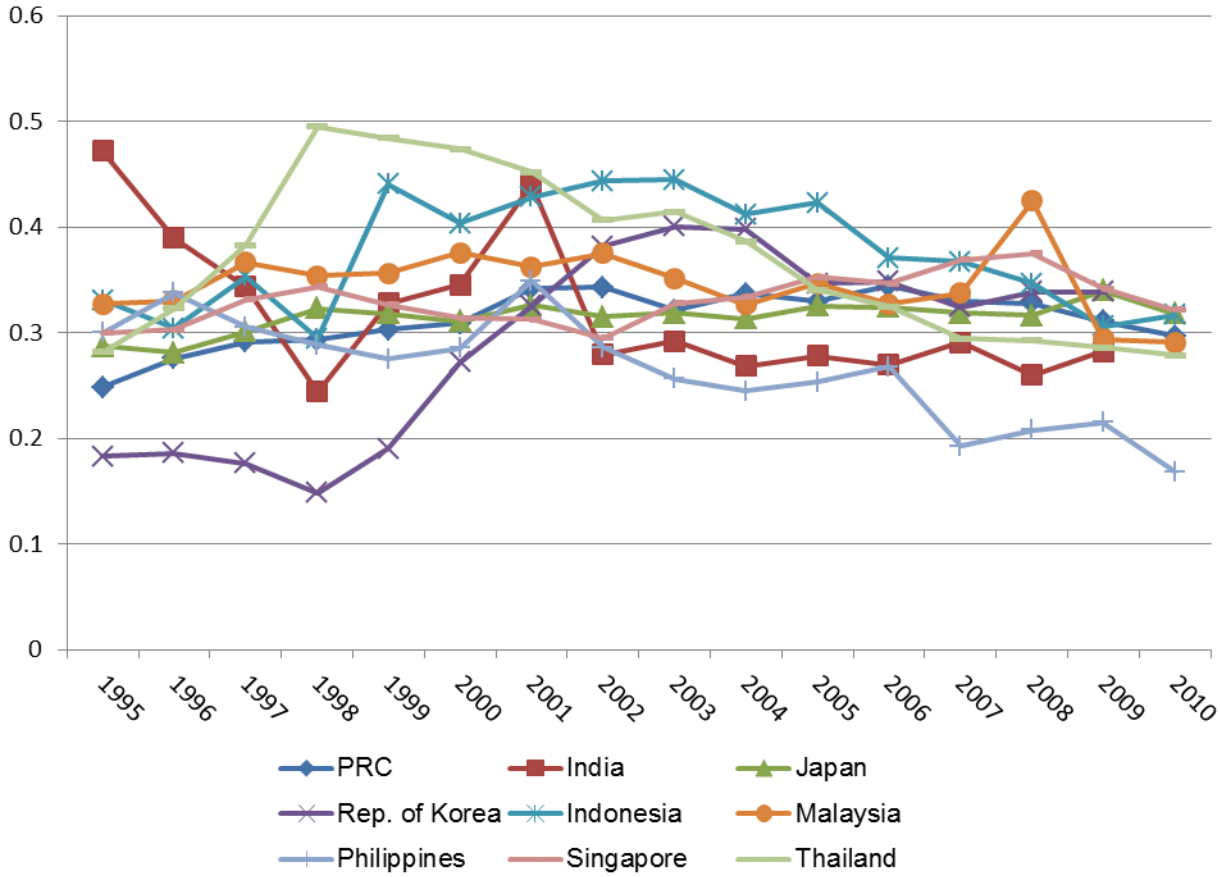


Source: Calculated from UN Comtrade Statistics

Figure 4 illustrates the share of parts and components trade in the machinery and parts sector from select countries to East Asia. The 20%–50% share indicates a high fraction of parts and components trade in the machinery industry in East Asia. The share increased from 1995 to2002 and then declined. This indicates the characteristics of international production networks with more assembly bases in several countries compared to the limited number of assembly bases in the 1990s. Japan is the only country experiencing a constant rise in the share of the parts and components trade because it continuously relocates production bases to East Asian countries to take advantage of lower production costs, which allows Japan to focus on the manufacture of high-tech parts.

Figure 4: Shares of Parts and Components Exports in Total Machinery and Parts Exports from Select Countries to East Asia[3]

(US$ billion)



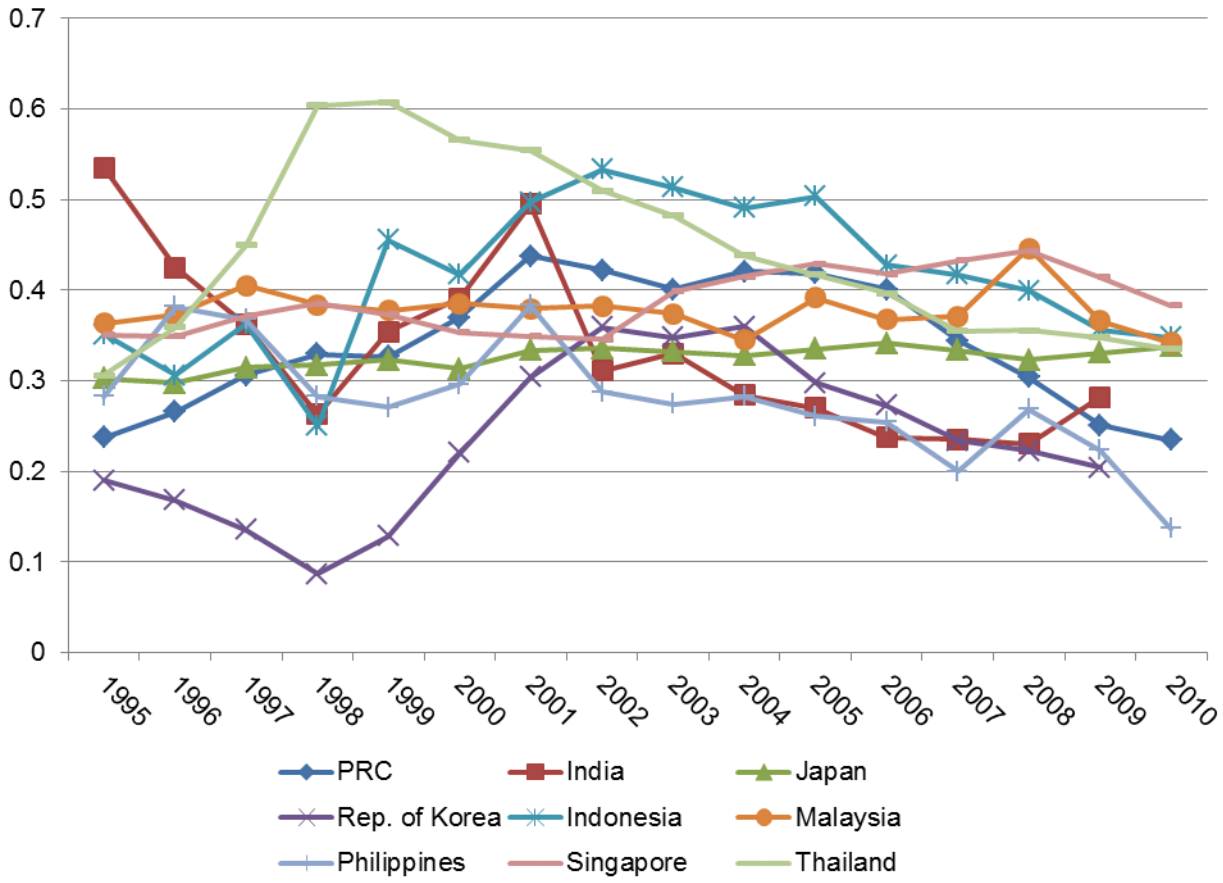
Source: Calculated from UN Comtrade statistics.

Figure 5 illustrates the share of parts and components trade in machinery and parts in ASEAN countries. Similar to trade among East Asian countries, an increasing trend in trade in parts and component can be seen among ASEAN countries as well. Japan, Malaysia, and Singapore show constant growth in the share of trade in parts and components. Thailand's share of the trade in parts and components has been declining since the 1997 Asian financial crisis, indicating its increasing importance as an assembly base.

[3]The total machinery and parts industry includes SITC 7, 82, 88, and 89.

Figure 5: Share of Parts and Components Exports of Total Machinery and Parts Exports from Select Countries to ASEAN

(US$ billion)

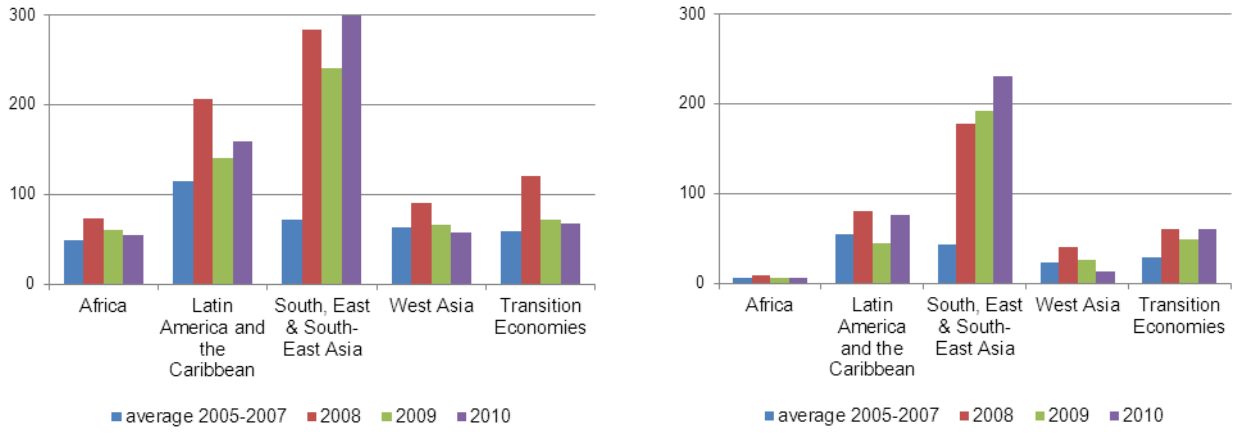


Source: Calculated from UN Comtrade Statistics

Next, we consider the characteristics of FDI in East Asia as it plays a vital role in the formation of international production networks. FDI inflows and outflows to developing countries show that the East Asian region is the most active among the developing and transitioning economies. According to the World Investment Report 2011, the outflows of FDI in East Asia come from the PRC and Hong Kong, China. In particular, PRC companies are actively buying overseas assets in numerous countries and industries. PRC FDI has overtaken Japan's FDI. However, these FDIs may be misleading as an example of international production networks as they may be simple FDIs without being part of any fragmentation. Among the non-equity mode FDI outflows of the top 20 countries in the world in 2010, five are Asian countries—the PRC (US$68 billion), Japan (US$56 billion), Singapore (US$20 billion), Korea (US$19 billion), and India (US$16 billion).

Figure 6: FDI Inflows and Outflows to Developing and Transition Economies to Developing and Transition Economies by Region, Average of 2005–2007 and 2008–2010

(US$ billion)



FDI Inflows FDI Outflows

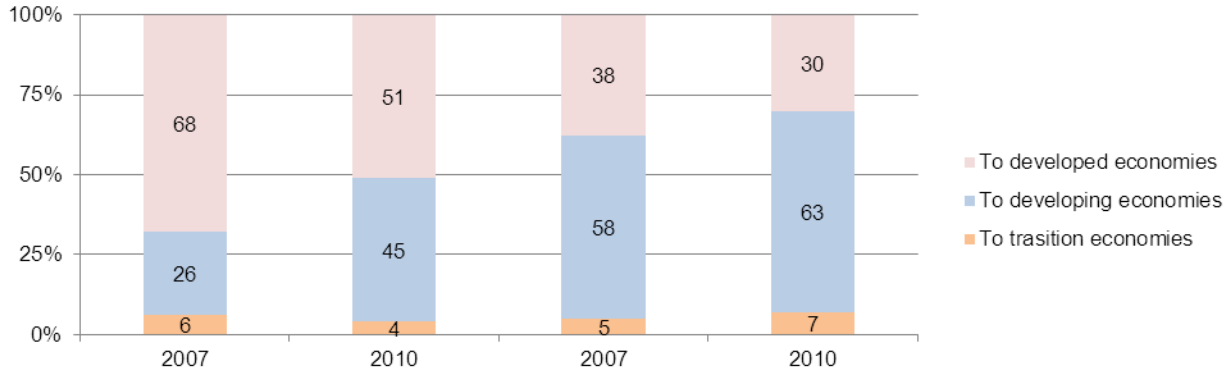
Source: UNCTAD, FDI/TNC database (www.unctad.org/fdistatistics).

Additionally, if we consider the role of MNEs in developing and transition economies, they are important investors in emerging markets.

Figure 7: Distribution of FDI Projects[a] by Host Region, 2007 and 2010

(%)

(a) by developed country TNCs (b) by developing and transitioning country TNCs



Source: UNCTAD, based on UNCTAD cross-border M&A database and information from the *Financial Times*, fDi Markets (www.fDimarkets.com).

[a]Including cross-border M&As and greenfield FDI projects.

The establishment of international production network by Japanese firms followed the Plaza Accord as mentioned above. Thorbecke and Salike (2011) point to statistical evidence that shows the FDI to Korea and Taipei,China as well as the export of intermediate goods from the two countries surged in the mid-1980s. A similar pattern of FDI and export of intermediate goods were repeated in Southeast Asian countries in the early 1990s and by the PRC after its accession to the World Trade Organization. Japan then produced the technological-intensive parts, or high value-added parts, and exported them to lower-wage countries for assembly. The lower cost Asian countries produced labor-intensive parts and assembled products for re-export. The relocation of Japanese investment started in Korea and Taipei,China. When the wage rates in the two economies became less competitive, the FDI then flowed to Southeast Asian countries. Due to the dynamism of the FDI, the current home countries for FDI have become the PRC and Viet Nam. One of the examples is the transferring the production base of autos and auto parts to Southeast Asia, in particular Thailand because of its low labor costs, natural resources, and large domestic market for vehicles, such as pickup trucks. However, the key parts are produced in Japan or supplied by Japanese subsidiary firms.

ASEAN, the European Union (EU), Japan, and the US are the top four sources of FDI inflow to ASEAN members. The second group consists of Australia, Canada, Cayman Islands, PRC, India, and Korea. Those 10 sources make up about80% of the total FDI inflows to ASEAN. In 2010, Singapore received nearly half (46.9%) of FDI inflow to ASEAN, while Indonesia, Malaysia, Viet Nam, and Thailand received 17.6%, 12.1%, 10.6%, and 8.3%, respectively.

Table 1: Top Ten Sources of Foreign Direct Investment Inflow to ASEAN

(Value in US$ million; share and change in %)

Country/region[1/]	Value				Share to total inflow			
	2008	2009	2010[p/]	2008–2010	2008	2009	2010[p/]	2008–2010
EU	7,010.1	9,112.9	16,984.1	33,107.2	14.9	24.1	22.4	20.6
ASEAN	9,449.3	5,222.5	12,107.5	26,779.3	20.1	13.8	16.0	16.7
US	3,517.5	4,086.7	8,578.1	16,182.4	7.5	10.8	11.3	10.1
Japan	4,129.4	3,762.6	8,386.1	16,278.1	8.8	9.9	11.1	10.1
Rep. of Korea	1,595.7	1,471.5	3,769.4	6,836.7	3.4	3.9	5.0	4.3
Cayman Islands	4,673.0	-693.2	3,089.4	7,069.2	9.9	-1.8	4.1	4.4
PRC	1,874.0	3,925.6	2,701.0	8,500.6	4.0	10.4	3.6	5.3
India	547.3	826.5	2,584.3	3,958.0	1.2	2.2	3.4	2.5
Australia	787.3	775.9	1,765.1	3,328.4	1.7	2.0	2.3	2.1
Canada	661.1	503.9	1,641.0	2,806.0	1.4	1.3	2.2	1.7
Total top ten sources	34,244.7	28,995.0	61,606.1	124,845.8	72.7	76.5	81.3	77.7
Others[2/]	12,830.9	8,886.3	14,151.6	35,868.8	27.3	23.5	18.7	22.3
Total FDI inflow to ASEAN	47,075.6	37,881.3	75,757.7	160,714.7	100.0	100.0	100.0	100.0

Symbols used: p/ = preliminary figures

Data in *italics* are the latest updated/revised figures from previous posting

Notes: Details may not add up to totals due to rounding off errors

1/ Ranked according to FDI inflows in 2010; covers countries on which data is available.

2/ Includes inflow from all other countries, as well as total reinvested earnings and inter-company loans in the Philippines.

Source: ASEAN Foreign Direct Investment Statistics Database (compiled/computed from data submission, publications and/or websites of ASEAN member states' central banks, national statistics offices, and relevant government agencies through the ASEAN Working Group on Foreign Direct Investment Statistics)

Table 2: Foreign Direct Investments Net Inflow, Intra- and Extra-ASEAN

(Value in US$ million; share and change in %)

Country	2008			2009			2010p/		
	Intra-ASEAN	Extra-ASEAN	Total net inflow	Intra-ASEAN	Extra-ASEAN	Total net inflow	Intra-ASEAN	Extra-ASEAN	Total net inflow
Brunei Dar.	0.9	238.3	239.2	3.2	366.5	369.7	89.6	539.9	629.5
Cambodia	240.9	574.3	815.2	174.0	365.1	539.1	349.0	433.6	782.6
Indonesia	3398.0	5920.1	9318.1	1380.1	3496.7	4876.8	5904.2	7400.1	13304.3
Lao PDR	47.7	180.1	227.8	57.3	261.3	318.6	135.4	197.2	332.6
Malaysia	1645.5	5602.9	7248.4	-269.7	1650.7	1381.0	525.6	8630.2	9155.9
Myanmar	103.5	872.1	975.6	19.5	559.1	578.6	(…)	(…)	(…)
Philippines	139.9	1404.1	1544.0	-4.9	1967.9	1963.0	-7.8	1720.8	1713.0
Singapore	659.5	7929.4	8588.9	2108.3	13170.7	15279.0	3377.0	32143.2	35520.2
Thailand	508.4	8031.0	8539.5	1326.0	3649.6	4975.6	433.6	5886.1	6319.7
Viet Nam	2705.0	6874.0	9579.0	428.7	7171.3	7600.0	1300.9	6699.1	8000.0
Total	9449.3	37626.3	47075.6	5222.5	32658.9	37881.3	12107.5	63650.2	75757.7
ASEAN 5[1/]	6351.3	28887.6	35238.9	4539.7	23935.6	28475.3	10232.7	55780.4	66013.1
BLCMV[1/]	3098.0	8738.7	11836.7	682.8	8723.2	9406.0	1874.8	7869.8	9744.6

Brunei Dar. = Brunei Darussalam

Table 2: Foreign Direct Investments Net Inflow, Intra- and Extra-ASEAN (Continued)

(Value in US$ million; share and change in %)

Country	Share to total net inflow to ASEAN, 2010			Share of Intra-ASEAN, 2010		
	Intra-ASEAN	Extra-ASEAN	Total net inflow	Intra-ASEAN	Extra-ASEAN	Total net inflow
Brunei Dar.	0.7	0.8	0.8	14.2	85.8	100.0
Cambodia	2.9	0.7	1.0	44.6	55.4	100.0
Indonesia	48.8	11.6	17.6	44.4	55.6	100.0
Lao PDR	1.1	0.3	0.4	40.7	59.3	100.0
Malaysia	4.3	13.6	12.1	5.7	94.3	100.0
Myanmar	(…)	(…)	(…)	(…)	(…)	(…)
Philippines	-0.1	2.7	2.3	-0.5	100.5	100.0
Singapore	27.9	50.5	46.9	9.5	90.5	100.0
Thailand	3.6	9.2	8.3	6.9	93.1	100.0
Viet Nam	10.7	10.5	10.6	16.3	83.7	100.0
Total	100.0	100.0	100.0	16.0	84.0	100.0
ASEAN 5[1/]	84.5	87.6	87.1	15.5	84.5	100.0
BLCMV[1/]	15.5	12.4	12.9	19.2	80.8	100.0

Symbols used: p/ = preliminary figures; (…) not applicable/not available/not compiled

Notes: Details may not add up to totals due to rounding off errors

1/ ASEAN 5 consists of Indonesia, Malaysia, the Philippines, Singapore, and Thailand, while BCLMV comprises Brunei Darussalam, Cambodia, Lao PDR, Myanmar, and Viet Nam.

Source: ASEAN Foreign Direct Investment Statistics Database (compiled/computed from data submission, publications and/or websites of ASEAN Member States' central banks, national statistics offices, and relevant government agencies through the ASEAN Working Group on Foreign Direct Investment Statistics)

Several important points can be drawn from intra- and extra-ASEAN FDI flows in 2010. Except for Singapore, the countries of Indonesia, Malaysia, Viet Nam, and Thailand drew about the same value of FDI inflows from extra-ASEAN. However, Indonesia dominated all ASEAN members in drawing FDI from other ASEAN members. Indonesia is an interesting case as the proportion of intra-ASEAN and extra-ASEAN FDI inflows are very similar. Unlike Indonesia, other ASEAN countries rely heavily on extra-ASEAN FDI. Though this statistical fact does not offer a clear conclusion on production networks and foreign investment in ASEAN, it does indicate that most ASEAN members rely on investment from extra-ASEAN countries. To illustrate the production networks in ASEAN and East Asia, two industries, autos and auto parts, and HDD shave been selected for the analyses.

Considering trade and investment regimes, institutional-led FDI consists of trade and investment policies. Changes in those policies include unilateral tariff reductions, international trade agreements including bilateralism and plurilateralism, import-substitution, export-promotion, and investment promotion. The World Bank database on the weighted mean applied tariff rate shows that developed countries such as Australia, New Zealand, and Singapore are less protected by the tariff. Only Cambodia, India, Lao PDR, the Philippines, and Viet Nam have a high weighted mean applied tariff rate. Surprisingly, Korea's rate is very high and is as high as less-developed ASEAN countries. The tariff reduction may arise from several reasons: unilaterally cutting of the tariff rate, duty-drawback, duty free treatment, or regional trade agreements.

Table 3: Weighted Mean Applied Tariff Rate

(%)

Country Name	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
World	(…)	(…)	6	5	6	5	5	5	3	3	3	3	3	(…)
Australia	13	9	17	21	1	1	1	1	1	0	0	1	0	0
Brunei Dar.	(…)	(…)	(…)	(…)	5	5	14	25	8	8	13	0	(…)	0
Cambodia	(…)	(…)	(…)	(…)	16	15	16	(…)	11	(…)	11	12	(…)	(…)
PRC	20	20	17	19	19	(…)	6	6	3	4	3	2	2	(…)
India	16	(…)	23	(…)	23	(…)	(…)	19	14	(…)	(…)	8	7	(…)
Indonesia	(…)	(…)	3	3	2	4	3	4	3	3	3	(…)	2	(…)
Japan	5	5	6	5	8	8	8	5	4	4	4	3	1	2
Rep. of Korea	(…)	(…)	6	(…)	(…)	19	(…)	18	(…)	11	11	(…)	11	13
Lao PDR	(…)	(…)	(…)	15	17	(…)	(…)	15	14	12	8	14	(…)	(…)
Malaysia	7	(…)	(…)	(…)	2	2	2	(…)	2	2	2	2	2	(…)
Myanmar	(…)	(…)	(…)	(…)	5	5	5	5	5	4	5	3	(…)	(…)
New Zealand	3	1	1	1	(…)	8	8	12	7	T	0	0	0	0
Philippines	(…)	13	10	6	6	6	5	5	5	5	5	10	5	5
Singapore	(…)	(…)	(…)	(…)	0	0	0	0	0	0	0	0	0	0
Thailand	(…)	(…)	(…)	8	4	(…)	5	(…)	2	2	2	2	3	(…)
Viet Nam	(…)	(…)	36	(…)	21	19	17	15	15	10	10	4	(…)	(…)

Source: http://data.worldbank.orgWeighted mean applied tariff is the average of effectively applied rates weighted by the product import shares corresponding to each partner country. Data are classified using the Harmonized System of trade at the six- or eight-digit level. Tariff line data were matched to Standard International Trade Classification revision 3 codes to define commodity groups and import weights.

According to the World Investment Report 2011, as shown in table 4, the national regulatory changes in the investment liberalization and promotion measures tended to decline from the peak of 234 measures in 2002 to 71 measures in 2009 with an exceptional year of 2010. On the other hand, the national regulatory changes in the investment regulations and restrictions increased from 12 measures in 2002 to 48 measures in 2010. The long term trend in the investment policy has become increasingly restrictive. The Report also shows that the percentage of investment liberalization and promotion in developing countries and transition economies in South, East, South Asia and West Asia was higher than in developed countries. Those developing countries and transition economies consist of, for instance, Bhutan, India, Indonesia, The Philippines and Myanmar.

Table 4: National Regulatory Changes, 2000–2010

(Number of measures)

Item	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Number of countries that introduced changes	70	71	72	82	103	92	91	58	54	50	74
Number of regulatory changes	150	207	246	242	270	203	177	98	106	102	149
Liberalization/promotion	147	193	234	218	234	162	142	74	83	71	101
Regulations/restrictions	3	14	12	24	36	41	35	24	23	31	48

Source: UNCTAD, Investment Policy Monitor database.

Moreover, most developing Asian countries are active in revising their investment policies. In 2010, some46 out of 56 revised measures were more favorable to FDI. East Asian, South Asian, and Southeast Asian countries are most active in favorable FDI measures related to ownership and control or approval and admission conditions for inward and outward FDI and other measures affecting the entry or establishment of MNEs. Such favorable FDI will support the international production network in areas that include ASEAN. Examples of investment liberalization include Indonesia's liberalized construction services, and a new consolidated Indian FDI policy announced in April 2011 to facilitate the expansion of established foreign owned enterprises and to permit FDI in certain agricultural activities. Examples of investment promotion measures among Asian countries are an improved package of incentives to attract foreign investors to the special economic zones in Korea, a new Special Economic Zone Law in Myanmar, and the start of the Public-Private Partnership Center in The Philippines.

Investment liberalization and promotion draws inward FDI into Asian countries and ASEAN countries in particular. As a result, the international production network has been strengthened between ASEAN and Japan, ASEAN and Korea, and ASEAN and the PRC.

Table 5: National Regulatory Changes in 2010, by Measure and Region

(Number of measures)

	Entry and Establishment[b]		Operation[c]		Promotion and Facilitation
	More Favorable to FDI	Less Favorable to FDI	More Favorable to FDI	Less Favorable to FDI	
Total	40	16	34	33	35
Developed countries	6	6	10	6	4
Developing economies	30	10	19	24	27
• Africa	4	2	8	4	11
• South Asia, East Asia, and Southeast Asia	12	5	5	5	12
• West Asia	10	0	4	0	3
• Latin America and the Caribbean	4	3	2	15	1
• Southeast Europe and the CIS	4	0	5	3	4

[a]Since some measures can be classified under more than one type, overall totals differ from national regulatory changes, 2000–2010

[b]Entry measures and establishment: measures related to ownership and control or approval and admission conditions for (both inward and outward) FDI and other measures affecting the entry or establishment of TNCs.

[c]Operation: measures related to non-discrimination, nationalization or expropriation, capital transfer, dispute settlement, performance requirements, corporate tax rates and other measures affecting the operating conditions for TNCs.

[d]Promotion and facilitation: measures related to fiscal and financial incentives, procedural measures related to approval and admission, or investment facilitation and other institutional support.

Source: UNCTAD, Investment Policy Monitor database.

Whether to liberalize and promote FDI depends on a country's industrial policies on the protection of domestic industries, national security, monopoly power, and the impact of economic crisis. FDI policy has a close relationship with domestic industrial policy. If FDI is necessary for national economic development, its promotion is expected. FDI restrictions can take various forms such as a limit on foreign ownership in companies when domestic or strategic industries need protection. Hence, many countries have an FDI guideline. According to the World Investment Report 2011, the PRC publishes China's Foreign Investment Industrial Guidance Catalog and Catalog of Foreign Investment Advantageous Industries in Central and Western China, while the Indian government issues India's Consolidated FDI Policy. Korea has a guideline titled FDI Promotion Policy in 2011. The Malaysian Industrial Development Authority provides the document Invest in Malaysia, and Thailand's Board of Investment has the Investment Promotion Policy for Sustainable Development.

To enhance the national competitiveness, FDI promotion policy is usually available for certain industries which require technology transfer and capacity building. To complement the FDI policy, special economic zones such as export processing zones or high-tech zones are provided for the foreign investors with basic infrastructure. FDI is restricted when domestic industry needs protection and the forms of restriction may be the land ownership restriction or limiting shareholding of foreigners. For examples, Transportation, media, electricity, and telecommunications are industries with industry-specific restrictions on foreign ownership in most developing countries.

In addition to investment liberalization and investment promotion, regional integration is crucial in linking economies, and it results in several success cases of intraregional trade and investment as well as regional production networks such as the ASEAN Free Trade Area and the ASEAN and Japan Comprehensive Economic Partnership. Asian regionalism has

developed rapidly through bilateral and plurilateral trade agreements. In addition to bilateral trade agreements ASEAN embarked on several economic integration initiatives such as the ASEAN Free Trade Area, the ASEAN Framework Agreement on Services, and the ASEAN Investment Area. ASEAN leaders eventually aim to establish an ASEAN Community, which will be based on three pillars: an ASEAN Security Community; an ASEAN Economic Community; and an ASEAN Socio-Cultural Community. The development of ASEAN economic integration also led to the ASEAN plus cooperation such as ASEAN+1, ASEAN+3 and ASEAN+6. The AEC will be completed by 2015, however, ASEAN members including Brunei Darussalam, Indonesia, Malaysia, the Philippines, Singapore, and Thailand lifted their tariffs in 2010 under the ASEAN Trade in Goods Agreement, while Cambodia, Lao PDR, Myanmar, and Viet Nam will lift their tariffs later.

ASEAN+1 refers to ASEAN and The PRC Free Trade Area, ASEAN and Japan Comprehensive Economic Partnership, ASEAN and Korea Free Trade Area, and ASEAN and India Free Trade Area. Each trade agreement is unique. The PRC and ASEAN members have a large extension of the agreement between the PRC and each ASEAN member by allowing for their own sensitive list and bilateral market access. The difficulty in concluding any agreement is due to the differences among the ASEAN members in economic development and structure. The East Asian Free Trade Area, or ASEAN+3, which includes ASEAN, the PRC, Japan, and Korea, aims to liberalize trade, expand investment promotion to all East Asia, promote development and technological cooperation, and establish a future-oriented economic structure. ASEAN+6, or Comprehensive Economic Partnership for East Asia (CEPEA), also known as the East Asia Summit, is the wider group in the region that includes Australia, India, and New Zealand. Japan regards CEPEA as an appropriate group for East Asia in trade and investment integration. Only ASEAN and ASEAN+1 have been implemented and resulted in the success of the international production networks. Even though regional trade agreements seem to benefit the trade and investment of the member countries, a Rule of Origin (RoO) regulation can be a major obstacle. RoO includes tariff heads or classifications, criteria on the local value-added content, and product specific rules and manufacturing process requirements. The advantage to ASEAN of ASEAN+1over the bilateral trade agreement between each ASEAN member and one of those +1 countries is the cumulative RoO or the regional value content as the export and import of products or parts will be tariff free once the cumulative value reaches the required level. Hence, the cumulative RoO will strengthen the international production network.

The East Asian international production network was not affected by the 1997 Asian financial crisis. Thorbeke and Salike (2011) pointed out that there are researches on the cross border production network for the case of Japan. The conclusion shows that Japanese firms are reluctant to relocate to another country because of the high cost in identifying locational advantages and have strong relationships with local business partners in Japan. The Asian financial crisis reduced the locational advantage for inward FDI to ASEAN, but the MNEs already present in ASEAN were not relocated.

The 2008 financial crisis saw global trade and investment drop by 20%. The East Asian economies in the first half of 2009 contracted in a higher proportion than the total global trade. East Asian economies were highly affected because of the lower demand for final products, which were assembled in East Asia by the regional production network. The economic slowdown triggered a credit crunch that resulted in a trade credit problem. Moreover, advanced communications technology and inventory management allowed businesses to respond faster to the crisis and on a larger scale. The PRC was deeply affected as it has been a production base for several consumer products since its accession to the WTO and exports the final assembled products to the global market in particular the EU and the US. Consequently, ASEAN countries that supply intermediate goods to the PRC were indirectly affected by the

slowdown because of the stocking of imported intermediate goods by PRC firms. Japanese firms, on the other hand, suffered more than PRC firms as Japanese export products were capital intensive and high-end durable goods and orders sharply dropped from developed countries such as the EU and the US. Athukorala (2010) pointed out that the financial crisis has had a stronger inverse impact on capital intensive products such as machinery, Information Communication Technology products, and electronics than traditional labor intensive product such as footwear, and textiles and garments as the former items are sensitive to changes in income. Therefore, only specific industries with international production networks need strategic adjustment to deal with the 2008 global financial crisis. Some industries that are affected from the 2008 global financial crisis required the FDI promotion to strengthen their supporting and related industries while some industries need to be protected by foreign restrictions due to the negative impacts from the crisis. Still, there is no clear evidence that the crisis led to a breakdown of regional production networks.

The 11 March 2011 earthquake and tsunami that struck the northeastern coast of Japan forced Japanese firms to find a new strategy to extend the international production network. As recommended by Japanese policymakers, high-value added parts should not be produced only in Japan but elsewhere to secure the supply chain of production. The tsunami disrupted Japan's production of high-tech parts in the auto and electrical appliance industries. ASEAN countries were indirectly affected by the lack of important parts to complete the production line. Hence, it is crucial for countries like Japan to strengthen international production networks.

3. PRODUCTION NETWORKS OF SPECIFIC INDUSTRIES IN EAST ASIA

This section examines production networks in the auto and HDD industries. These two industries were chosen because they are major East Asian export sectors. In addition, their production networks differ. According to Pasha (2011), the HDD industry is more fragmented than the auto industry because it requires lower capacity. Quantitative and qualitative methods are used to analyze the production networks in the HDD industry, and the auto and auto parts sector.

For the quantitative method, we start with the calculation of the Grubel–Lloyd (GL) index to determine intra-industry trade in the selected industries. The GL index can be calculated as follows:

$$IIT_i = 1 - \frac{|X_i - M_i|}{X_i + M_i}$$

Where Xi is the export values of industry i and Mi is the import values of industry i.

Next, we identify whether intra-industry trade of the selected industries are vertical IIT or horizontal IIT following, Fontagne and Fredenberg (1997) and Ando (2006). Intra-industry trade is considered to be horizontal IIT with the following condition:

$$\frac{1}{1.25} \leq \frac{P_{kj}^X}{P_{kj}^M} \leq 1.25$$

Where P_{kj}^{X} indicates the unit value of industry j exported to the world by country k.

P_{kj}^{M} indicates the unit value of industry j imported from the world by country k.

The threshold of 25% is employed here because, according to Ando (2006), the threshold of 25% is more precise to analyze the accuracy of vertical IIT.

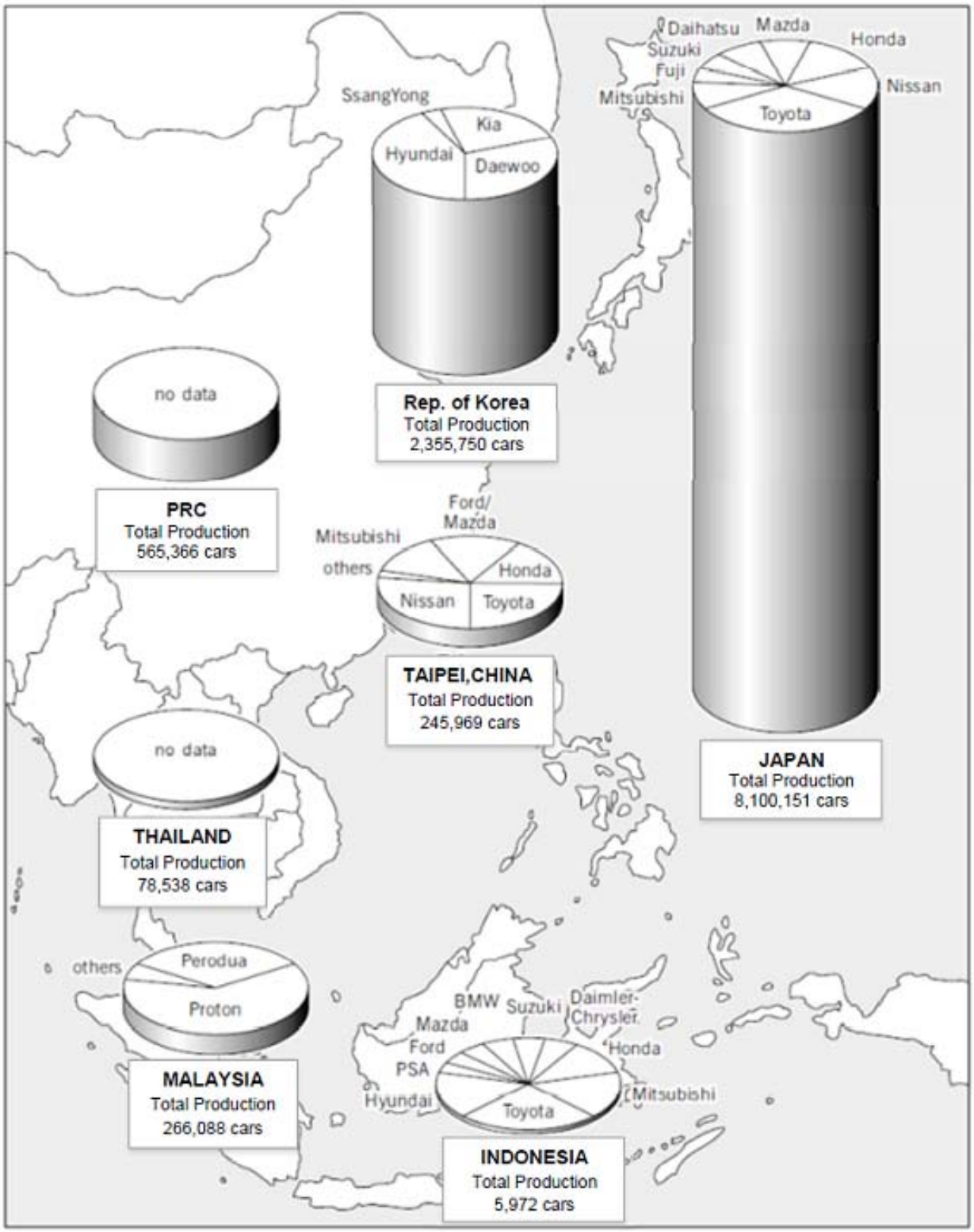
3.1 Data Description

Export and import values and quantities are obtained from the United Nations (UN) Comtrade. The data are at the HS six-digit level illustrated in Appendix Table A2 in the appendix. Countries in the study are ASEAN-5 (Indonesia, Malaysia, Philippines, Singapore, and Thailand), the PRC, India, Japan, and Korea. The study covers the period 1994 to 2010.

3.2 Auto Industry

Since the 1970s the production strategy in the global auto industry has been changing from mass production to international production networks, which began with the relocation of many US auto factories to Canada and Mexico via the Canada—United States Automotive Products Agreement of 1965 and the North American Free Trade Agreement. Also, the appreciation of yen in the 1980s increased production costs for Japanese automakers. Consequently, many companies relocated their production to East Asia, including ASEAN. The 1997 Asian financial crisis drove more Japanese and US firms to establish production bases in East Asia as the asset prices dropped sharply, or the so-called “FDI-fire sale.” The forms of the network are joint ventures and direct investment by multinational corporations (MNC). As a result, there is an international production network in the auto industry in East Asia. Intra-industry trade in the region confirms this fact, which will be shown later.

Figure 8: Auto Production in East Asia



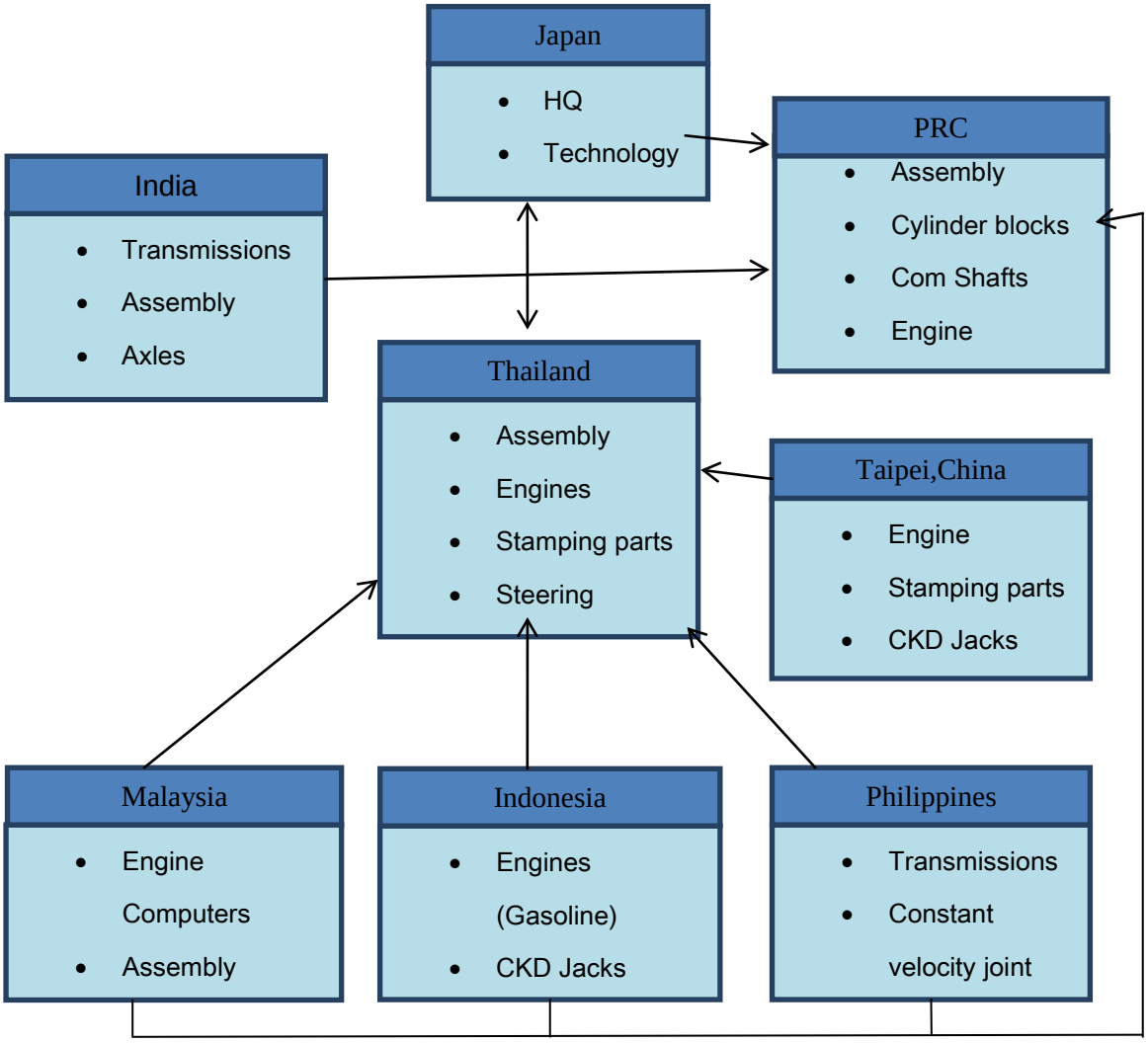
Source: Dicken (2003)

Figure 8 shows that Japan; Korea; Malaysia; Taipei,China; and Thailand are key auto producers in East Asia. The PRC; Indonesia; Taipei,China; and Thailand are production bases for MNCs. Japanese MNCs dominate the international production networks in East Asia. Western firms began establishing production bases in East Asia after the 1997 Asian financial crisis. Only the PRC is equally important as a production base for Europe, Japan and US MNCs.

Although the auto industry has a long value chain and it can be sliced into a fragmented process, the transportation cost is relatively higher as compared to the value of the final product. Therefore, economies of scale, a sizable domestic market, and the logistic cost must be taken into consideration of the production with the production network framework. Automakers began investing and producing in Thailand years ago and have developed domestically the support industries needed to produce the labor-intensive parts for their assembly lines. Hiratsuka (2011b) pointed out that the local procurement to overseas procurement ratio is very high for autos because manufacturers and assemblers aim to save on transport costs by procuring from domestic sources. First tier firms in the domestic market are usually foreign-owned FDI, while second tier firms may consist of Thai-owned firms equipped with Japanese technology or assisted in production by Japanese firms to ensure quality. The import of high-tech parts, such as electronic parts, are from its home country such as Japan.

Figure 9 shows the international production network of Toyota in East Asia. Toyota's most important assembly base in East Asia is the PRC and the main assembly base in ASEAN is Thailand. Other ASEAN countries are concentrated on the production of parts and components and assemblers of some product lines. Moreover, the East Asian bases import some of and components from Japan (high-technology parts), the PRC and India, and from other suppliers such as Denso.

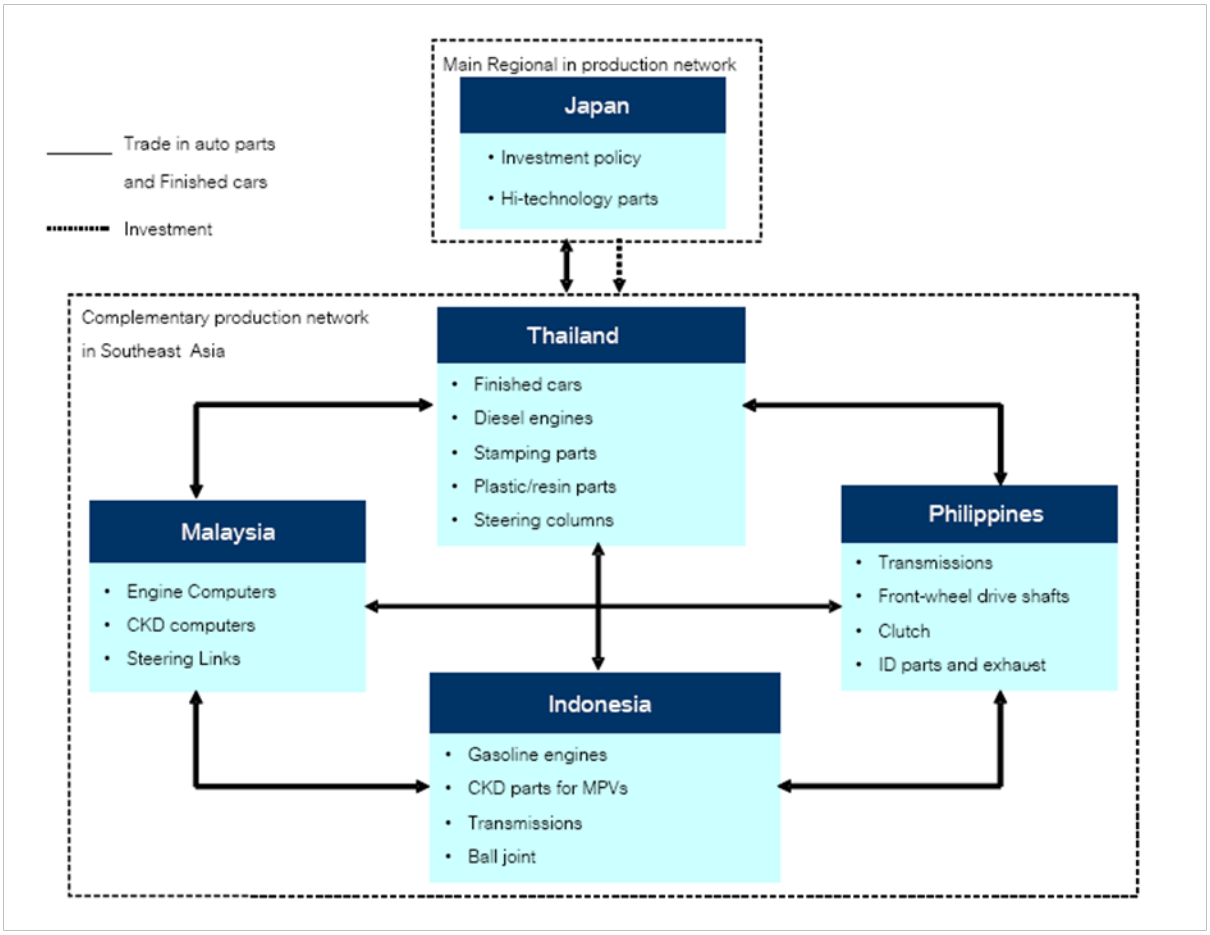
Figure 9: Toyota's Reginal Production Network in East Asia



Source: Adjusted from Dent (2008)

Thailand is a major assembly base of Japanese MNCs, while Indonesia, Malaysia, and the Philippines are parts and components manufacturers, as seen in Figure 10. This formation of production network leads to intra-industry trade in ASEAN's auto industry.

Figure 10: International Production Network of the auto industry in ASEAN



Source: Adjusted from Tsukamoto (2006)

Hiratsuka (2011b) illustrated that the Japanese affiliate assemblers operate in four ASEAN countries. Indonesia makes cylinder heads and blocks, engine valves, steering wheels, and transmissions. Malaysia makes instrument panels, bumpers, and drive shafts. Thailand produces frame panels, electronic parts, interior parts, and engine parts, while the Philippines produces engine fuel systems, engine electronics parts, suspension parts, and manual transmissions. However, the situation may change because the tsunami that hit Japan on 11 March 2011 disrupted the supply of electrical parts. Consequently, auto assembly lines in several countries, including Thailand, stopped. Japanese manufacturers are revising their business strategy to diversify the production of high-tech parts outside of Japan.

The calculation of Grubel–Lloyd (GL) index and Vertical Intra industry trade (VIIT) index confirms the existence of international production networks in the auto industry in East Asia. Table 6 shows intra-industry trade of ASEAN's autos and parts. The results show that trade in

autos and parts in ASEAN and with the PRC, India, Japan, and Korea exhibits a pattern of intra-industry trade. An increasing trend of intra industry trade is observed in trade within ASEAN, which indicates stronger production sharing in the ASEAN auto industry.

The GL index among East Asian countries shows a pattern of intra-industry trade in autos and parts after the 1997 Asian financial crisis. This comes from the fire-sale FDI during that time among several countries in the region that were hit by the crisis. The FDI inflows created international production networks and coproduction bases in the region.

Table 6: GL Index of ASEAN Auto and Parts Trade

From-To	Within ASEAN	ASEAN-PRC	ASEAN-India	ASEAN-Japan	ASEAN-Korea	Within East Asia
1994	(…)	(…)	(…)	(…)	(…)	0.13
1995	0.67	(…)	(…)	(…)	(…)	0.21
1996	0.35	(…)	(…)	(…)	(…)	0.58
1997	0.42	0.97	0.76	0.54	0.32	0.77
1998	0.67	0.76	0.59	0.48	0.60	0.91
1999	0.67	0.76	0.74	0.71	0.38	0.95
2000	0.56	0.72	0.71	0.80	0.34	0.94
2001	0.63	0.82	0.93	0.89	0.37	0.95
2002	0.69	0.87	0.88	0.88	0.39	0.92
2003	0.60	0.76	0.98	0.66	0.42	0.89
2004	0.61	0.73	0.98	0.65	0.44	0.9
2005	0.69	0.77	0.90	0.70	0.45	0.91
2006	0.78	0.82	0.84	0.81	0.52	0.93
2007	0.80	0.79	0.70	0.70	0.56	0.92
2008	0.77	0.79	0.84	0.63	0.53	0.92
2009	0.73	0.81	0.91	0.65	0.43	0.87
2010	0.72	0.81	0.87	0.65	0.46	0.86
Average	0.65	0.80	0.83	0.70	0.44	0.80

Source: Author's calculation

Table 7 shows the GL index of auto parts. We also see an increase in intra-industry trade in auto parts in the ASEAN region that indicates the key role of ASEAN countries as co-production bases for the industry. Also, the high level of intra-industry trade in auto parts is seen in ASEAN's trade with the PRC, India, and Japan. The high intra-industry trade with Japan comes from the fact that Japan is the home country while the PRC and India are also important production bases of Japanese auto MNEs. Similar to autos and parts, the GL index of the auto parts trade in East Asia show a pattern of high intra-industry trade within the region. Particularly, the intra-industry trade in autos and parts has been noticeable since the 1997Asian financial crisis. During that time, the crisis-hit countries of East Asia saw a huge amount of fire-sale FDI. The GL index confirms the formation of international production networks of the auto industry in East Asia, especially after the 1997 Asian financial crisis, as indicated in Figure 9 and Figure 11.

Table 7: GL Index of ASEAN Auto Parts Trade

From-To	Within ASEAN	ASEAN-PRC	ASEAN-India	ASEAN-Japan	ASEAN-Korea	Within East Asia
1994	(…)	(…)	(…)	(…)	(…)	0.16
1995	0.67	(…)	(…)	(…)	(…)	0.25
1996	0.36	(…)	(…)	(…)	(…)	0.65
1997	0.45	0.93	0.76	0.56	0.70	0.74
1998	0.69	0.77	0.59	0.49	0.80	0.92
1999	0.67	0.73	0.75	0.77	0.56	0.94
2000	0.58	0.73	0.71	0.80	0.48	0.95
2001	0.66	0.82	0.9	0.90	0.47	0.95
2002	0.70	0.87	0.82	0.95	0.48	0.96
2003	0.62	0.81	0.85	0.81	0.5	0.94
2004	0.63	0.78	0.84	0.78	0.53	0.93
2005	0.71	0.80	0.78	0.82	0.54	0.93
2006	0.79	0.83	0.79	0.93	0.63	0.94
2007	0.83	0.79	0.68	0.77	0.66	0.94
2008	0.78	0.75	0.78	0.65	0.65	0.95
2009	0.74	0.79	0.85	0.68	0.54	0.90
2010	0.74	0.79	0.78	0.7	0.49	0.90
Average	0.66	0.80	0.78	0.76	0.57	0.82

Source: Author's calculation

Table 8 shows whether intra-industry trade in the auto industry is vertical or horizontal. The 25% threshold is used following Ando (2006). Table 8 shows that intra-industry trade in ASEAN and among ASEAN and the major trading partners are of the vertical type. The VIIT indexes between ASEAN-PRC, ASEAN-India, and ASEAN-Korea indicate that ASEAN countries export higher-value products to those countries. However, a decrease can be observed in the VIIT index between ASEAN-PRC, which implies the more important role of the PRC as an assembly base. The VIIT index between ASEAN and Japan shows that ASEAN tends to import high-technology parts and finished products from Japan. The VIIT index of autos and parts trade among East Asian countries exhibits the mixed pattern of HIIT and VIIT. This comes from the fact that there are both automotive part exporters and automobile exporters among East Asian countries. As a result, both horizontal and vertical intra-industry trade occurs in the region.

Table 8: VIIT Index of ASEAN and East Asian Auto and Parts Trade

From-To	Within ASEAN	ASEAN-PRC	ASEAN-India	ASEAN-Japan	ASEAN-Korea	Within East Asia
1994	(…)	(…)	(…)	(…)	(…)	(…)
1995	0.26	(…)	(…)	(…)	(…)	2.46
1996	0.75	(…)	(…)	(…)	(…)	0.11
1997	0.29	7.06	1.26	1.61	220.99	0.74
1998	0.37	2.19	0.50	0.07	282.43	3.70
1999	0.61	0.64	199.88	0.18	355.95	1.51
2000	0.49	1.71	1.83	1.00	406.08	0.77
2001	1.02	1.96	2.54	1.05	108.76	3.23
2002	0.57	1.66	658.15	0.03	67.80	1.23
2003	0.75	7.08	8.11	0.17	339.21	1.05
2004	0.91	0.86	1794.71	0.23	97.24	1.35
2005	0.71	1.57	71.80	0.33	166.71	1.39
2006	0.46	1.31	11.69	0.43	455.43	1.05
2007	0.62	1.15	538.67	0.16	448.74	1.12
2008	0.83	0.84	415.98	0.06	956.42	1.84
2009	0.86	0.03	10.55	1.04	342.82	0.74
Average	0.66	2.07	265.48	0.53	303.54	1.01

Source: Author's calculation

Table 9 shows Thailand's intra-industry trade in the auto industry. As Figure 9 and Figure 11 illustrate, Thailand is the major assembly base of Japanese auto MNEs. This is confirmed by the VIIT index, which shows that Thailand exports more high-value auto products versus importing them.

Table 9: VIIT Index of the Thai Auto and Parts Trade

From-To	Thailand-ASEAN	Thailand-PRC	Thailand-India	Thailand-Japan	Thailand-Korea	Thailand-East Asia
1994	(…)	(…)	(…)	(…)	(…)	(…)
1995	(…)	(…)	(…)	(…)	(…)	(…)
1996	6.92	(…)	(…)	(…)	(…)	0.38
1997	1.49	(…)	(…)	(…)	(…)	0.01
1998	15.37	0.63	0.05	0.20	12.27	0.86
1999	3.44	0.60	0.12	2.06	548.84	1181.44
2000	2.93	0.42	0.60	28.51	5.40	70.09
2001	0.39	0.39	0.52	158.89	22.66	60.66
2002	0.42	0.06	0.41	1.54	9.67	157.93
2003	0.95	0.89	0.64	23.66	50.96	1221.19
2004	0.08	0.89	0.96	94.68	101.49	454.53
2005	0.17	0.76	16.23	88.14	5.55	127.03
2006	0.65	1.09	0.18	1.00	1578.38	0.75
2007	0.02	9.39	0.09	106.02	2.01	27.12
2008	0.26	0.93	0.81	1.02	1.59	569.85
2009	0.25	0.38	2.91	2.07	1.01	170.16
2010	1.00	1.00	1.00	1.00	1.00	1.00
Average	2.29	1.34	1.89	39.14	180.06	269.53

Source: Author's calculation

The benefit from a regional trade agreement (RTA) or an FTA, other than the ASEAN Trade in Goods Agreement (ATIGA), appears to be minimal as most autos and auto-related items are subject to the sensitive or highly sensitive list. Moreover, when the final product has zero tariffs, the rule of origin seems to be very complicated due to the combination of change in tariff heading and classification and the value content. The ATIGA tends to benefit member countries more than other trade agreements such as ASEAN-The PRC Free Trade Area (ACFTA). Under the ASEAN-Japan Comprehensive Economic Partnership (AJCEP), Japan will enjoy tariff elimination by making the high-tech or high-value added parts in Japan and then exporting them for assembly in ASEAN countries while using the supporting industries in ASEAN. Pasha (2011), on the other hand, concludes that the current regime of RTAs does not enhance the international production network in the auto sector by using the case studies of the PRC, India, and Indonesia.

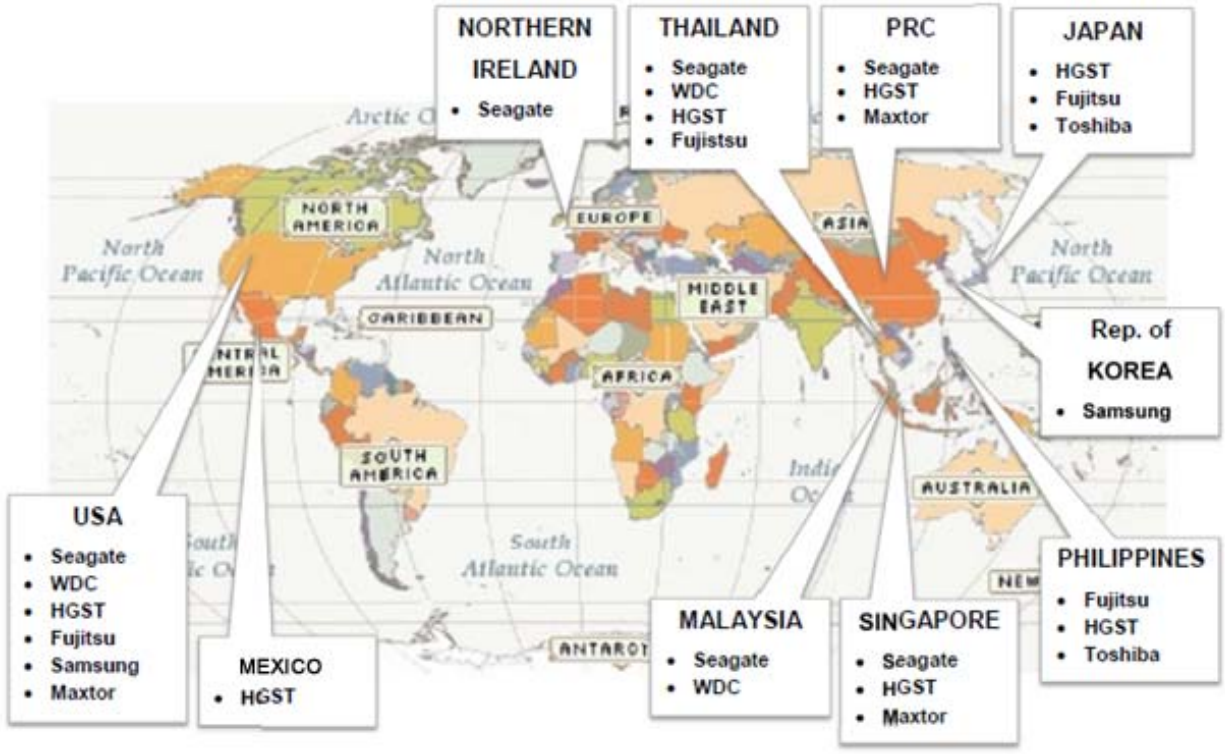
3.3 HDD industry

The hard disk drive (HDD) industry is a key international production network in East Asia. The industry is growing on high global demand for IT products and digital content. The HDD industry

is one of the industries that can form international production fragmentation since its value chain from the upstream process to the downstream process is long. The logistics cost must be low enough to integrate parts into the final product. HDD production appears to match these characteristics as it involves in the upstream the fabrication of wafers, printed circuit boards, spindle motors, head-gimbal assemblies, actuator arms, disk clamps, and disk platters, among other parts. Wafer fabrication is usually done in the home countries of MNEs and developing countries carry out most of the low-value added parts manufacturing and assembly. ASEAN countries, or more recently the PRC, provide the high-skilled workers for the assembly lines.

Hitachi Global Storage Technology, Seagate Technology, Samsung, Toshiba, and Western Digital are the world's five major HDD producers. All operate in the pattern of international production networks and global sourcing to benefit from cheaper production and labor costs. The PRC, Malaysia, Singapore, and Thailand are key production bases as seen in Figure 11.

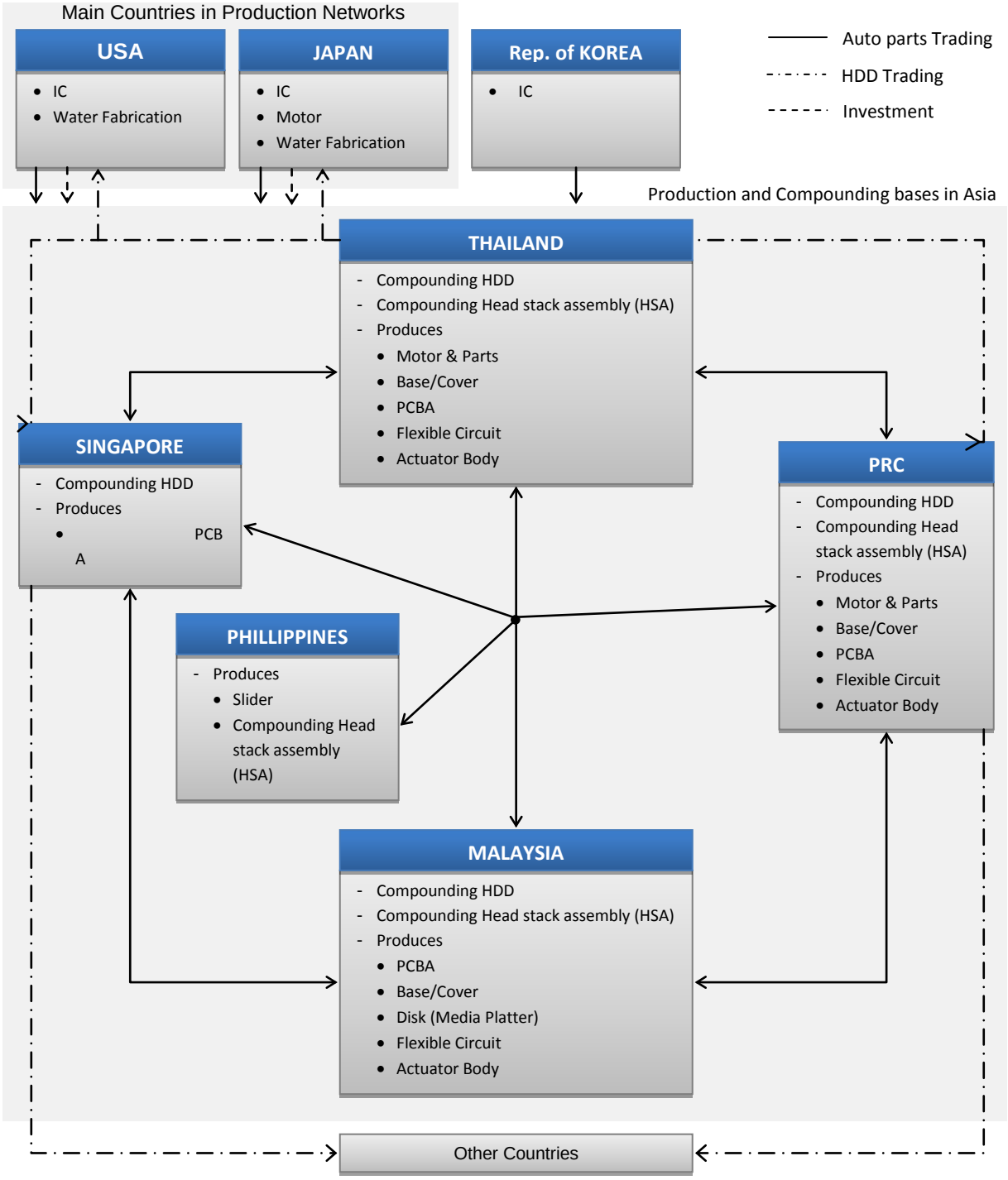
Figure 11: The global Production Bases of All HDD Companies



Source: NECTEC (2006)

Figure 12 shows that the PRC, Thailand, and Singapore are major assembly bases. Thailand concentrates on the production of 2.5 inch HDDs, while the PRC produces mainly 3.5 inch HDDs. Singapore makes high-technology HDDs. Other ASEAN countries make parts and components. For example, Malaysia makes media platters and printed circuit boards, while the Philippines makes sliders and head stack assemblies.

Figure 12: International Production Networks in the HDD Industry in East Asia



Source: Adjusted from NECTEC (2007)

Most assembly bases also make parts and components. For example, Thailand makes 75%–80% of the HDD parts and components used in its assembly process. However, the assemblers need to import some components from other countries, such as wafer fabrication and integrated

circuit (IC) from core countries, and media platters and printed circuit boards from the PRC and Malaysia. Consequently, this creates international production networks.

The PRC and Thailand are the world's major HDD exporters as seen in Table 10. As a result, we consider the characteristics of HDD trade in the three mentioned countries.

Table 10: Top Ten Exporters of Storage Units

(Value in US$ million; growth in %)

Country	2006		2007			2008	
	Value	Share	Value	Share	Growth	Value	Growth
World	60934.83	100.00	63361.50	100.00	3.98	(…)	(…)
Thailand	6823.38	11.20	10204.90	16.11	49.56	11789.28	15.53
PRC	11917.20	19.56	11617.26	18.33	-2.52	11708.04	0.78
Singapore	8333.77	13.68	6477.43	10.22	-22.27	6549.29	1.11
Hong Kong, China	3656.26	6.00	4015.25	6.34	9.82	5238.97	30.48
Netherlands	5056.26	8.30	6135.47	9.68	21.34	5206.46	-15.14
US	4166.30	6.84	4591.47	7.25	10.20	4473.98	-2.56
Malaysia	2600.49	4.27	2481.30	3.92	-4.58	2712.38	9.31
Korea	2296.76	3.77	2618.94	4.13	14.03	2246.65	-14.22
Germany	2178.26	3.57	2119.25	3.34	-2.71	2199.21	3.77
Philippines	2452.81	4.03	2082.55	3.29	-15.10	1651.39	-20.70
Rest of the world	11453.34	18.80	11017.68	17.39	-3.80	(…)	(…)

Source: Author's calculation from World Trade Atlas's database

Table 11 shows the GL index of the Thai HDD trade as a key HDD production base. The GL index indicates the significant Thai intra-industry trade in HDD only with ASEAN countries and the PRC. Figure 12 shows that the PRC, Thailand, and several ASEAN countries are in the international production networks of the HDD industry.

Table 11: GL index of Thailand's HDD trade

From-To	Thailand-ASEAN	Thailand-PRC	Thailand-India	Thailand-Indonesia	Thailand-Japan	Thailand-Korea	Thailand-Malaysia	Thailand-Singapore	Thailand-EAST ASIA
1999	0.38	0.77	0.38	0.70	0.20	0.30	0.53	0.37	0.25
2000	0.52	0.85	0.51	0.58	0.19	0.38	0.52	0.32	0.37
2001	0.37	0.98	0.43	0.42	0.28	0.32	0.46	0.42	0.31
2002	0.69	0.84	0.50	0.44	0.34	0.22	0.40	0.57	0.44
2003	0.99	0.88	0.73	0.53	0.43	0.46	0.34	0.63	0.41
2004	0.98	0.98	0.52	0.53	0.52	0.50	0.31	0.67	0.33
2005	0.55	0.95	0.64	0.57	0.63	0.57	0.26	0.88	0.29
2006	0.48	0.98	0.56	0.49	0.71	0.56	0.25	0.89	0.27
2007	0.59	0.92	0.65	0.50	0.72	0.81	0.24	0.94	0.23
2008	0.98	0.99	0.59	0.50	0.78	1.00	0.21	0.89	0.22
2009	0.86	0.90	0.62	0.48	0.78	0.68	0.19	0.92	0.24
2010	1.00	0.97	0.96	0.48	0.73	0.45	0.22	0.74	0.35
Average	0.67	0.88	0.87	0.53	0.52	0.44	0.51	0.41	0.29

Source: Author's calculation.

Table 12 illustrates the VIIT index of the Thai intra-industry trade in HDD. The index indicates the pattern of vertical intra-industry trade rather than the horizontal one, especially with ASEAN counterparts. The index also implies that Thailand exports higher-value HDD products, either finished products or more expensive components to other countries. This finding also confirms the characteristics of HDD international production networks indicated in Figure 12.

Table 12: VIIT Index of Thailand's HDD Trade

From-To	Thailand-ASEAN	Thailand-PRC	Thailand-India	Thailand-Indonesia	Thailand-Japan	Thailand-Korea	Thailand-Malaysia	Thailand-Singapore	Thailand-EAST ASIA
1999	51.49	17.96	14.86	0.08	0.13	6.43	0.39	3.44	4.40
2000	59.67	3.88	25.51	0.67	0.57	6.29	7.01	11.26	5.52
2001	76.48	28.09	3.09	0.34	0.52	7.25	5.02	17.53	1.20
2002	36.55	30.10	3.47	2.71	3.74	123.15	1.60	15.46	0.91
2003	26.88	44.76	1.22	7.49	4.00	9.05	1.34	9.92	0.90
2004	26.13	41.96	3.65	8.86	3.47	13.90	2.16	5.43	2.11
2005	7.71	9.91	4.54	4.22	0.81	3.87	0.99	83.01	1.38
2006	2.74	2.24	10.24	0.30	0.69	2.07	0.96	1.68	2.26
2007	1.35	1.11	11.16	0.71	0.73	3.63	1.24	1.88	3.40
2008	1.29	0.91	5.96	0.36	0.72	2.78	1.11	1.47	1.61
2009	0.93	0.48	4.89	0.37	1.17	2.35	1.79	1.19	1.96
Average	26.47	16.49	8.05	2.37	1.51	16.43	2.15	13.84	2.33

Source: Author's calculation.

A similar pattern can be seen from the level of intra-industry trade in the PRC's HDD trade as seen in Table 13. We can experience the characteristics of intra-industry trade in the PRC's HDD trade with Japan, Korea, Singapore, and Thailand, which are either HDD production bases or the home countries for HDD MNEs. However, if we consider the GL index of the PRC with East Asian countries as a whole, we observe that the pattern of HDD trade is more inter-industry trade than intra-industry trade.

Table 13: GL Index of PRC's HDD Trade

From-To	PRC-India	PRC-Indonesia	PRC-Japan	PRC-Korea	PRC-Malaysia	PRC-Singapore	PRC-Thailand	PRC-East Asia
1999	0.02	0.20	0.90	0.77	0.33	0.79	0.92	0.03
2000	0.00	0.30	0.63	0.82	0.26	0.23	0.73	0.00
2001	0.04	0.26	0.46	0.92	0.47	0.43	0.78	0.01
2002	0.01	0.12	0.30	0.65	0.73	0.30	0.71	0.02
2003	0.03	0.09	0.27	0.98	0.54	0.14	0.81	0.02
2004	0.02	0.11	0.26	0.67	0.68	0.12	0.87	0.01
2005	0.01	0.13	0.20	0.66	0.88	0.07	0.78	0.00
2006	0.01	0.17	0.19	0.60	0.97	0.07	0.81	0.00
2007	0.00	0.33	0.23	0.86	0.99	0.07	0.73	0.02
2008	0.00	0.74	0.18	0.47	0.88	0.14	0.68	0.04
2009	0.00	0.82	0.19	0.32	0.94	0.18	0.45	0.10
2010	0.01	0.30	0.35	0.70	0.70	0.23	0.75	0.26
Average	0.02	0.20	0.90	0.77	0.33	0.79	0.92	0.08

Source: Author's calculation.

Consider the VIIT index of the PRC's HDD intra-industry trade in Table 14: all of the PRC's intra-industry trade in HDDs are of the vertical type except the intra-industry trade with India. The PRC exports higher-value products to Japan, Malaysia, and the Philippines while imports higher-value contents or products from Korea, Singapore, and Thailand. Considering the patter of intra-industry trade in HDD of the PRC with East Asian countries as a whole, we also find that PRC exports lower-valued HDD to East Asian countries. This confirms the characteristics of international production network indicated in Figure 12 that Singapore and Thailand produce more sophisticated HDDs compared to the PRC.

Table 14: VIIT Index of PRCHDD Trade

From-To	PRC-India	PRC-Indonesia	PRC-Japan	PRC-Korea	PRC-Malaysia	PRC-Singapore	PRC-Thailand	PRC-East Asia
2000	0.03	7.66	0.15	0.24	1.36	0.00	0.10	23.03
2001	(…)	187.23	2.71	0.01	0.01	0.00	0.12	0.06
2002	1.59	2031.05	0.15	0.01	21.98	0.00	0.01	0.00
2003	0.69	35.62	0.02	0.03	2.36	0.00	0.01	0.00
2004	1.87	103.82	0.73	0.00	1.00	0.00	0.11	0.00
2005	1.70	1.07	1.80	0.86	0.06	0.01	0.15	0.01
2006	2.51	2.59	20.99	0.00	0.28	0.00	0.18	0.00
2007	0.08	143.77	(…)	0.02	0.51	0.00	1.00	0.00
2008	0.10	30.18	22.26	0.29	0.90	0.06	0.25	0.00
2009	0.36	123.24	285.80	0.00	5.95	0.01	0.55	0.00
Average	1.13	205.36	30.68	0.19	2.56	0.08	0.48	2.31

Source: Author's calculation

Regarding the effect of preferential trade agreements on the HDD industry, the HDD industry has two means to enjoy the benefit of producing in Thailand through the Board of Investment's (BOI) promotion measures and tariff reductions from RTAs. The tariff structure of the HDD industry is distorted, as mentioned by Kohpaiboon (2011), as HDDs are free from tariffs, but there are tariffs on intermediate goods such as motors, ball bearings, and aluminum plates. The BOI's investment promotion policy provides privileges to HDD makers that are foreign-owned and export-oriented, and since 1983 the privileges involve tax holidays for corporate earnings and tariff exemptions.

Thailand has been active in RTAs and has implemented FTAs with several trading partners. Those FTAs include ASEAN (ATIGA), ASEAN and the PRC (ACFTA), ASEAN and India (AIFTA), ASEAN and Japan (AJCEP), ASEAN and Korea (AKFTA), Japan and Thailand (JTEPA), India and Thailand (TIFTA), Australia and Thailand (TAFTA), and New Zealand and Thailand (TNZFTA). However, the use of the FTA with tariff reduction or elimination is close to none because HDDs and parts manufacturers can enjoy the benefit of zero-tariff rates from BOI's investment promotion. Kohpaiboon (2011) illustrates the low utilization rate of FTAs in the case of motor imports as seen in Table 15. Most motor imports benefit from the BOI's tariff exemption. In 2009, 63% of motor imports had tariff exemptions while the use of the FTA was only 2%. With the approval of the BOI, HDD makers can access imports without delay caused by filling the FTA allowance form, and calculating and paying levies. Pasha (2011) confirms that the market-led international production network has been successfully in developing the HDD industry in Thailand and the RTAs have had a neutral effect on the HDD industry in Thailand.

Table 15: Motor Imports in Thailand Applied for Tariff Exemptions and RTA Preferential Schemes, 2003–2006.

(%)

Composition	2003	2004	2005	2006
BOI's tariff exemptions	54.20	54.50	49.00	63.40
FTA	0.80	3.10	4.30	1.90
• AFTA	0.80	3.10	4.30	1.50
• JTEPA	0.00	0.00	0.00	0.40

Source: Kohpaiboon (2011)

It may be concluded that foreign-owned, export-oriented firms are likely to benefit more from the FDI promotion policy, which aims at export. The privilege from zero tariff rates on imported raw materials and intermediate parts is the same as what RTAs or FTAs offer, but the management cost under the FDI promotion policy tends to be lower than the procedure of FTA use. The costs of the FTA use are for a firm to submit information on cost structure to satisfy the rule of origin and its documentary processes. The FTA trade privilege will mostly be applied when the final goods are traded among the members of the RTA provided that the rule of origin is fulfilled.

4. CONCLUSION

Trade statistics show an increasing trend in intra-regional trade and investment in Asia as a result of several regional trade agreements. This might suggests a higher dependency among East Asian countries. However, previous literature such as ADB (2007) shows that the increase in intra-Asian trade is a result of the vertical integration of production networks among countries. In other words, an increase in intra-regional trade is due to a rise in trade in parts and components or intermediate goods. The major final consumers remain the Group of Three (G3) economies—the US, the EU, and Japan. Therefore, the region still has a high exposure to the US and the EU.

This study explores trade statistics to reveal trade patterns in East Asia. We find strong evidence in support of the proposition that an increase in intra-regional trade is driven by formation of international production networks in the region. Our findings show a rise in exports of parts and components both in East Asia and in the ASEAN region. At the same time, parts and components trade as a share of total trade in the region has continued to increase. The study also considers FDI inflows and outflows in the region as a driver of international production networks. We find that FDI inflows have surged in the East Asian region and have a similar pattern as trade in parts and components. The current major recipients of FDI inflows in East Asia are the PRC and Viet Nam, while Singapore remains the major FDI recipient in ASEAN. Also, G3 countries remain the most vital investors in East Asia indicating the G3 countries' firms continue to be leaders of international production networks in the region.

We also explore the pattern of international production networks in two selected industries—autos and parts, and HDD, in East Asia. We find a high share of intra-industry trade in both industries. The study also assesses the structure of vertical intra-industry trade in those industries between East Asian countries, and especially ASEAN countries, through calculation of the VIIT index, suggesting the occurrence of international production networks in those industries in the region. We also highlight the PRC and Thailand as key assembly bases.

Finally, international production networks in the region benefit from the investment promotion policies of several countries, such as the PRC, Malaysia, and Thailand, rather than from FTAs.

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APPENDIX

Table A1: Standard International Trade Classification Revision 2 Included in the Calculation of Trade in Parts and Components of Machinery and Parts Industry

Group	Sub group	Item	Definition	BEC category
7			Machinery and transport equipment	
711	711.9		Parts, n.e.s. of the boilers and auxiliary plant falling within headings 711.1 and 711.2	42
713	713.1	713.19	Parts, n.e.s., of the aircraft engines falling within heading 713.11	53
	713.3	713.31	Internal combustion piston engines, marine propulsion –Outboard	522
		713.32	Internal combustion piston engines, marine propulsion -Other than Outboard	53
	713.9		Parts, n.e.s, for the internal combustion piston engines falling within headings 713.2, 713.3 and 713.8	53
714	714.9		Parts, n.e.s. of the engines and motors of group 714 and item 714.8	53
716	716.9		Parts, n.e.s., of rotating electric plant	42
718	718.8	718.89	Regulators for and parts, n.e.s. of the engines and motors falling within headings 718.81 and 718.82	42
721	721.1	721.19	Parts, n.e.s. of the machines falling within heading 721.1	42
	721.2	721.29	Parts, n.e.s. of the machines falling within heading 721.2	42
	721.3	721.39	Parts, n.e.s. of the machines falling within heading 721.3	42
	721.9	721.98	Parts, n.e.s. of the machines falling within heading 721.91	42
		721.99	Parts, n.e.s. of the machines and appliances falling within heading 721.97	42
723	723.9		Parts, n.e.s., of the machinery and equipment falling within headings 723.41 to 723.46	42
724	724.4	724.49	Parts, n.e.s. of and accessories for use with the machines falling within 724.4	42
	724.6	724.69	Parts, n.e.s. of and accessories for use with the machines of headings 724.51, 724.52 and 724.53 or the auxiliary machinery of heading 724.61	42
	724.7	724.79	Parts, n.e.s. of the machines falling within headings 724.7 and 775.1 (including engraved or etched plates, blocks or rollers for use with the printing machines of heading 724.74	42
725	725.9		Parts, n.e.s. of the machines falling within headings 725	42
726	726.8	726.89	Parts, n.e.s. of bookbinding machinery	42
	726.9		Parts, n.e.s. of the machines falling within headings 726.31, 726.4 and 726.7	42
727	727.1	727.19	Parts, n.e.s. of the machinery falling within headings 727.11	42
	727.2	727.29	Parts, n.e.s. of the food-processing machinery falling within headings 727.22	42
728	728.1	728.19	Parts, n.e.s. of and accessories suitable for use solely or principally with the machine-tools falling within heading 728.1	42
	728.3	728.39	Parts, n.e.s. of the machinery falling within heading 728.3	42

	728.4	728.49	Parts, n.e.s. of the Machines and mechanical appliances falling within headings 723.48, 727.21 and 728.42 to 728.48	42
736	736.9		Parts, n.e.s. of and accessories suitable for use solely or principally with the machine-tools falling within heading 736	42
737	737.1	737.19	Parts, n.e.s. of the machines and appliances falling within heading 737.11	42
	737.2	737.29	Rolls for and Parts, n.e.s. of rolling mills	42
741	741.4	741.49	Parts, n.e.s. of refrigerators and refrigerating equipment	42
742	742.9		Parts, n.e.s. of the pumps and liquid elevators falling within heading 742	42
743	743.9		Parts, n.e.s. of the machines and apparatus falling within headings 743.5 and 743.6	42
744	744.1	744.19	Parts, n.e.s. of the trucks and tractors falling within heading 744.11	42
	744.9		Parts, n.e.s. of the machinery falling within heading 744.2	42
745	745.1	745.19	Parts, n.e.s. of the tools falling within heading 745.11	42
	745.2	745.23	Parts, n.e.s. of the machinery falling within headings 745.22 and 775.3	42
749	749.9	749.99	Machinery parts, not containing electrical connectors, insulators, coils, contacts or other electrical features, n.e.s.	42
759			Parts, n.e.s. of and accessories (other than covers, carrying cases and the like) suitable for use solely or principally with machines of a kind falling within headings 751 and 752	
764			Telecommunications equipment, n.e.s.; and parts, n.e.s., of and accessories of apparatus and equipment falling within division 76	
771	771.2	771.29	Parts, n.e.s. of the electric power machinery falling within heading 771	42
772			Electrical apparatus for making and breaking electrical circuits, for the protection of electrical circuits, or for making connections to or in electrical circuits (e.g., switches, relays, fuses, lightning arresters, surge suppressors, plugs, lamp holders and junction boxes); resistors, fixed or variable (including potentiometers), other than heating resistors; printed circuits; switchboards(other than telephone switchboards), and control panels, n.e.s.; parts, n.e.s. of the foregoing apparatus	
775	775.7	775.79	Parts, n.e.s. of the electro-mechanical, domestic appliances falling within heading 775.7	22
	775.8	775.89	Parts, n.e.s. of the electro-thermic appliances falling within headings 775.81, 775.82, 775.83, 775.84, 775.86 and 775.87	22
776	776.8	776.89	Parts, n.e.s. of the electronic components falling within heading 776	42
778	778.1	778.19	Parts, n.e.s. of electric accumulators	22
	778.2	778.29	Parts, n.e.s. of the lamps falling within heading 778.2	22
	778.8	778.89	Electrical parts of machinery or apparatus, n.e.s.	42
784			Parts and accessories, n.e.s. of the motor vehicles falling within headings 722, 781, 782 and 783	
785	785.3	785.39	Parts, n.e.s. of and accessories for the articles falling within heading 785	53
786	786.8	786.89	Parts, n.e.s. of the trailers falling within headings 786.11 and 786.12 and of the vehicles falling within headings 786.81	53
791	791.9	791.99	Parts, n.e.s. of the railway and tramway locomotives and rolling-stock falling within headings 791.1 to 791.5	53
792	792.9		Parts, n.e.s. (not including tyres, engines and electrical parts) of the aircraft falling within heading 792	53
821	821.1	821.19	Parts, n.e.s. of the chairs and other seats falling within heading 821.11	22

	821.9	821.99	Furniture, n.e.s. of other materials; parts, n.e.s. of the furniture falling within heading 821.9	61
874	874.2	874.29	Parts, n.e.s. of and accessories for the instruments, appliances and machines falling within heading 874.21	42
881	881.1	881.19	Parts, n.e.s. of and accessories for the cameras and flashlight apparatus falling within heading 881.1	22
	881.2	881.21	Cinematographic cameras, projectors, sound recorders and sound reproducers, combined or not, for film of less than 16 mm width(including cameras for double-8 mm film)	61
		881.29	Parts, n.e.s. of and accessories for the cinematographic cameras, projectors, sound recorders and sound reproducers falling within heading 881.2	22
884	884.1	884.11	Lenses, prisms, mirrors, and other optical elements, of any material(other than such elements of glass not optically worked)--unmounted; sheets or plates of polarizing material	22
885	885.2	885.29	Clock and watch parts, n.e.s.	22
899	899.4	899.49	Parts, fittings, trimmings and accessories of the articles falling within heading 899.41 or 899.42	22

Table A2: the 6-Digit HS Used in the Calculation of GL Index and VIIT Index

Rubber	401110	**Electric**	850710	**Clocks**	910400
	401120		850720	**Seats**	940120
	401220		850730		940190
	401290		850740	**Automobiles**	870321
	401310		850780		870322
Glass	700711		851220		870323
	700721		851230		870324
	700910		851240		870331
Metal	830120		851290		870332
	830230		851829		870333
Engines	840731		852721		870390
	840732		852729	**Harddisk**	847110
	840733		853921		847130
	840734		853929		847141
	840790		854430		847149
	840820	**Chassis fitted**	870600		847150
Engine parts	840991	**Vehicle bodies**	870710		847160
	840999	**Vehicle parts**	870810		847170
	841330		870821		847180
	842123		870829		847190
	842131	**Transmissions**	870840		
	842542	**Vehicle**	870850		
Machinery	848310		870870		
	848320		870880		
	848330		870891		
	848340		870892		
	848350		870893		
	848360		870894		
	848390		870899		