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What Are the Opportunities and Challenges for ASEAN?

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Abstract: *This paper attempts to investigate the features of development and restructuring patterns of regional production/distribution networks, mainly in machinery sectors, using finely disaggregated international trade data. More specifically, the paper first studies the developing patterns of machinery trade for the East Asian countries, then examines those patterns in terms of the extensive margin in order to investigate the extent and depth of the networks, and demonstrate how the networks and industrial shape are being restructured. The paper also presents some evidences on the expanding connectivity of production networks in East Asia from regional to global by shedding lights on the link between East Asia and Europe via CEE countries and concludes with policy implications on challenges in taking advantages of the mechanics of the 2nd unbundling for each ASEAN member state and ASEAN as a whole.*

Keywords*:* international production networks, machinery trade, East Asia, the extensive margin

JEL classification : F14, F23, L23

1. Introduction

The 2nd unbundling or the international division of labor in terms of production processes/tasks has gradually dominated the world trade since the 1980s (Baldwin (2011)). The 2nd unbundling in the manufacturing sector, particularly in machinery industries, has been developed in three regions: the US-Mexico/US-Costa Rica cross-border production sharing, the Western Europe (WE) and the Central and Eastern Europe (CEE) manufacturing nexus, and the East Asian production networks. The degree of complexity and sophistication of the 2nd unbundling, however, differs across the regions. Cross-border production sharing in the Americas mostly remains simplistic intra-firm, back-and-forth division of labor across national borders without meaningful linkages with developing countries' domestic economies.[1] On the other hand, in East Asia, regional production networks have reached further sophistication where many countries/regions get involved, fine-tuning combination of intra-firm and inter-firm (arm's length) transactions is developed, and the formation of industrial agglomerations on the developing countries' side is advanced.[2] Although the formation of industrial agglomerations seems to start also in Europe, particularly in automobile industry, the degree of sophistication in fragmentation and agglomeration is much more advanced in East Asia than in Europe at this point in time.

The formation of such regional production/distribution networks in East Asia has enhanced regional manufacturing competitiveness and contributed to the rapid economic growth of the countries in the region. The competitive industrial performance (CIP) index, which is compiled by the United Nations Industrial Development Organization (UNIDO) and measures the ability of countries to competitively produce and export manufactured goods, clearly indicates that the East Asian countries have strengthened their manufacturing competitiveness and their indices are higher than the sample average in most cases. In particular, China and Vietnam have rapidly improved the competitiveness in recent years, and four out of 11 East Asian countries are ranked in the top 10 out of the 118 countries in 2009.

Table 1: Competitive Industrial Performance (CIP) Index and its ranking for East Asia

	Rank					Index				
Country	1985	1993	1998	2003	2009	1985	1993	1998	2003	2009
China	61	28	30	27	5	0.02	0.34	0.38	0.41	0.56
Hong Kong	18	6	9	13	17	0.32	0.58	0.58	0.53	0.38
Indonesia	65	60	54	47	43	0.01	0.22	0.25	0.26	0.20
Japan	2	3	4	4	3	0.73	0.74	0.72	0.72	0.63
Korea	22	17	15	9	7	0.25	0.48	0.51	0.59	0.48
Malaysia	30	20	17	19	27	0.12	0.46	0.49	0.47	0.32
Philippines	45	44	28	32	33	0.04	0.27	0.39	0.40	0.27
Singapore	6	1	1	1	1	0.59	0.84	0.89	0.90	0.64
Taiwan	19	10	12	10	11	0.29	0.51	0.55	0.54	0.44
Thailand	43	32	29	28	25	0.06	0.32	0.39	0.41	0.32
Viet Nam	...	...	99	72	58	...	...	0.11	0.19	0.17
# of samples/ sample average		100	118	120	118		0.28	0.28	0.28	0.21

Note: Indices higher than the sample average are highlighted

Source: UNIDO database

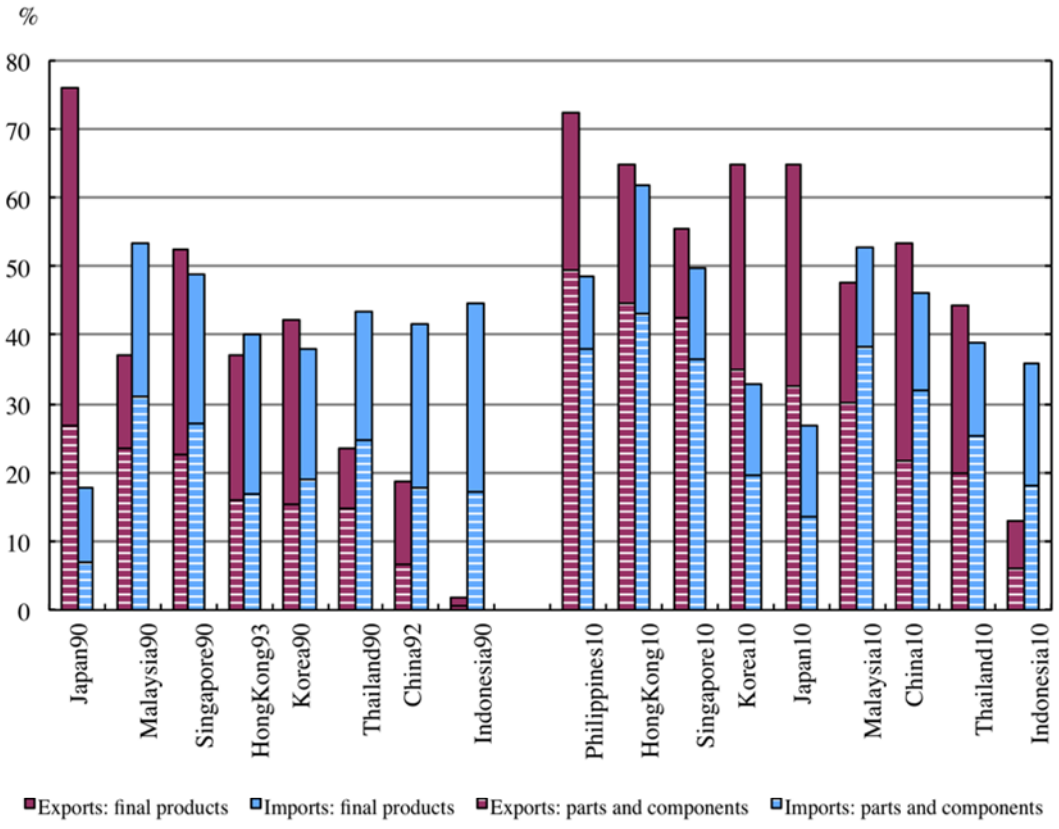
This paper attempts to investigate the features of development and restructuring patterns of regional production/distribution networks, mainly in machinery sectors, using international trade data at the most disaggregated level that is internationally comparable, i.e., HS 6-digit level. The paper also tries to present the expanding connectivity of production networks in East Asia from regional to global by shedding lights on the link between East Asia and Europe via CEE countries.

The rest of the paper is organized as follows: the next section shows the features of the development of regional production/distribution networks since the 1990s. Section 3 examines patterns of trade for the East Asian countries after the 2008-2009 Global Financial Crisis (GFC) in terms of extensive margins in order to investigate the extent and depth of regional production/distribution networks and demonstrate how the networks and industrial shape are being restructured. Section 4 shows how significantly the regional networks in East Asia are being connected to the outside from the perspective of their link with Europe, and section 5 discusses challenges and policy implications.

2. The Development of Regional Production/Distribution Networks

Machinery trade comprises a significant proportion of trade with the world for each East Asian economy, and the shares of machinery trade, in particular machinery parts and components trade, rapidly increased from the early 1990s to the 2000s (Figure 1).[3] In addition, the ratios of machinery intermediate goods are high for both exports and imports in East Asia. This evidence indicates the existence of export-oriented operations, as well as an active and drastically expanding vertical back-and-forth transactions, reflecting the development of fragmentation of production.[4]

Figure 1: Machinery Trade in East Asia: Shares in Total Exports/Imports (early 1990s and 2010)

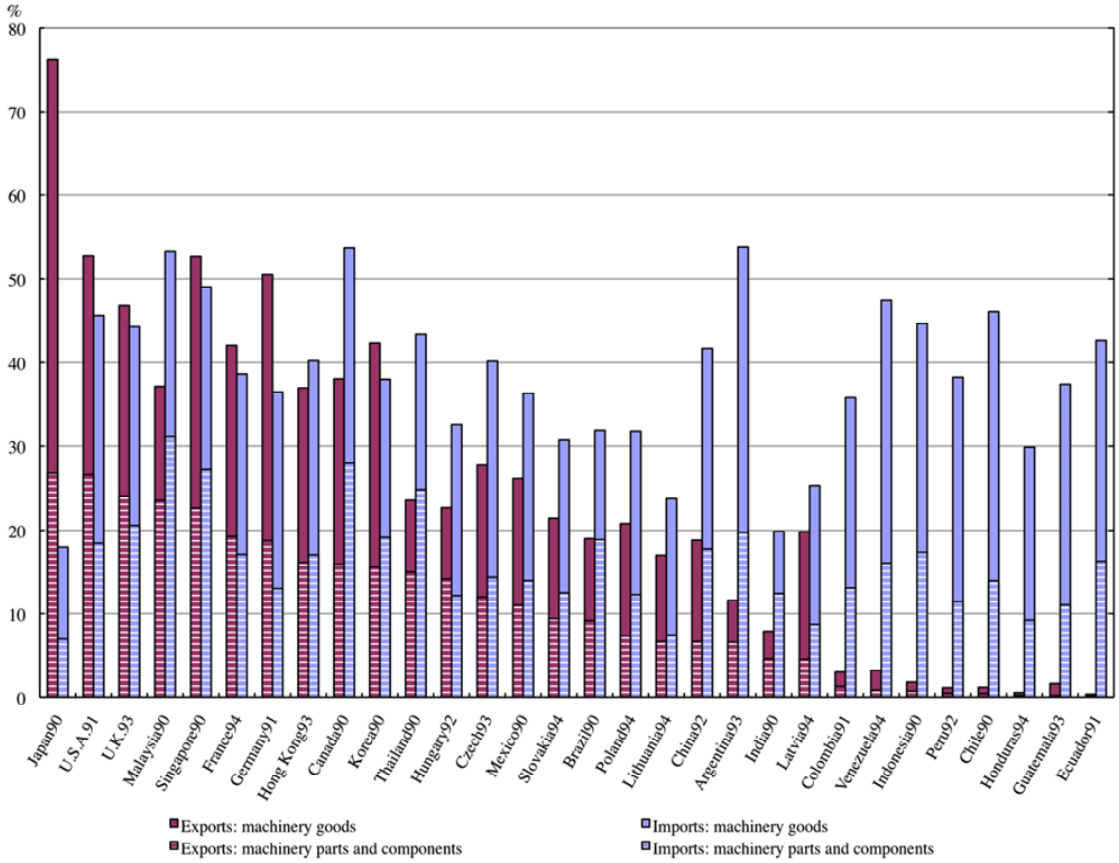


Data: Ando (2006) and Ando and Kimura (2013a).

A large proportion of the above-mentioned machinery parts and components trade in East Asia is intra-regional. Moreover, intra-regional trade values of machinery parts and components *per se* have significantly expanded for both exports and imports, indicating how explosively and rapidly vertical back-and-forth transactions in machinery parts and components had proliferated throughout the region, before the GFC occurred.[5]

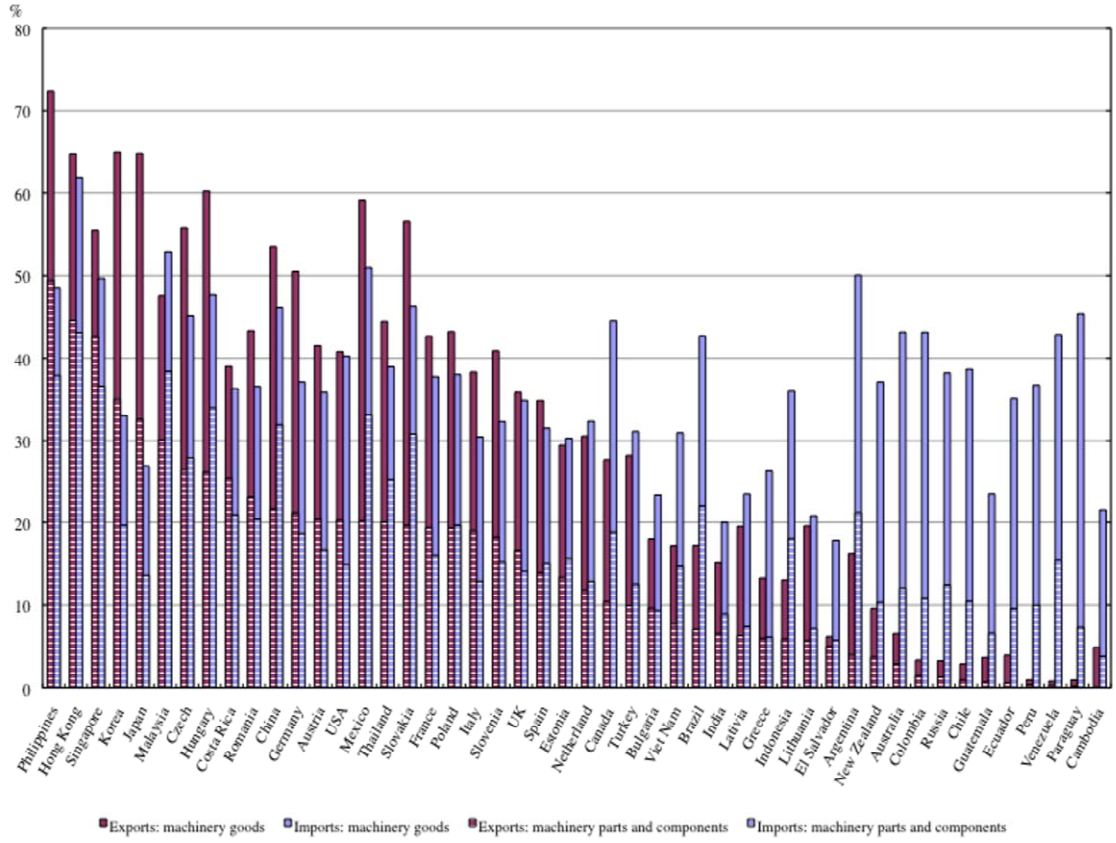
The proportions of machinery trade, in particular machinery parts and components trade, have also grown in a number of countries in other regions. Figures 2 and 3 present the corresponding ratios in selected countries in the world in the early 1990s and 2010; the figures array countries in terms of the export share of machinery parts and components. The ratios of machinery parts and components exports are in particular useful indicators to judge how far the concerned country participates in international production networks in machinery industries. While most countries with higher shares of machinery parts and components exports are developed countries in the early 1990s, they are largely replaced by East Asian developing countries by 2010 with much higher shares. The proportions also grew substantially for some countries in Eastern Europe as well as Mexico.

Figure 2: Machinery Goods and Machinery Parts and Components: Shares in Total Exports and Imports in the early 1990s



Data: Ando (2006).

Figure 3: Machinery Goods and Machinery Parts and Components: Shares in Total Exports and Imports in 2010



Data: Ando and Kimura (2013a).

Moreover, by 1995, the Philippines, Singapore, Malaysia, Korea, and Thailand were already involved in tight production networks in East Asia, with high ratios of parts and components for both exports and imports suggesting active back-and-forth transactions.[6] On the other hand, China took a bit of more time to come in, and Indonesia was far behind. By 2010, however, China significantly moved up to the left with higher shares of machinery parts and components exports, while Indonesia still seems to need more time to a deeper participation in the production networks, even being behind Vietnam.

In East Asia, the formation of industrial agglomeration is motivated by the requirement of geographical proximity in inter-firm fragmentation (Kimura and Ando (2005)). Production networks typically start with intra-firm fragmentation in geographical distance.

As production networks are increasingly sophisticated, however, inter-firm division of labor comes into the architecture. Inter-firm division of labor is typically in geographical proximity because transaction costs between unrelated firms have a strong positive relationship with geographical distance. Typical industrial agglomerations such as Bangkok Metropolitan Area, Pearl River Basin, and Shanghai and its backyard have geographical extension of about 100km diameter where 2 to 2.5 hour-drives by trucks cover the whole area with just-in-time production networks.

3. Industrial Restructuring: Changes in the Extent and Depth of Regional Production Networks[7]

Machinery trade rapidly bounced back from the significant fall caused by the GFC.[8] In other words, there were indeed initial negative impacts from the GFC on regional production/distribution networks, but, at the same time, East Asia's trade has rapidly recovered through the networks. In particular, East Asia itself is a major contributor to such a rapid recovery, in both machinery parts and components and machinery final goods trade (Ando, 2010). As a result, intra-regional trade, particularly intra-regional machinery trade, fell below the 2007 level by only a few percent, despite the huge demand shock experienced throughout the world, at least on a nominal basis at the annual level (Table 2).[9] This finding suggests that regional production/distribution networks possess a resiliency against shocks.[10]

Table 2: Intra-regional Trade of East Asia 9: Value and Share

	Exports					Imports				
Destination/origin	2007	2008	2009	2010	2011	2007	2008	2009	2010	2011
(a) All products										
Value (nominal): 2007=1										
World	1.00	1.13	0.93	1.21	1.41	1.00	1.03	0.83	1.10	1.35
EastAsia15	1.00	1.12	0.95	1.26	1.48	1.00	1.12	0.93	1.23	1.42
Share: World=100										
World	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
EastAsia15	48.1	47.6	49.1	50.0	50.5	53.4	50.2	51.5	51.6	48.7
China	12.6	12.3	13.6	13.9	13.9	14.8	13.9	14.5	13.8	13.2
CLMV	1.5	1.7	1.9	2.0	2.2	0.8	0.9	1.0	0.9	1.1
ASEAN4	7.9	8.2	8.0	8.5	8.7	10.6	10.2	10.2	10.6	10.1
ASEAN5	9.1	9.6	9.5	10.0	10.4	11.3	10.9	11.0	11.3	11.0
ASEAN10	12.9	13.4	13.5	13.8	14.1	14.8	14.5	14.6	14.9	14.4
NIEs4	19.6	18.9	19.2	19.4	19.2	16.6	15.2	15.7	15.9	15.0
Japan	6.5	6.5	6.3	6.1	6.5	10.4	9.9	9.9	10.2	9.1
(b) Machinery parts and components										
Value (nominal): 2007=1										
World	1.00	1.06	0.94	1.19	1.31	1.00	1.05	0.91	1.19	1.27
EastAsia15	1.00	1.04	0.95	1.19	1.30	1.00	1.04	0.90	1.22	1.28
Share: World=100										
World	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
EastAsia15	63.9	62.4	65.1	64.0	63.5	69.9	69.3	69.3	71.3	70.7
China	20.9	20.9	23.6	22.0	22.8	14.2	15.1	15.3	15.1	15.7
CLMV	0.7	0.9	1.1	1.1	1.3	0.3	0.4	0.4	0.5	0.6
ASEAN4	10.5	10.3	9.7	9.8	9.3	12.5	11.7	11.1	11.9	11.2
ASEAN5	11.1	11.1	10.6	10.8	10.5	12.8	12.1	11.5	12.4	11.8
ASEAN10	15.7	15.1	14.8	15.0	14.1	17.2	16.7	16.4	17.1	16.4
NIEs4	26.2	24.7	25.6	26.3	25.2	28.2	27.0	27.9	28.7	28.2
Japan	5.7	5.6	5.1	4.8	4.8	14.7	15.1	14.6	15.1	15.0
(c) Machinery final products										
Value (nominal): 2007=1										
World	1.00	1.11	0.91	1.16	1.29	1.00	1.11	0.99	1.28	1.54
EastAsia15	1.00	1.12	0.99	1.32	1.52	1.00	1.12	0.97	1.29	1.51
Share: World=100										
World	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
EastAsia15	30.4	30.6	33.3	34.7	35.8	58.7	59.0	57.2	59.0	57.8
China	6.2	6.2	6.6	7.4	7.5	23.4	23.1	24.5	25.3	25.5
CLMV	0.9	1.1	1.3	1.3	1.5	0.3	1.3	0.5	0.5	0.7
ASEAN4	4.6	5.0	5.1	5.5	5.7	9.9	10.2	9.9	10.0	9.1
ASEAN5	5.2	5.8	6.1	6.4	6.7	10.2	10.6	10.4	10.5	9.7
ASEAN10	8.4	9.1	9.9	9.6	10.2	13.3	14.5	13.8	13.2	12.6
NIEs4	14.6	14.3	15.6	15.8	16.2	11.4	10.7	10.4	10.0	10.6
Japan	4.2	4.1	4.7	4.7	4.8	13.6	13.7	11.8	13.2	12.0

Data: Ando (2013).

Table 2 also demonstrates important further evidence that the East Asian market is rising in its significance as a market for final products. In a short period from 2007 to 2011, the intra-regional export ratio rose from 30 percent to 36 percent. This rise in the

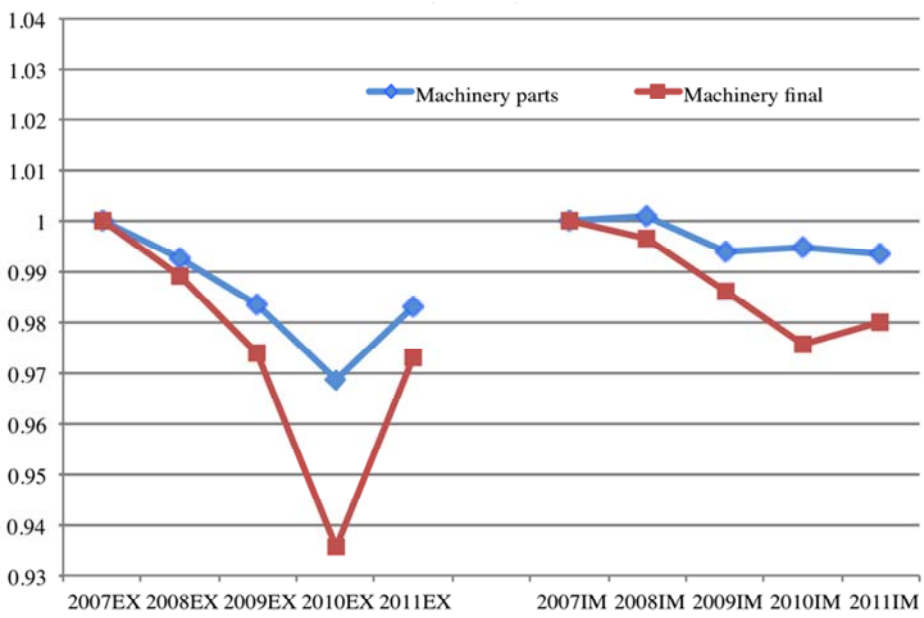
share of intra-regional exports in all exports is not only due to the demand decline in the US and EU but also to an expansion of intra-regional exports in machinery final products *per se*; their exports to the world in 2011 were 1.3 times as large as that in 2007, their intra-regional exports was up 1.5 times. Even on the import side, the intra-regional share for machinery final products were close to 60 percent, and the intra-regional value expanded by 51 percent. Although the inter-regional markets such as those in the U.S and the EU are still important, East Asia is increasingly gaining importance not only as a production site but also as a consumption site for final products that are produced in the regional production/distribution networks.

Focusing on intra-regional trade in machinery goods highlights a change in the composition of trading pairs within the region or the reshuffling of regional production networking. In the period from 2007 to 2011, China and the CLMV saw their shares increase from 20.9 percent to 22.8 percent and from 0.7 percent to 1.3 percent, respectively, while the intra-regional share remained around 64 percent and Japan lost the share from 5.7 percent to 4.8 percent for machinery parts and components. In addition, China and the CLMV increased their shares even for machinery final products, while the Japan' share slightly increased. Note that Viet Nam was the main contributor to the increasing share for the CLMV, as you can guess from the difference between the share for the ASEAN 4 and that for the ASEAN 5 (ASEAN4 plus Vietnam). These suggest the restructuring of production/distribution networks as well as a greater recent participation by the CLMV, particularly Vietnam, in the regional networks, though the degree of participation is still low.

Figure 4 represents the number of machinery products exported to/imported from the world, regardless of partner countries, for nine East Asian countries, and Figure 5 shows the number of exported/imported product-country pairs for intra-regional machinery trade of the same countries.[11] [12] [13] Interestingly, while the number of products exported to the world slightly declined after the GFC, the number of exported product-country pairs for intra-regional trade increased, particularly in 2011. The net increase in the sum of exported

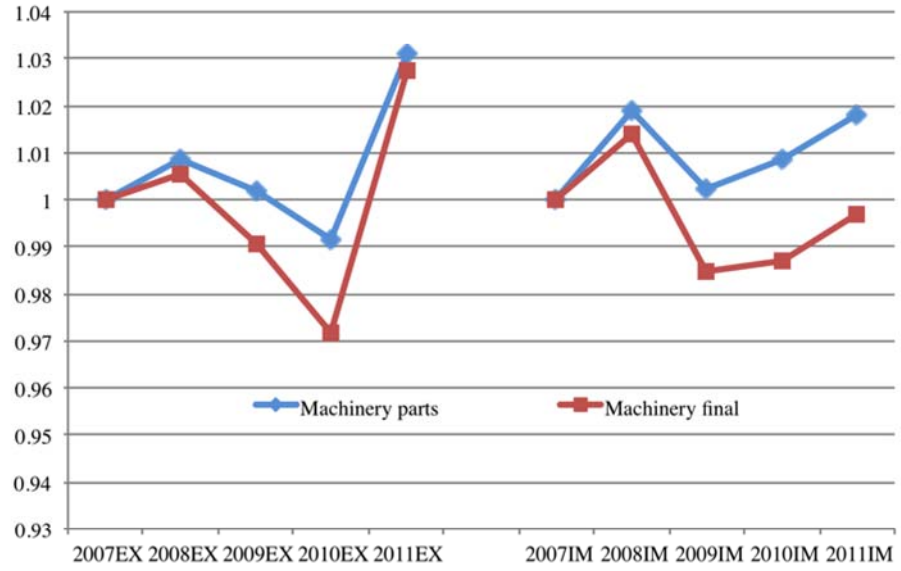
product-country pairs among East Asian countries suggests that some countries began additional trade relationships with certain partners for certain products, and these new trade links exceeded the number of trade relationships ended by some countries.

Figure 4: The Number of Products Traded with the World for East Asia 9 (2007=1)



Note: The number of Products traded with the world is at HS 6 digit level, regardless of partner countries.
Data: Ando (2012).

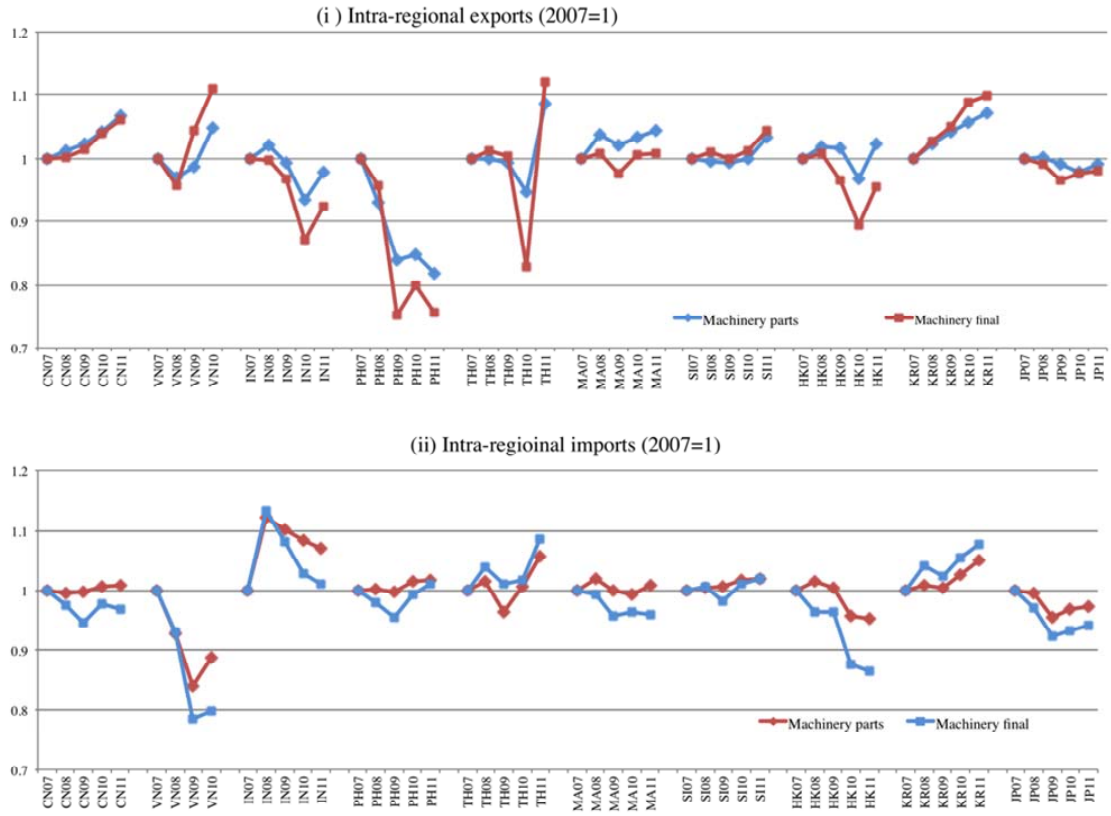
Figure 5: The Number of Exported/Imported Product-country Pairs for Intra-regional Trade: East Asian 9 (2007=1)



Note: intra-regional trading partners are East Asia 15
Data: Ando (2012).

To investigate which countries entered the trading market and exited from it, we first examine changes in the number of exported/imported product-country pairs for each country's trade with the East Asia 15, focusing on machinery trade (Figure 6).[14] China steadily increased its export number in both machinery parts and components, and machinery final products. Moreover, Korea also increased its number for both exports and imports in machinery parts and components as well as machinery final products, suggesting that Korea has become more active within the region. The number for Viet Nam is apparently increasing for exports but decreased for imports. This implies that Viet Nam has begun to be connected into regional production networks and has started new export relationships in place of imports.

Figure 6: The Number of Product-country Pairs for Intra-regional Machinery Trade



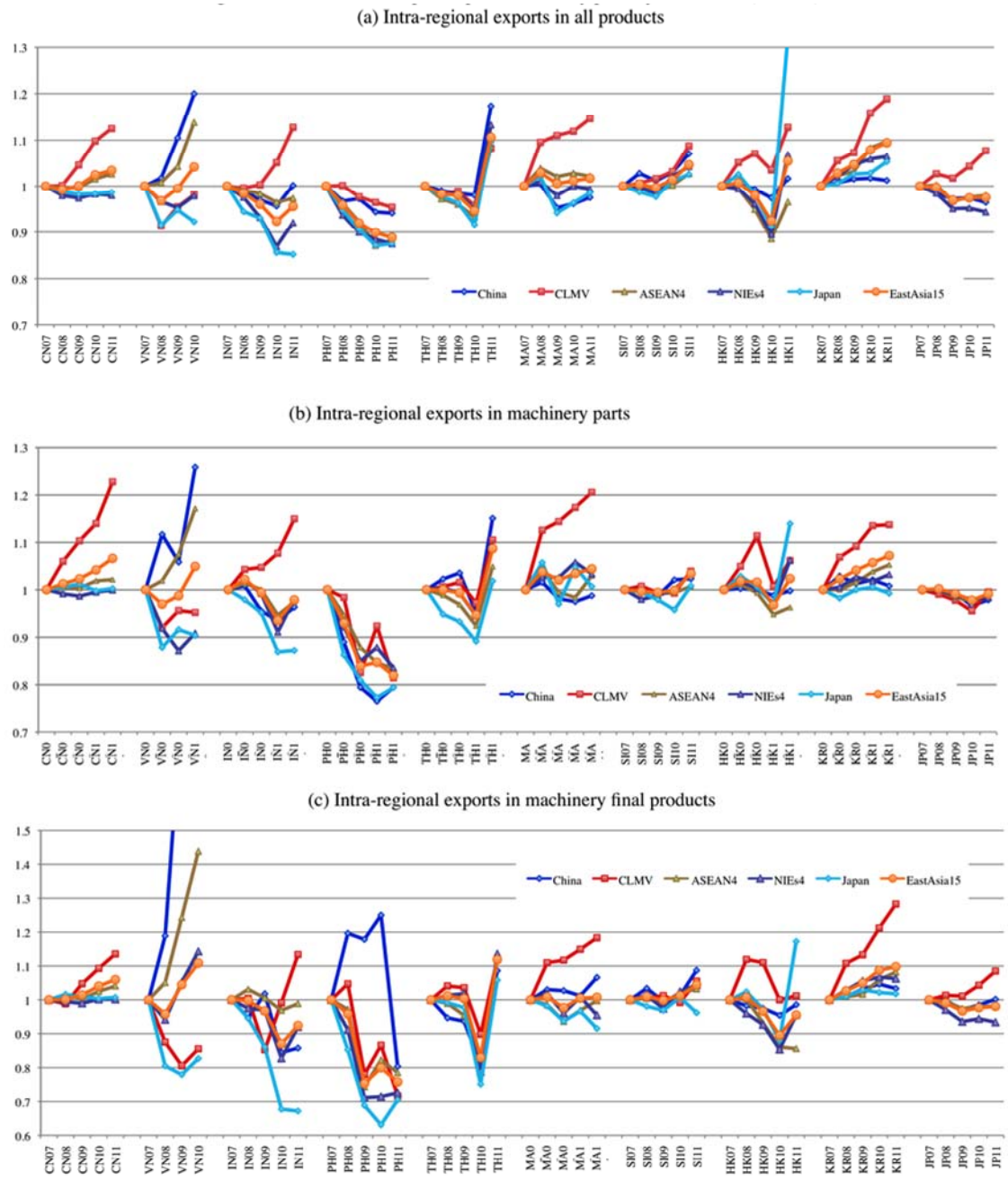
Data: Ando (2012).

On the other hand, the Philippines has tended to reduce its number for machinery exports, suggesting that it may have been loosing its position in the regional production networks in machinery sectors recently. As Figure A.3 shows, the value of machinery exports to the world *per se* has not reduced seriously until 2010, though it is significantly declined in 2011. However, the Philippines' exports are concentrated on the much less number of products compared with other East Asian countries including Vietnam, and the number of exported commodities was further reduced from 2007 to 2011 (Figure A.4). Moreover, the number of product-country pairs for intra-regional exports by the Philippines, which is again less than the number by Vietnam, also tends to decrease (Table A.5). Behind such a significant decline in export value in 2011 and a possible declining trend of the extensive margin, there seem to be several reasons; the recession in Europe and the US in 2011 with a trigger of financial

crisis in Europe resulted in the shrinkage of demand, the imports of integrated circuit by Europe from the Philippines rapidly declined according to the shrinkage of production of electric machinery products in that region, and the origin of the imports of semiconductors such as diode and transistor by Hong Kong to reexport to China shifted from those imported from the Philippines to those such as light emitting diode (LED) imported from Malaysia.[15]

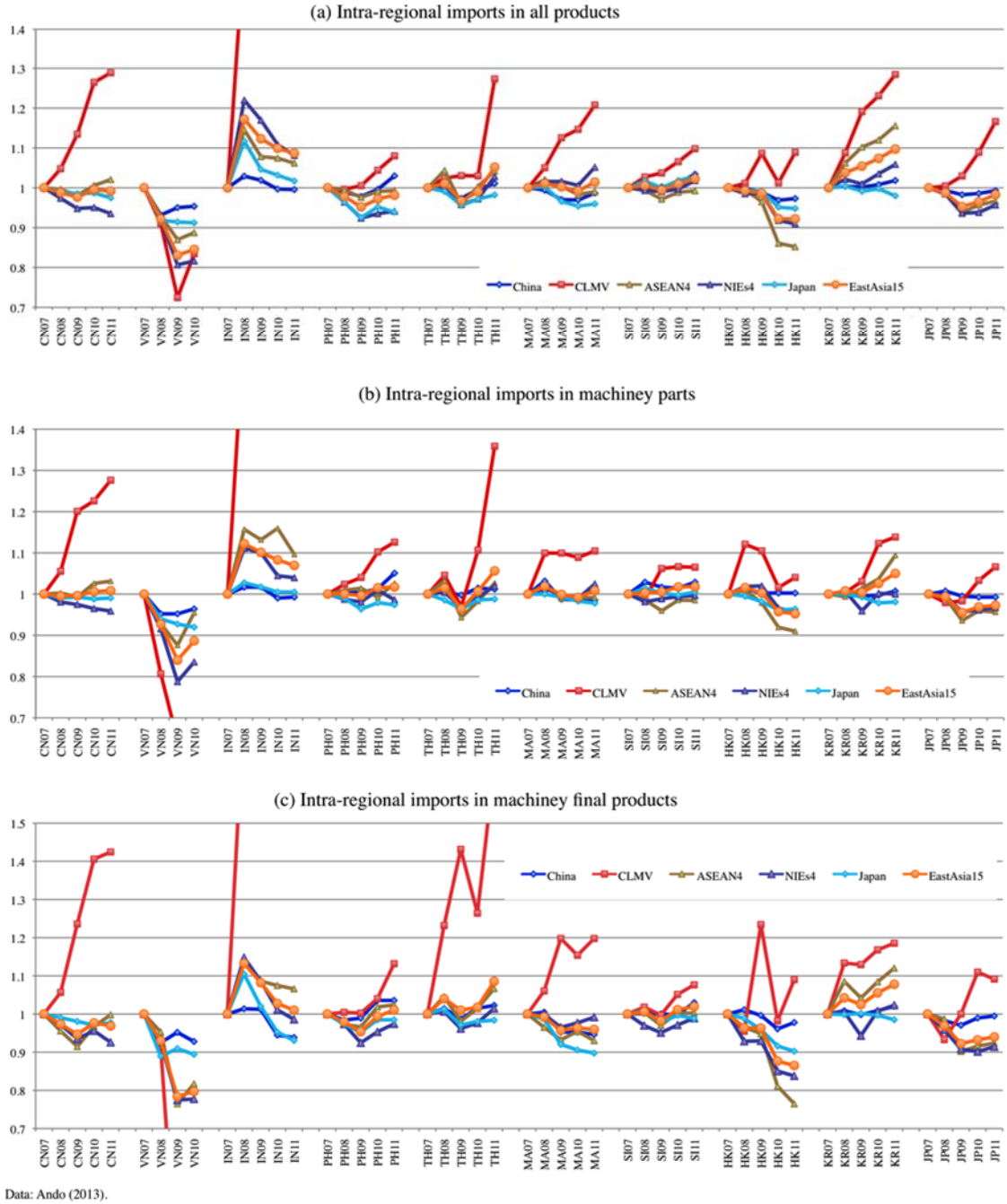
To further examine the restructuring patterns or the extent and depth of regional production networks in terms of extensive margins, we investigate the number of exported product-country pairs by destination for the intra-regional machinery exports of each country; destinations are China, the CLMV, the ASEAN 4, the NIEs 4, Japan, and the East Asia 15 (Figure 7). Figure 8 shows the corresponding number of imported product-country pairs by origin for intra-regional machinery imports. These figures provide several interesting insights. First, the CLMV are rapidly becoming connected to both the machinery exports and imports with other East Asian countries. Of course, the number of products traded with the CLMV was quite small in 2007, compared with other economies/groups, and thus the index for the CLMV as a partner tends to expand to a greater extent. Given this, however, the outstandingly rapid increase in the index for the CLMV implies that these countries, although mainly Viet Nam began to be connected to regional production/distribution networks.

Figure 7: The Number of Exported Product-country Pairs by Destination (2007=1)



Data: Ando (2012).

Figure 8: The Number of Imported Product-country Pairs by Origin (2007=1)



Data: Ando (2013).

Data: Ando (2012).

Second, China has increased in the number of products traded with the ASEAN 4 and the CLMV for both exports and imports in machinery parts and components. On the other hand, the number of machinery final products exported by China to the ASEAN 4 has increased, but

the number imported from the ASEAN 4 has not. These statistics suggest that China is becoming a more important supplier of machinery final products, assembled from machinery parts and components imported from other East Asian countries, particularly from the ASEAN countries.

Third, connections between Viet Nam and China and between Viet Nam and the ASEAN 4 have been strengthening. The index for Viet Nam's exports to China/ASEAN 4 and the index for China's/ASEAN4's imports from the CLMV are increasing, both in machinery parts and components and final products, indicating that some transactions between Viet Nam and China and between Viet Nam and the ASEAN 4 have been started in recent years.

All of the discussion based on extensive margins and trade values/shares suggests that intra-regional trade has been enhanced, and that it has contributed as a boost to quick recovery from the GFC, and that the restructuring of regional production/distribution networks has been accelerated, with the GFC as a trigger.

4. Connectivity from Regional to Global: The Case of the Link with Europe via CEE[16]

In the 1st unbundling, trade in raw materials and finished products is not very sensitive to time costs and thus can occur at a long distance. Trade in parts and components in the 2nd unbundling is quite different in nature. Parts and components must be procured to each production block at the right timing. A slight delay in the arrival of one single part may stop the whole production lines. Subtle coordination is required among multiple production blocks, and service links that connect each production block are crucial, with tight information and communication technology (ICT) connectivity and reliable logistics

connectivity. Therefore, a large portion of machinery parts and components trade occurs in general within a region such as East Asia.

The recent years, however, have witnessed a new phenomenon; significant links between East Asian and European production networks through CEE, that is, production networks across the largest continent emerge.[17] As Tables 3 to 5 show, transactions among CEE countries became much more active than before. In addition, East Asia plays an extremely important role in this sector from the perspective of production sharing in Europe as well. CEE's imports in machinery goods, mainly parts and components, from East Asia notably increased; in the electric machinery sector, the import value grew by 57 times for parts and components and 21 times for final products during the past 15 years. As a result, the import share of East Asia expanded from 10 percent to 45 percent for parts and components and from 18 percent to 40 percent for final products; in particular, the share in Poland exceeds 60 percent for parts and components.[18] On the other hand, the import share of WE shrunk down from 61 percent to 30 percent for parts and components and from 46 percent to 20 percent for final products. These suggest that production networks in this sector obviously expanded from regional to global, with imports of key parts and components as well as finished machinery products from East Asia.

Table 3: The Rankings of CEE5's Trade Partners and Shares in Trade with the World

(i) The electric machinery sector

	1995						2010					
	Total		Parts		Final		Total		Parts		Final	
	Name	%	Name	%	Name	%	Name	%	Name	%	Name	%
1	DEU	32.5	DEU	38.2	DEU	22.0	CHN	22.3	CHN	20.5	CHN	26.3
2	AUT	7.0	AUT	7.7	JPN	7.9	DEU	17.6	DEU	20.2	DEU	11.9
3	GBR	6.1	GBR	6.1	FRA	6.5	KOR	11.1	KOR	13.7	HUN	7.2
4	USA	5.8	USA	5.5	USA	6.3	HUN	4.2	NLD	5.0	KOR	5.1
5	FRA	5.7	FRA	5.2	GBR	6.0	NLD	4.2	JPN	4.0	SVK	4.0
6	ITA	4.6	ITA	4.3	AUT	5.8	JPN	3.7	HUN	2.9	POL	3.4
7	JPN	4.3	KOR	3.7	ITA	5.2	ITA	2.6	ITA	2.7	JPN	3.0
8	KOR	3.4	NLD	3.1	FIN	4.6	AUT	2.3	FRA	2.4	CZE	2.6
9	NLD	2.9	CZE	2.3	SWE	3.2	FRA	2.1	AUT	2.4	ITA	2.5
10	FIN	2.5	JPN	2.3	KOR	2.9	GBR	2.1	GBR	2.2	NLD	2.4
11	SWE	2.5	SWE	2.0	SVK	2.8	SVK	2.0	CZE	1.7	USA	2.1
12	CHE	2.1	BGD	2.0	CHE	2.6	POL	2.0	THA	1.7	AUT	2.0
13	CZE	2.1	CHE	1.8	NLD	2.5	CZE	2.0	MYS	1.6	GBR	1.9
14	SVK	2.0	SVK	1.6	CHN	2.4	USA	1.5	HKG	1.5	ROM	1.6
15	BGD	1.9	HKG	1.5	BGD	1.7	MYS	1.5	POL	1.4	FRA	1.5
16	HKG	1.5	FIN	1.4	CZE	1.6	HKG	1.5	USA	1.3	HKG	1.5
17	CHN	1.2	POL	1.0	MYS	1.6	THA	1.5	ROM	1.2	MYS	1.4
18	ESP	1.2	ESP	1.0	ESP	1.5	ROM	1.4	SVK	1.2	FIN	1.4
19	SGP	1.1	SGP	0.9	HKG	1.5	SWE	0.8	SGP	0.8	IND	1.1
20	POL	0.8	CHN	0.6	SGP	1.4	ESP	0.8	SWE	0.8	UKR	1.1

Note: CEE5 are Czech, Hungary, Poland, Romania, and Slovakia. See Ando and Kimura (2013a) for corresponding tables in all machinery sectors and transport equipment sector.

Data: Ando and Kimura (2013a).

Table 4: By-origin Import Value and Share of Machinery Trade in CEE5

			(a) All machinery sectors			(b) Electric machinery sector			(c) Transport equipment sector		
	Year	Ori.	Total	Parts	Final	Total	Parts	Final	Total	Parts	Final
Value index	2010	World	7.2	10.3	5.0	11.3	12.1	9.8	8.4	12.2	6.4
(1995=1)	2010	Asia	26.3	55.9	13.2	38.8	56.9	21.3	7.6	45.3	3.4
	2010	WE	4.6	6.8	2.9	5.4	5.9	4.2	7.7	12.4	5.2
	2010	CEE	11.8	11.5	12.2	24.5	18.5	36.1	10.0	10.0	9.9
Share	1995	Asia	8.7	6.3	10.4	12.6	9.5	18.1	10.0	3.0	13.7
(in total (%))	1995	WE	59.0	61.8	56.9	55.8	61.4	45.6	57.5	59.4	56.5
	1995	CEE	6.5	8.7	4.8	5.3	5.4	5.1	11.1	18.5	7.3
	2010	Asia	31.5	33.9	27.9	43.2	44.9	39.5	9.0	11.0	7.1
	2010	WE	37.7	40.5	33.5	26.8	29.9	19.8	52.8	60.4	45.5
	2010	CEE	10.5	9.6	11.9	11.5	8.3	18.7	13.1	15.2	11.1

Data: Ando and Kimura (2013a).

Table 5: By-origin Import Value and Share of Electric Machinery Parts and Components

	Year	Ori.	Czech	Hungary	Poland	Romania	Slovakia
Value index	2010	World	8.4	16.9	9.6	12.9	24.6
(1995=1)	2010	Asia	50.8	112.6	54.4	7.5	210.6
	2010	WE	3.6	8.0	4.1	11.9	13.4
	2010	CEE	12.2	47.9	35.1	100.3	6.6
Share	1995	Asia	6.7	6.9	11.2	25.3	5.2
(in total (%))	1995	WE	70.9	66.1	52.5	51.9	44.1
	1995	CEE	5.7	2.0	1.7	2.7	30.8
	2010	Asia	40.8	45.8	63.4	14.7	44.1
	2010	WE	30.4	31.4	22.6	47.9	24.1
	2010	CEE	8.3	5.6	6.1	21.0	8.3

Data: Ando and Kimura (2013a).

The import share of East Asia for parts and components in the transport equipment sector is much lower than the corresponding share in the electric machinery sector, though the share increased from three percent to 11 percent.[19] In addition, the export share of East Asia remains small with one to three percent for both sectors, though the export value expanded by 11 times (29 times) for parts and components and 46 times (12 times) for final products in the electric machinery sector (the transport equipment sector). These also emphasize that production networks expanded from regional to global with a stronger connection with East Asia on the import side in the electric machinery sector, but not so in the transport equipment sector with the exception of Slovakia.

Table 6 shows the results of gravity estimation for the electric machinery sector in 1995 and 2010, with a distinction between machinery parts and components and final products. This table confirms that the CEE's connection with East Asia is strong and becomes tighter, particularly from the perspective of imports in parts and components in the electric machinery sector. The coefficient for East Asia is positive and mostly statistically significant. In addition, the coefficient is much greater for the electric machinery sector than the transport equipment sector when the results in the same years are compared, and the coefficient became

larger particularly for trade in parts and components.[20] With a control of distance and other economic conditions, these results suggest that the CEE's connection with East Asia is stronger for both sectors than the average predicted by the model, which is particularly true for the electric machinery sector.

Table 6: Gravity Model Estimations for Machinery Imports of CEE: The Electric Machinery Sector

	1995			2010		
Independe	Total	Extensive	Intensive	Total	Extensive	Intensive
i) Machinery parts and components						
Constant	-21.52 **	-0.10	-21.07 ***	-38.36 ***	-15.09 ***	-22.40 ***
	(9.26)	(2.09)	(7.88)	(9.37)	(2.34)	(7.39)
Distance	-2.67 ***	-0.71 ***	-1.94 ***	-2.53 ***	-0.68 ***	-1.82 ***
	(0.20)	(0.05)	(0.17)	(0.19)	(0.05)	(0.15)
GDPi	0.13	-0.21 ***	0.33	1.05 ***	0.40 ***	0.66 **
	(0.36)	(0.08)	(0.30)	(0.34)	(0.08)	(0.27)
GDPj	1.83 ***	0.46 ***	1.37 ***	1.61 ***	0.46 ***	1.13 ***
	(0.10)	(0.02)	(0.09)	(0.10)	(0.02)	(0.08)
GDPpcij	0.33 **	0.16 ***	0.16	0.25	0.13 ***	0.10
	(0.16)	(0.04)	(0.14)	(0.18)	(0.05)	(0.14)
Asia	6.06 ***	1.46 ***	4.55 ***	6.89 ***	1.69 ***	5.08 ***
	(0.77)	(0.17)	(0.65)	(0.71)	(0.18)	(0.56)
Adj R2	0.614	0.680	0.542	0.584	0.635	0.529
ii) Machinery final products						
Constant	-19.55 **	0.74	-19.94 **	-49.23 ***	-15.45 ***	-33.33 ***
	(9.13)	(2.00)	(7.88)	(9.20)	(2.07)	(7.50)
Distance	-2.56 ***	-0.64 ***	-1.92 ***	-2.51 ***	-0.63 ***	-1.83 ***
	(0.20)	(0.04)	(0.17)	(0.19)	(0.04)	(0.15)
GDPi	0.10	-0.24 ***	0.34	1.27 ***	0.38 ***	0.89 ***
	(0.35)	(0.77)	(0.30)	(0.33)	(0.07)	(0.27)
GDPj	1.66 ***	0.41 ***	1.25 ***	1.77 ***	0.45 ***	1.29 ***
	(0.10)	(0.02)	(0.09)	(0.10)	(0.02)	(0.08)
GDPpcij	0.48 ***	0.20 ***	0.27 *	0.25	0.13 ***	0.07
	(0.16)	(0.03)	(0.14)	(0.18)	(0.04)	(0.15)
Asia	7.04 ***	1.70 ***	5.29 ***	6.41 ***	1.54 ***	4.71 ***
	(0.76)	(0.17)	(0.66)	(0.70)	(0.16)	(0.57)
Adj R2	0.607	0.683	0.530	0.613	0.678	0.558

Notes: Figures in parenthesis are t value. *** indicates that the results are statistically significant at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level. Number of observations is 460. The results using PPML estimation and the results for transport equipment sector are available in Ando and Kimura (2013a).

Data: Ando and Kimura (2013a).

Moreover, CEE's imports from East Asia enlarged not only due to an expansion of the import value per product but also due to an increase in the number of imported products. The above-mentioned feature is observed not only for the total value of imports but also for the number of imported products (extensive margin) as well as the import value per product (intensive margin). It implies that CEE's imports from East Asia grow not only as the results of an expansion of the trade value per product but also as the results of an increase in the number of variety. Following the further development and restructuring of production networks in East Asia involving many countries at different income levels, the production networks in Europe have expanded even beyond the region, in a strong connection with many East Asian countries.

As Table 3 clearly confirm, many East Asian countries are ranked in the top 20 origins of imports for CEE5 in 2010, particularly in the electric machinery sector; among East Asian countries, China, Korea, and Japan (Korea and Japan) have distinctive high rankings in the electric machinery sector (transport equipment sector). Multinational enterprises (MNEs) in WE establish their manufacturing affiliates in CEE, and such moves are accelerated after the accession of CEE to the EU. In the dominance of East Asia in electronics industry, MNEs in WE start introducing massive electronic parts and components by importing from their affiliates and/or unrelated firms in East Asia and using them for their production in CEE. Moreover, in forming industrial agglomerations in CEE, particularly in automobile industry, machinery parts and components imported from East Asia also play an important supplementary role. In addition, MNEs originated from East Asia such as Japanese and Korean conduct FDI in CEE and intensify sourcing from East Asia.[21] These end up with tight production links between East Asia and CEE to serve for the market in WE, particularly after the EU enlargement. We observe the emergence of connectivity from the East end of the largest continents to the West end, bridged by CEE.

5. Opportunity and challenges for ASEAN

In the past decade, less developed countries (LDCs) all over the world could experience rapid economic growth. The basis for economic growth, however, widely varied across regions. Many LDCs including Sub-Saharan African countries enjoyed income growth by resource investment and currency appreciation by taking advantage of resource price hike. On the other hand, most of ASEAN and the East Asian countries steadily grew based on manufacturing and other productive sector growth with utilizing the mechanics of production networks. While we observed drastic wage hikes in the US$ term in other parts of the world including Africa, Eastern Europe, and Latin America, wage levels in ASEAN and East Asia are mostly competitive due to the mild terms of trade aggravation and resource moves from informal to formal sector. The dominance of ASEAN and East Asia at the front of industrialization seems to be even more solid in the coming decade.

ASEAN should be proud of almost completing a novel, revolutionary development model, together with Northeast Asia, showing how LDCs can move up from poverty to prosperity. ASEAN is in a position of exploring the potential of the mechanics of production networks or the 2nd unbundling. Countries/regions that have not fully come into production networks yet have to find bottlenecks, remove them, and participate in a new realm of the 2nd unbundling. Countries/regions that have already come into production networks must exploit positive economies of agglomeration, make local small and medium enterprises (SMEs) participate in production networks, and upgrade innovation. Although a full scenario of moving up from mid-income to fully developed economy has not yet been established, utilizing the mechanics of the 2nd unbundling is certainly an advantage for ASEAN.

More specifically, this study suggests that each ASEAN member state and ASEAN as a whole faces the following challenges in taking advantages of the mechanics of production networks or the 2nd unbundling:

Cambodia, Laos, and Myanmar – Now is the time for Cambodia, Laos, and Myanmar to come into production networks in machinery industries. Identify and remove bottlenecks to participate in production networks; check network set-up costs, service link costs, and production costs *per se*. Typically, it is necessary to facilitate/promote foreign direct investment (FDI), liberalize/facilitate trade, enhance physical/institutional connectivity, and provide economic infrastructure services such as electricity supply and industrial estate services. Once some FDI comes in, the accumulation of trouble-shootings will improve investment climate, and more FDI will follow.

Viet Nam, Indonesia, and the Philippines – Although Viet Nam and Indonesia recently increase the involvement in international production networks in machinery industries, the degree of participation should be deepened much more. It is still necessary to find bottlenecks by checking network set-up costs, service link costs, and production costs *per se*. In case of the Philippines, the proportion of machineries in exports and imports is already high, but the extensive margin or the scope of machinery industries is still narrow. Further FDI promotion in a wider scope is necessary. At the same time, these three countries start forming industrial agglomerations. To make them efficient and capture positive externalities, it is necessary to make proper physical designing of metropolitan areas and foster local firms to come into production networks.

Thailand and Malaysia – Thailand and Malaysia have fully participated in international production networks in machinery industries and have successfully formed industrial agglomerations. Now they need to take advantage of positive agglomeration effects. This is an uncharted territory of a new development model. Although it is not easy to draw a complete picture of development strategies, they at least have to encourage local firms to participate in production networks, allow them to get access to technological information and finance, upgrade innovation, and transform their industrial structure.

Singapore – Singapore has already reached a group of developed countries. It will continuously be strategic to seek a proper positioning in ASEAN and East Asia and explore a new type of development model.

Brunei – Brunei may not need to be industrialized but would certainly like to set a long-term goal in which the current level of resource dependency may not be sustained forever.

ASEAN as a whole – Attractiveness in investment climate is the strength of ASEAN. The deepening of economic integration in ASEAN and with its neighboring countries enhances the effectiveness of its development model with taking advantage of the mechanics of production networks or the 2nd unbundling.

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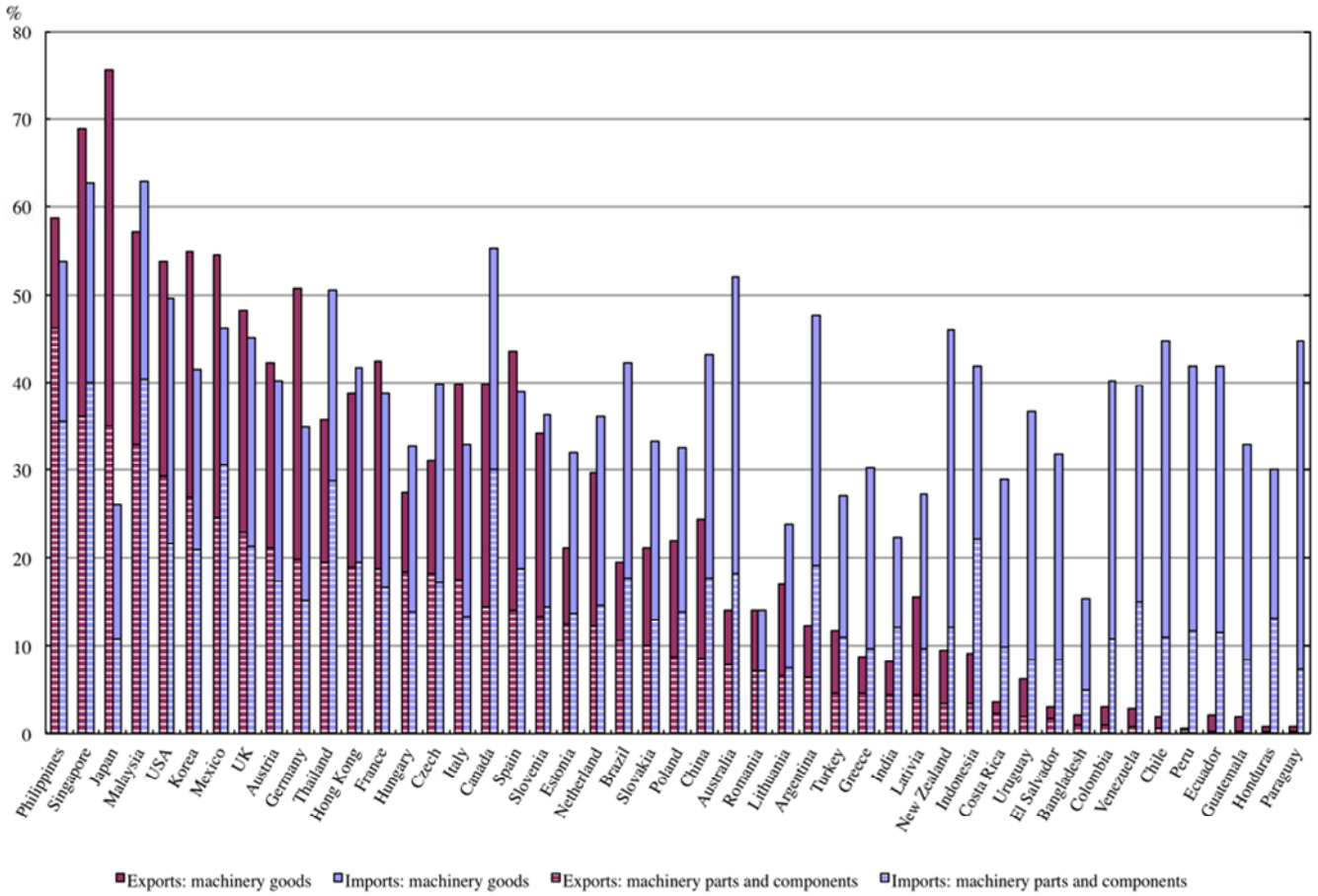
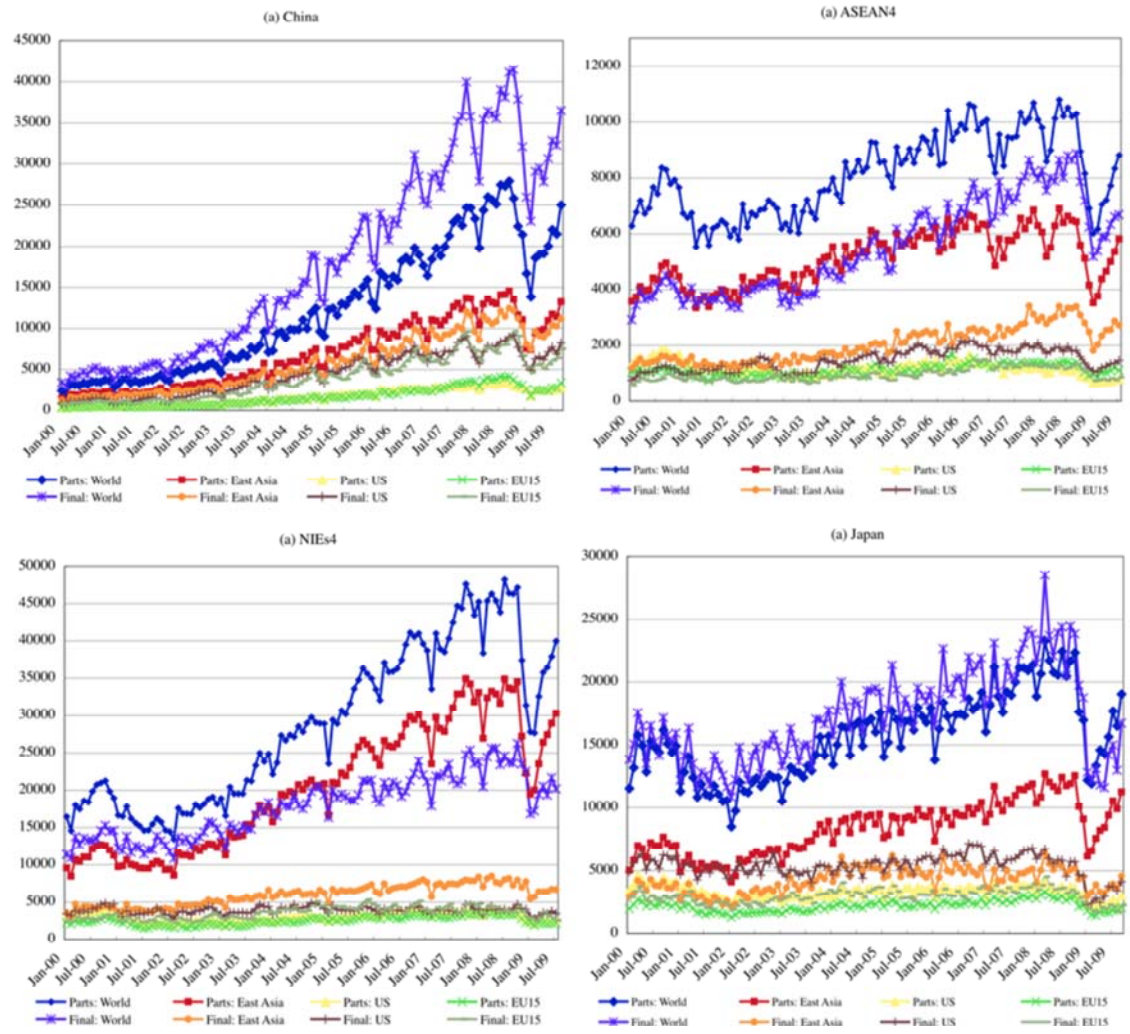
Figure A.1: Machinery Goods and Machinery Parts and Components: Share in Total Exports and Imports in 1995



Note: The data for the Philippines is for 1996 due to lack of data for 1995.

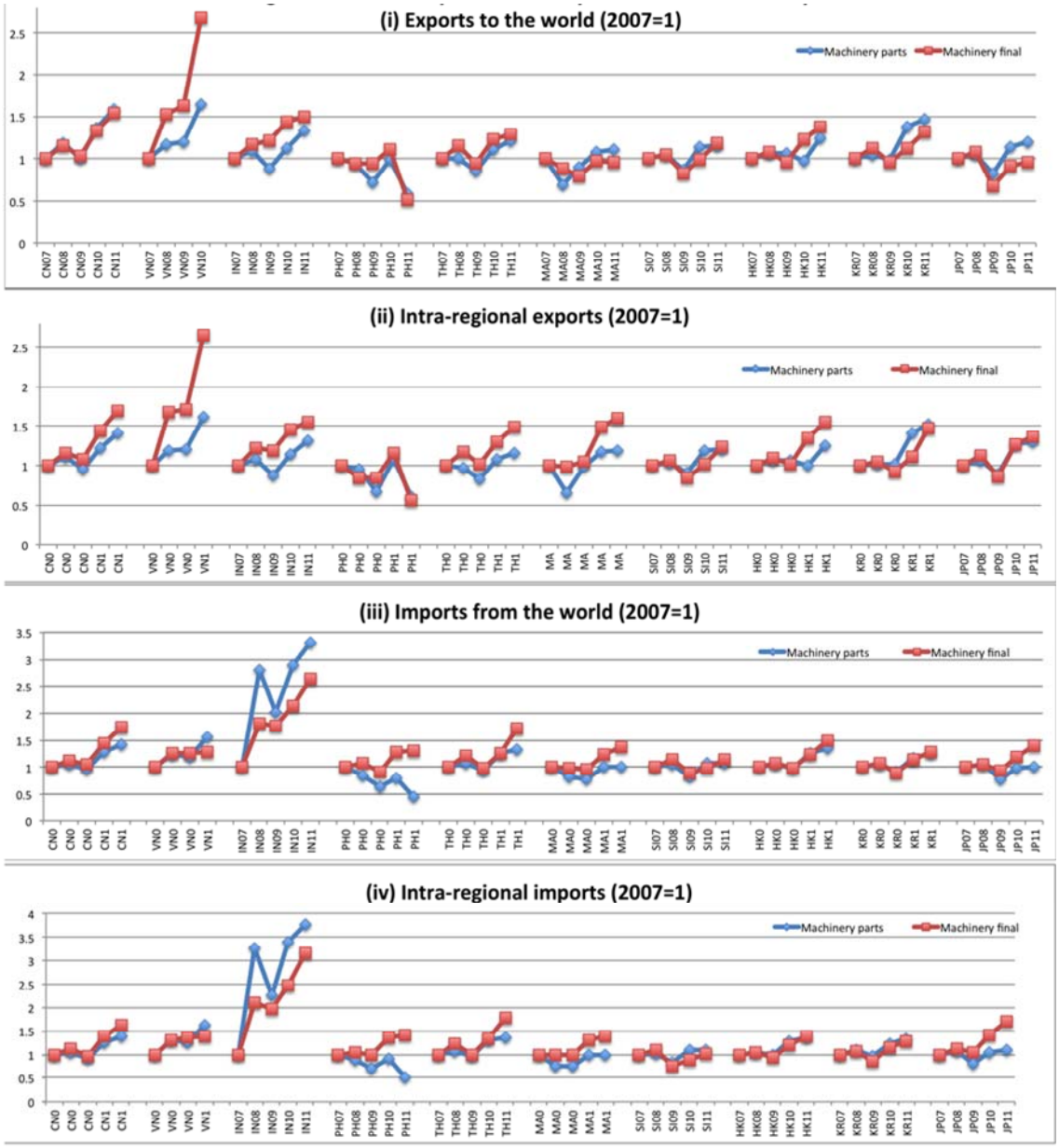
Data: Ando and Kimura (2013a).

Figure A.2: Monthly Machinery Trade since 2000 for East Asia: Exports (millions US$)



Data: Ando (2010).

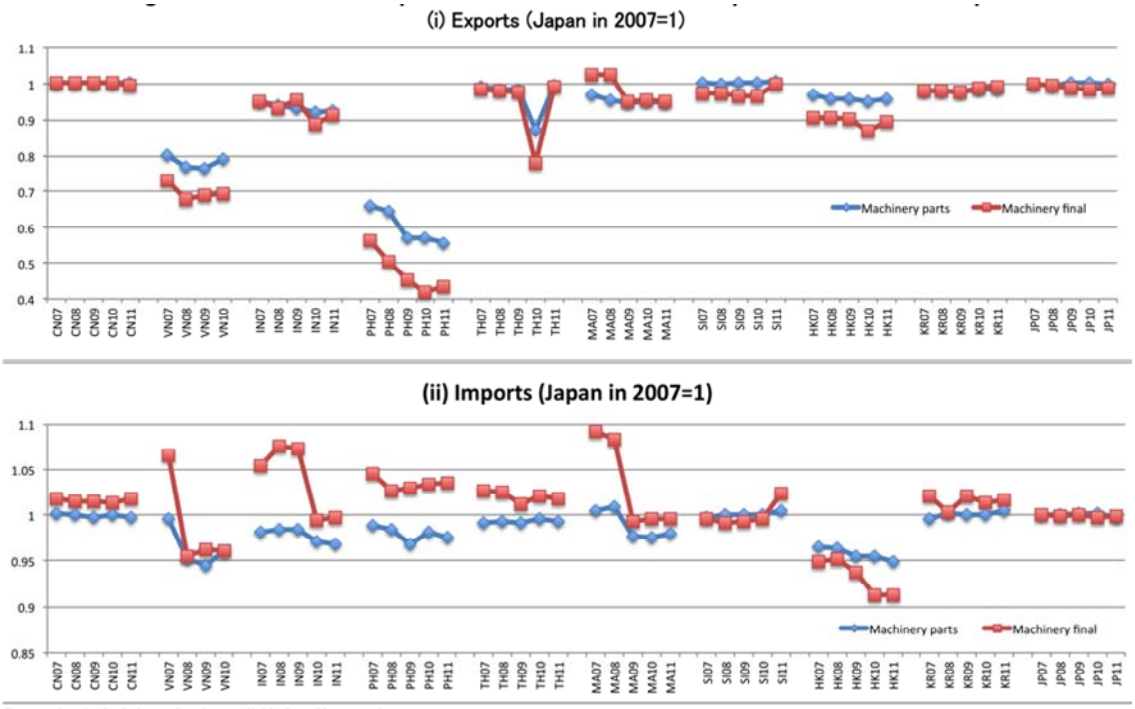
Figure A.3: Machinery Trade Value by Each East Asian Country



Note: the number of products traded with the world for figures (1) and (iii) is at HS 6 digit level, regardless of partner countries.

Data: authors' calculation, using data available from Uncomtrade.

Figure A.4: The Number of Products Traded with the World by Each Asian Country



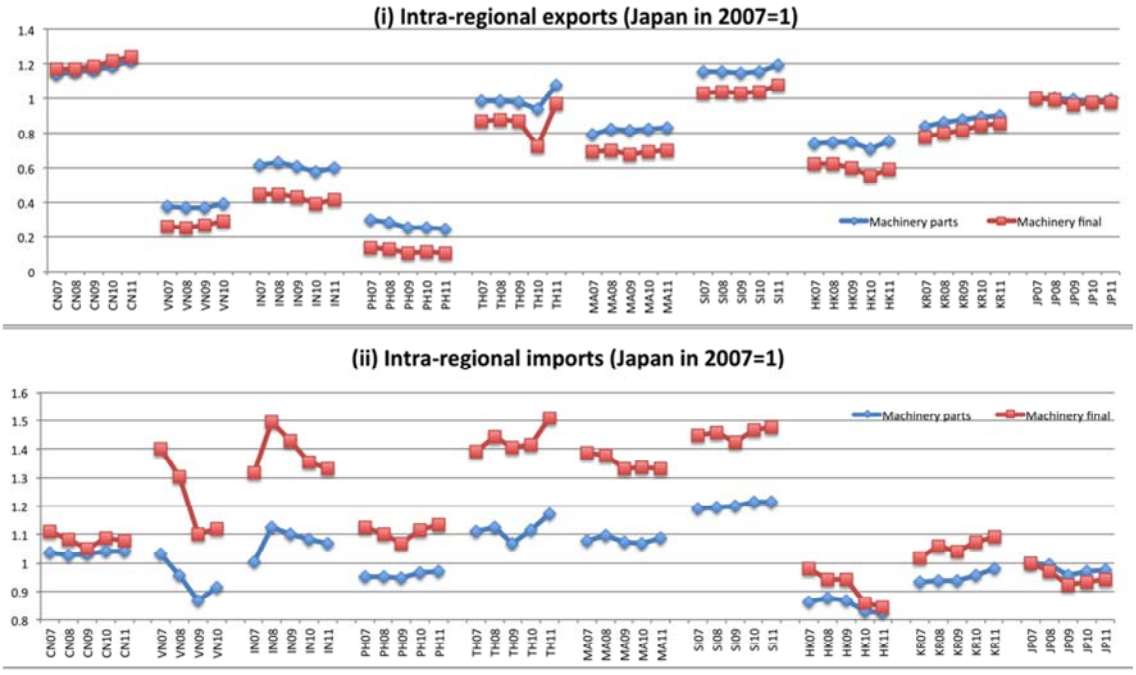
Data: authors' calculation, using data available from Uncomtrade.

Note: the number of products traded with the world is at HS 6 digit level, regardless of partner countries.

Note: the number of products traded with the world for figures (1) and (iii) is at HS 6 digit level, regardless of partner countries.

Data: authors' calculation, using data available from Uncomtrade.

Figure A.5: The Number of Products-country pairs for Intra-regional Machinery Trade



Data: authors' calculation, using data available from Uncomtrade.

ENDNOTES

[1] Ando, Arndt, and Kimura (2009) demonstrated these evidences, using the firm level data of the Japanese and U.S. firms in Latin America, mainly in Mexico.

[2] See, for instance, Ando and Kimura (2005, 2009) for sophisticated features of production networks in East Asia.

[3] In this paper, machinery goods are composed of general machinery, electrical machinery, transport equipment, and precision machinery (Harmonized System (HS) 84-92). See Ando and Kimura (2013) for the definition of machinery parts and components. The machinery final products are regarded as machinery goods other than machinery parts and components.

[4] See Jones and Kierzkowski (1990, 2001), Arndt and Kierzkowski (2001), and Deardorff (2001) for the fragmentation theory. For the two-dimensional fragmentation, see Kimura and Ando (2005).

[5] In the 1990s, vertical transactions, particularly back-and-forth transactions of parts and components in vertically fragmented production processes across borders, rather than the trade of quality-differentiated commodities that is supported by the theoretical model of intra-industry trade with vertical product differentiation, were drastically expanded in East Asia (Ando, 2006).

[6] See Figure A.1 in the Appendix for machinery shares in 1995.

[7] This section is mostly drawn from Ando (2012).

[8] See Figure A.2 for the case of monthly exports.

[9] In Table 2, the East Asia 9 consists of the East Asia 10 excluding Taiwan. The East Asia 10 including China, the ASEAN4 (Indonesia, the Philippines, Thailand, and Malaysia), the Newly Industrializing Economies (NIEs) 4 (Korea, Hong Kong, Singapore, and Taiwan), and Japan. The East Asia 15 is composed of China, the ASEAN10, Korea, Hong Kong, Taiwan, and Japan. Due to the availability of data, we set the trading countries as the East Asia 9 and trading partners as the East Asia 15. Note that Taiwan is not explicitly included in the UNcomtrade database, but trade with Taiwan is said to be close to that for "other Asia, not elsewhere specified (nes)" (shown only as a partner country). Therefore, Taiwan is included here as a partner, considering that Taiwan is one of the important economies for regional production networks. The CLMV countries are Cambodia, Laos, Myanmar and Vietnam.

[10] See Ando and Kimura (2012) for the analysis on the resiliency of regional production networks in East Asia from the perspective of Japanese exports.

[11] The number of products is expressed as an index based on the number in January 2007; the number of exported products for all products, regardless of partner countries, at the HS 6-digit level was 39,069, and the corresponding number of imported products was 43,057.

[12] The number of exported product-country pairs for intra-regional trade of all products at the HS 6-digit level in January 2007 was 252,865, and the corresponding number of imported product-country pairs was 228,531.

[13] Figure A.3 in the Appendix show the value of trade with the world and the value of intra-regional trade for 10 East Asian countries, which are expressed as the ones indexed to the 2007 level of each country.

[14] Figures A.4 and A.5 present the number of products traded with the world and the number of traded product-country pairs for intra-regional trade by each East Asian country, regardless of partner countries, as the ones indexed to the 2007 level in Japan. These figures help to understand the relative level of a concerned country's involvement in the production networks.

[15] See JETRO (2012) for more detailed discussion on a significant decline of electric machinery exports in 2011.

[16] This section is based on the analysis in Ando and Kimura (2013a).

[17] Ando and Kimura (2013b) conduct a similar data analysis on the production link between East Asia and North America and demonstrate that the expanding fragmentation of production in North America with a strong connection of Mexico, in addition to the US, with imports from East Asia, particularly in the electric machinery sector.

[18] While the import share of East Asia is high in 2010 for Czech (41 percent for parts and components and 43 percent for final products), Hungary (46 percent and 41 percent), Poland (63 percent and 47 percent), and Slovakia (44 percent and 25 percent), the share is not so high for Romania with 15 percent and 31 percent, respectively. Instead, Romania's import (export) share of CEE increased from three percent to 21 percent (from one percent to 14 percent) for parts and components and from two percent to 17 percent (from one percent to 12 percent) for final products. These suggest that the direct connection of Romania with East Asia is not so strong but transactions with other CEE countries became much more active for both imports and exports.

[19] For Slovakia, the import share of East Asia for parts and components in the transport equipment sector increased from one percent in 1995 to 18 percent in 2010, which is much higher than the corresponding shares for other CEE countries.

[20] See Ando and Kimura (2013) for the results for the transport equipment sector.

[21] One of the most significant factors behind FDI in CEE by Japanese firms is the proximity to their customers in WE. Since parts and components are highly customized, and closer communication with suppliers is important particularly in Europe, firms need to locate nearby to conduct vertical and flexible adjustment. Japanese machinery affiliates in CEE often sell their parts and components to WE to be used in the final stage of production in WE considering the rules of origin of EU and high tariffs imposed on some final products by EU, particularly before the EU expansion, instead of conducting the final stage in CEE. The EU enlargement significantly changed locations of production blocks within Europe.

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