Chapter 8

East Asian Production Networks and Lessons for Agriculture

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CHAPTER 8

EAST ASIAN PRODUCTION NETWORKS AND LESSONS FOR AGRICULTURE

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Introduction

Intricate trading networks have emerged in East Asia, developed by Japanese multinational corporations (MNCs) seeking to maintain price competitiveness as the yen appreciated by 60% in the 1980s. Japanese corporations tried to lower production costs by relocating factories to lower-cost locations. These foreign direct investment (FDI) flows not only reduced costs but also transferred technological and managerial know-how, increased local procurement, multiplied trade in intermediate goods, and strengthened distribution networks (Gaulier et al., 2005). These value chains have multiplied efficiency gains and caused prices of consumption goods to drop.

The slicing up of the value chain in East Asia is particularly sophisticated and well-developed. It involves complicated combinations of intra-firm trade, arms-length transactions, and outsourcing (Kimura and Ando, 2005). Borrus et al. (2000: 2) have provided a definition of these value chains:

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

Production activities within these networks can be fragmented into individual modules, and the modules can be allocated to different locations based on differences in comparative

advantage. For instance, research and development and technology-intensive activities can be performed in advanced countries and labour-intensive assembly can be performed in lower-wage countries. This type of trade is vertical intra-industry trade. It differs from the trade in final goods emphasised by Ricardian and Heckscher-Ohlin models of international trade. Kimura and Ando (2005) have developed a theoretical model to explain how these trade–FDI–technology linkages can be promoted. In their framework, firms fragment production when the cost saving arising from fragmenting production exceeds the costs of linking geographically separated production blocks. This latter cost is called the service link cost, which can be lowered by, inter alia, improving infrastructure, educating workers, strengthening the rule of law and the enforcement of contracts, protecting intellectual property, and ameliorating information asymmetry problems. Within the manufacturing sector, value chains in Asia have exploded, promoting technology transfer and development in emerging Asia and causing prices of final goods to tumble. However, within the agricultural sector, similar value chains have yet to emerge.

This paper first recounts the emergence and evolution of production networks in manufacturing and then seeks to draw suggestions for agriculture. The next section examines the emergence of production networks in Asia. Section 3 considers China, which has become more and more central in global value chains. Section 4 discusses the agricultural sector in Asia. Section 5 concludes.

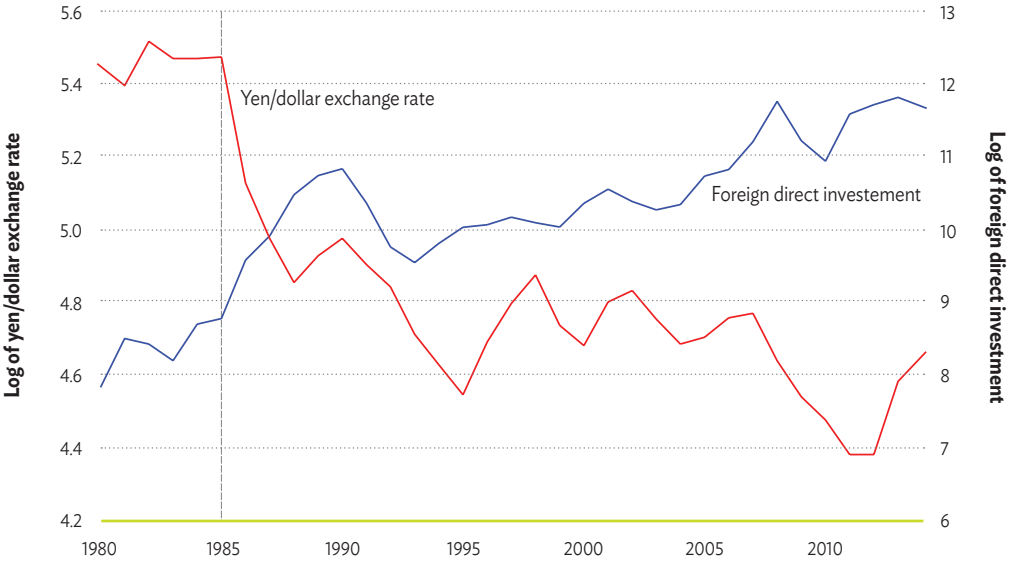
The Emergence of Production Networks in East Asia

On 22 September 1985, France, Germany, Japan, the United Kingdom (UK), and the United States (US) agreed to push down the value of the dollar in an attempt to reduce large US trade deficits with Germany, Japan, and other countries.

The Japanese yen subsequently appreciated by more than 50% and Japanese exporters lost their price competitiveness. To reduce costs, Japanese firms transferred labour-intensive operations to lower-wage countries. They continued to produce technology-intensive parts and components domestically and shipped these abroad for assembly and re-export (Figure 1).

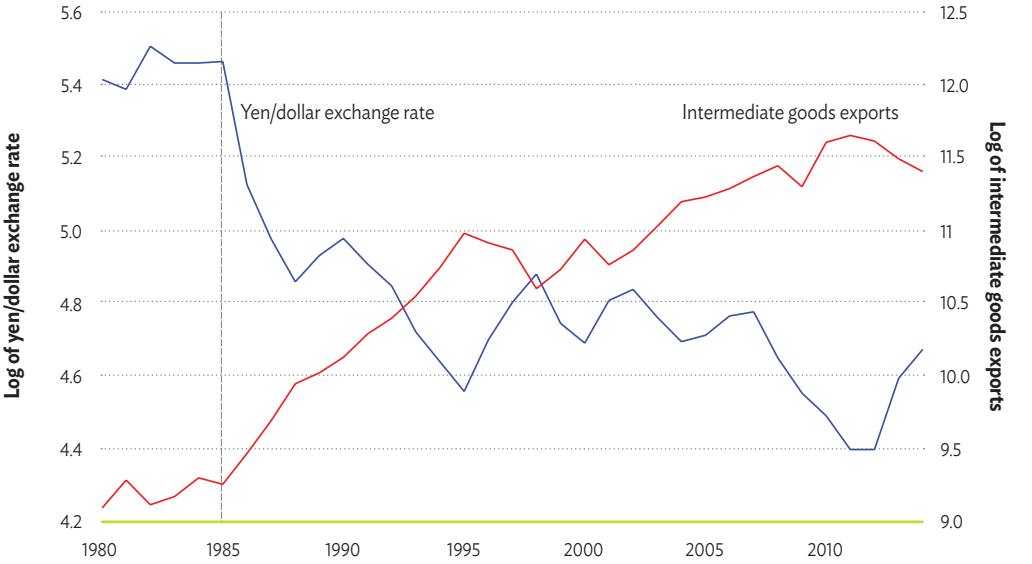
Figure 1 shows that as the yen began appreciating, Japanese FDI increased logarithmically by 50% as Japanese MNCs began transferring factories abroad. Figure 2 shows that as the yen appreciated, exports of parts and components – all intermediate goods – to East Asian neighbors soared. Where did these goods go?

Figure 1: Yen-Dollar Exchange Rate and Japanese Outward Foreign Direct Investment



Source: CEPII-CHELEM database, 2015.

Figure 2: Yen–Dollar Exchange Rate and Japanese Intermediate Goods Exports to East Asia



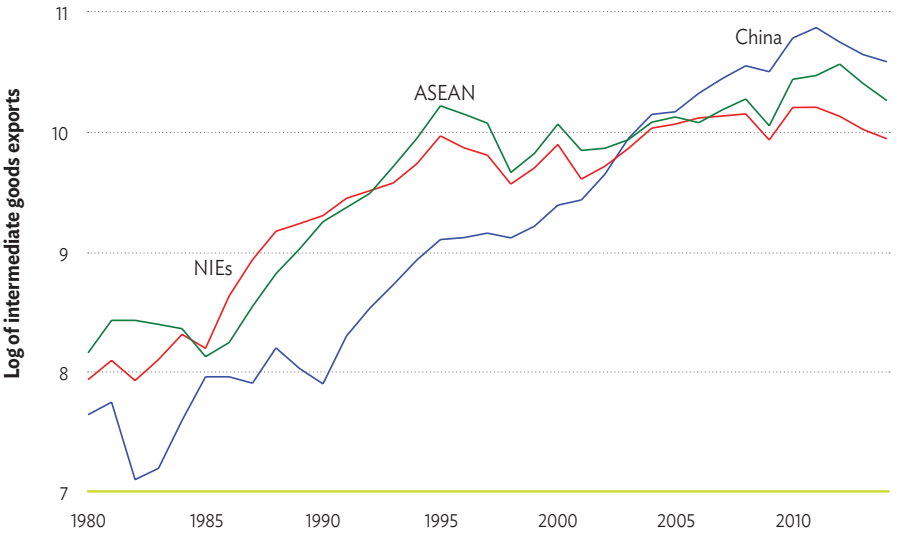
Note: East Asia includes China, Malaysia, Indonesia, the Philippines, Singapore, Republic of Korea, Taiwan, and Thailand.

Source: CEPII-CHELEM database, 2015.

Figure 3 and Figure 4 show that initially, intermediate goods and FDI went largely to the newly industrialised economies (NIEs) of the Republic of Korea and Taiwan. The infrastructure was good in these countries, the work force disciplined and educated, and the governments stable. However, between the Plaza Accord in September 1985 and the middle of 1989, the Korean won appreciated by 30% and the New Taiwan dollar by 45%. In addition, wages skyrocketed in these two economies at the end of the 1980s as the flow of labour from farms to factories dried up (see Yoshitomi, 2003). Performing labour-intensive operations in NIEs became costly for Japanese MNCs. As Figure 3 and Figure 4 indicate, they shifted production to the Association of Southeast Asian Nations (ASEAN) countries.

Within the important electronics value chain, FDI and intermediate goods went to Malaysia, the Philippines, and Thailand, but not to Indonesia. One problem with the latter is the low quality of its roads, ports, and other infrastructure.

Figure 3: Japanese Intermediate Goods Exports to Parts of East Asia



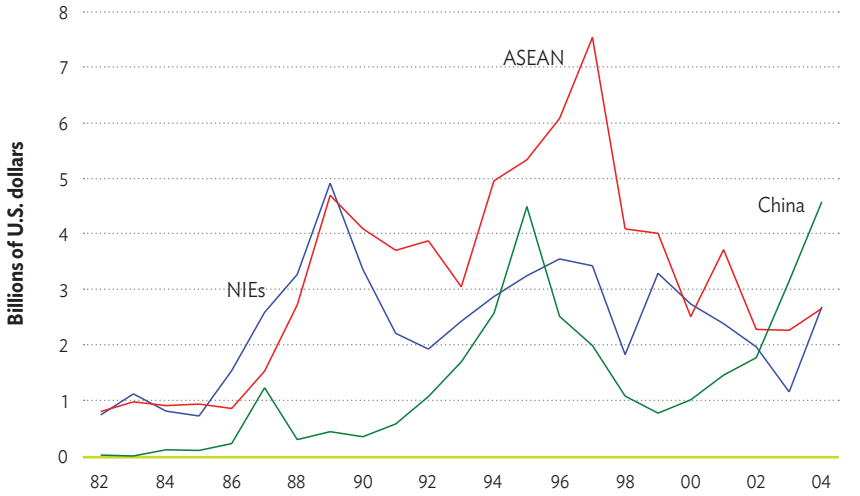
Note: NIEs refers to Republic of Korea and Taiwan. ASEAN refers to Malaysia, Indonesia, the Philippines, Singapore, and Thailand.

Source: CEPII-CHELEM database, 2015.

ASEAN experienced a major crisis in 1997–98. The banking sectors collapsed and there were riots and other problems. The crisis dampened the appetite of Japanese firms to invest in ASEAN. Figure 3 and Figure 4 show the decline of FDI and intermediate goods flowing from Japan to ASEAN after the crisis. While Japanese companies left their factories in ASEAN, they began looking for other locations for new production. Figure 3 and Figure 4 show that China emerged in the 2000s as a leading destination for Japan's overseas production. China joined the World Trade Organization in 2001, and this gave

MNCs confidence to invest in this country because they believed that it would follow the rule of law more closely. In addition, foreign investors were attracted by the high-quality roads, ports, airports, and other infrastructure in the Pearl River Delta and the Yangtze River Delta.

Figure 4: Japanese Outward FDI to Parts of East Asia

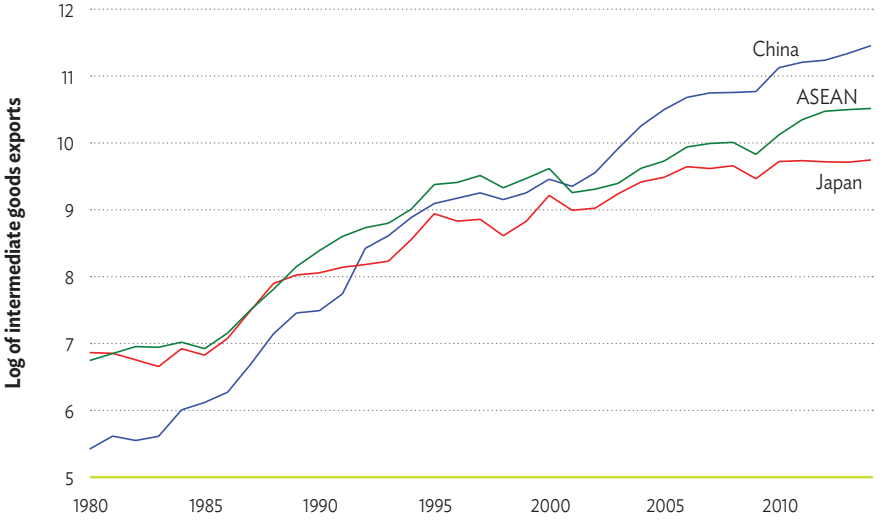


ASEAN = Association of Southeast Asian Nations, FDI = foreign direct investment, NIEs = newly industrialised economies.

Note: NIEs refers to Republic of Korea and Taiwan. ASEAN refers to Malaysia, Indonesia, the Philippines, Singapore, and Thailand.

Source: Japanese Ministry of Finance, 2005.

Figure 5: Intermediate Goods Exports of NIEs to Parts of East Asia



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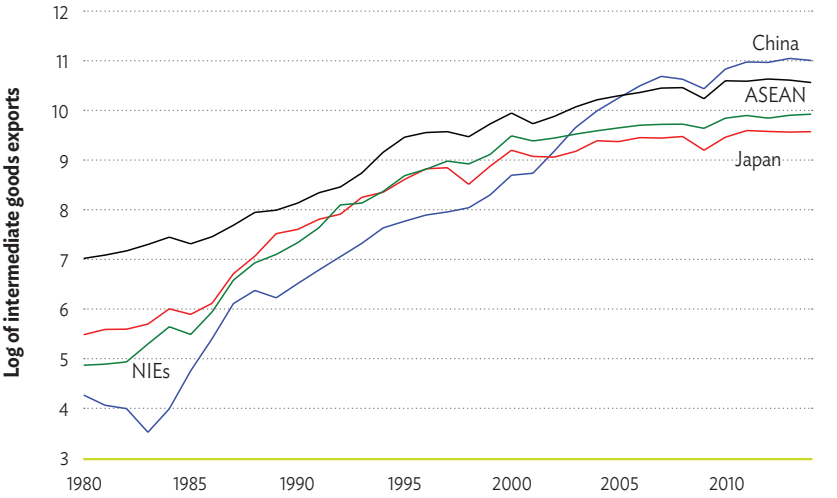
Source: CEPII-CHELEM database, 2015.

As the Republic of Korea (henceforth, Korea) and Taiwan were climbing the technology ladder and as wages in their economies increased, they also began moving factories to lower-wage regions of Asia. Figure 5 shows that before China's accession to WTO, ASEAN was an important location, but more and more productions were relocated to China after 2000. However, as wages have increased in China, MNCs in NIEs have relocated production to Viet Nam. Korea's intermediate goods exports to Viet Nam increased almost four times after 2008 to reach US$8 billion.

ASEAN countries have also been increasingly active in sending parts and components and other intermediate goods to their Asian neighbours. Figure 6 shows that the leading recipient of these goods is China, but many of these flow to other ASEAN countries as well. An example will help clarify how production links in ASEAN work. Hiratsuka (2011) discussed in detail the operations of Hitachi Global Storage Technologies (HGST), a leading producer of hard disk drives (HDD) in Thailand. He documented how HGST procured most parts and components from Indonesia, Malaysia, the Philippines, and Singapore. The close locations meant that supplier firms could send parts and components by overnight express and could also send engineers to improve communication with HGST engineers. These engineers could also come quickly should there be problems with parts. HGST procured media from Malaysia and Singapore; printed circuit boards from Indonesia, the Philippines, and Thailand; pivots from Malaysia, Singapore, and Thailand; voice coils from Indonesia, Malaysia, and Thailand; and bases from Malaysia and Thailand. These parts and components were also procured from countries other than those mentioned. Hiratsuka (2011) noted that employing multiple suppliers increased competition between suppliers and reduced the risk of parts and components being unavailable due to natural disasters, political problems, and other factors. While the parts and components listed above were obtained through arms-length transactions, core components such as heads and suspension were procured through intra-firm trade with HGST's head office in the US and its affiliate in Mexico.

Figure 7 shows total intermediate goods exports from all of East Asia to the individual parts. It makes clear that Japan has been the most upstream location since the 1980s. ASEAN was the most downstream until 2003. Since then, China has more and more become the final link in regional value chains.

Figure 6: ASEAN's Intermediate Goods Exports to Parts of East Asia



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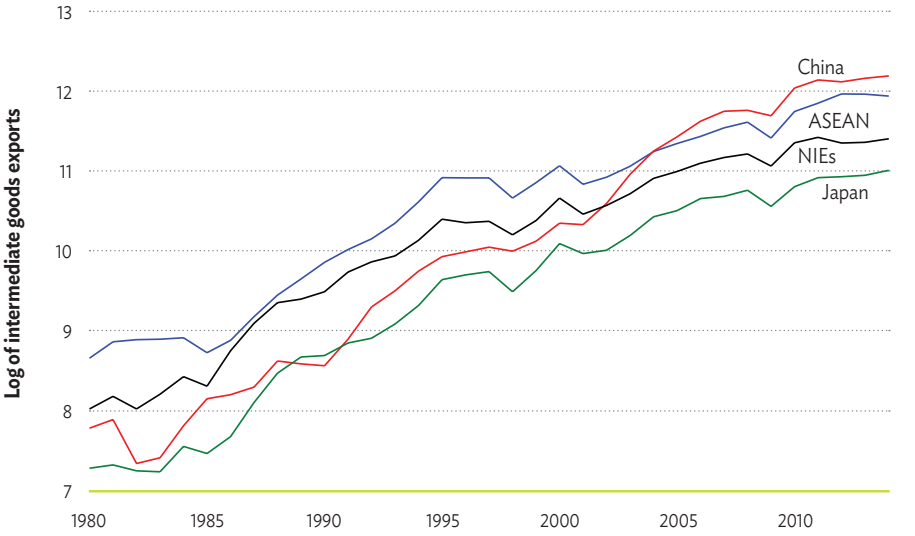
Note: NIEs refers to Republic of Korea and Taiwan. ASEAN refers to Malaysia, Indonesia, the Philippines, Singapore, and Thailand.

Source: CEPII-CHELEM database, 2015.

Figure 7: East Asia's Intermediate Goods Exports to Parts of East Asia



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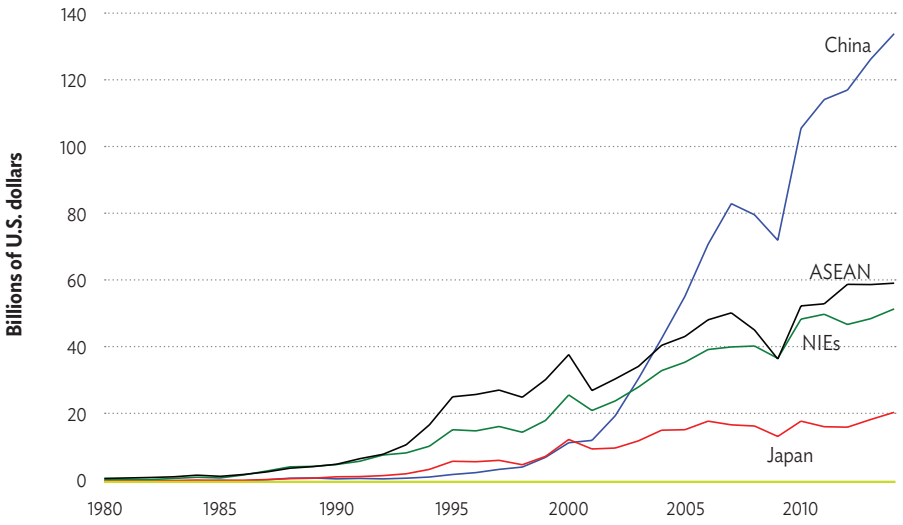
Note: NIEs refers to Republic of Korea and Taiwan. ASEAN refers to Malaysia, Indonesia, the Philippines, Singapore, and Thailand. East Asia includes NIEs, ASEAN, Japan, and China.

Source: CEPII-CHELEM database, 2015.

Figure 8: East Asia's Exports of Electronic Parts and Components to Locations in East Asia



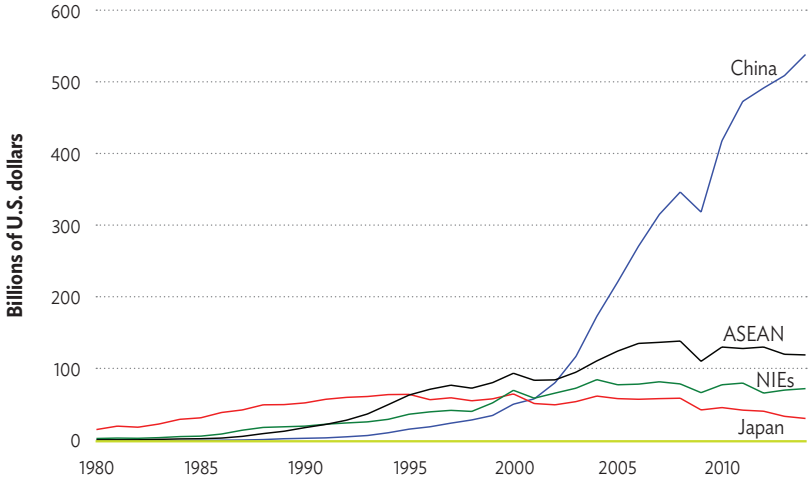
ASEAN = Association of Southeast Asian Nations, NIEs = newly industrialised economies.

Note: NIEs refers to Republic of Korea and Taiwan. ASEAN refers to Malaysia, Indonesia, the Philippines, Singapore, and Thailand. East Asia includes NIEs, ASEAN, Japan, and China. Electronic components come from the HS classification numbers 8540, 8541, and 8542.

Source: CEPII-CHELEM database, 2015.

Far and away, the most important industry within East Asian value chains is the electronics industry. This sector has done well partly because of very low tariffs.

Figure 9: East Asia's Exports of Final Electronic Goods to the World



ASEAN = Association of Southeast Asian Nations, NIEs = newly industrialised economies.

Note: NIEs refers to Republic of Korea and Taiwan. ASEAN refers to Malaysia, Indonesia, the Philippines, Singapore, and Thailand. East Asia includes NIEs, ASEAN, Japan, and China. Final electronic goods include computers, telephones, and consumer electronic goods and correspond to HS classification numbers 8469-73, 8517-22, 8525-39, 8543-48.

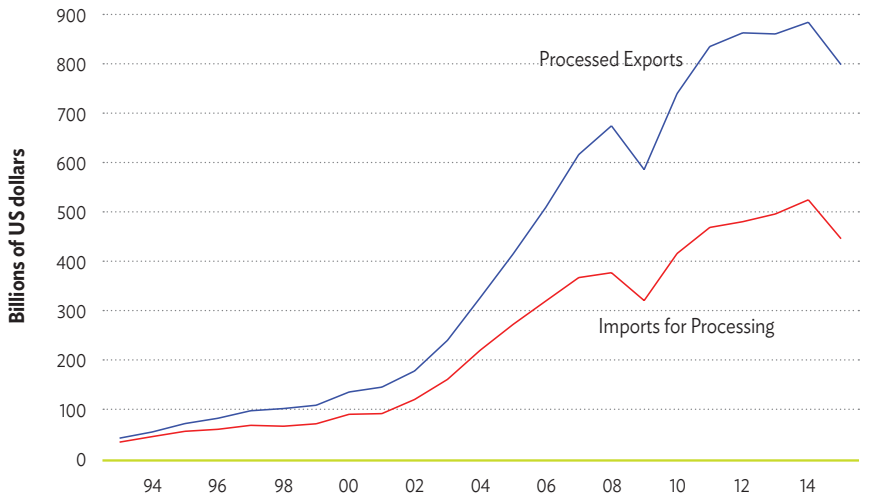
Source: CEPII-CHELEM database, 2015.

To shed further light on the evolution of value chains in the region, Figure 8 shows the flow of electronic parts and components within the region, and Figure 9 shows the exports to the world of the final electronics goods produced using electronic parts and components. These final goods include computers, telephones, and consumer electronics goods. Figure 8 shows that more and more electronic parts and components go to China, and more and more final electronics goods are exported from China. Thus, China is not only the final link but has also become the central country within regional value chains.

China's Ordinary and Processing Trade

To shed light on China's role in global value chains, it is helpful to consider China's two primary trading regimes: processing trade and ordinary trade. Processed exports are produced using parts and components that are imported duty free. Processed exports can only be used to produce goods for re-exports and are not allowed to enter the domestic economy. Ordinary exports are produced using local inputs and using imported inputs that are not imported duty free. Figure 10 plots China's processing imports and exports.

Figure 10: China's Processing Trade, 1993-2015



US = United States

Source: China Customs statistics, 2016.

As the figure shows, the surplus in processing trade keeps increasing. This indicates that more of the value added of sophisticated processed exports come from China. The surplus is wider than the figure indicates, since each year more than US$70 billion of imports for processing are actually produced in China and then shipped out and back in to obtain favourable tax benefits (Xing, 2012).

The increase in China's value added in processed goods reflects the fact that the Chinese government has steered Chinese firms towards higher value-added activities (Republic of China, 2012). In addition, China's capital deepening has permitted more parts and components to be produced domestically (Knight and Wang, 2011). China's industrial clusters and processing supply chains have also become deeper (Kuijs, 2011). Finally, investments in education in China have facilitated technology assimilation from FDI firms and progress towards higher value added activities (see Kiyota, Matsuura, Urata, and Wei, 2006; Yusuf et al., 2003).

Figure 11 plots China's ordinary imports and exports. The figure shows that ordinary exports had grown rapidly, and that the growth rate only started to slow down in 2015. Figure 11 also shows that ordinary imports fell in 2015. This fall was due to the drop in the prices of primary products such as crude oil and iron ore, and to a decrease in import demand because of China's slowdown and because of President Xi Jinping's crackdown on government officials receiving luxury imported goods (Qian and Wen, 2015).

Figure 11: China's Ordinary Trade, 1993-2015

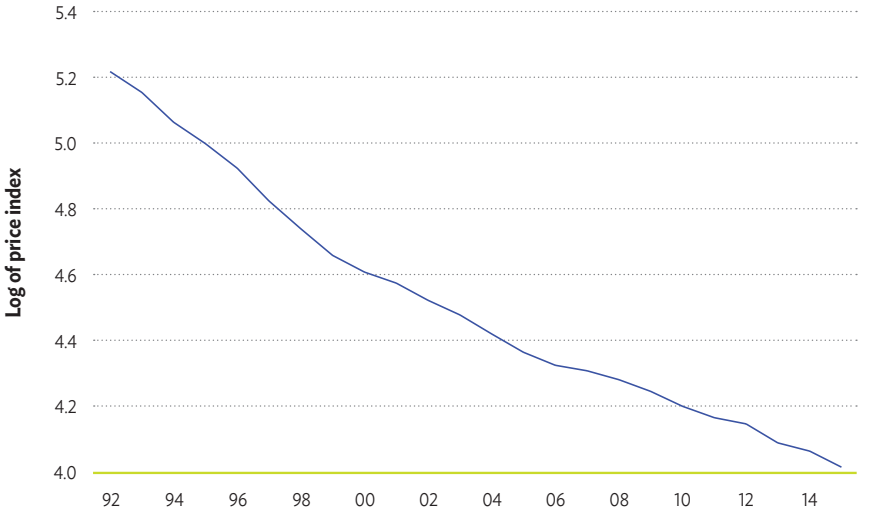
US = United States

Source: China Customs statistics, 2016.

Correcting both processing and ordinary trade for goods produced in China and then round-tripped for tax reasons, China ran a surplus in 2015 of US$422 billion in processing trade and US$330 billion in ordinary trade. China's combined surplus in processing and ordinary trade thus equaled US$752 billion. Thus, China ran a huge surplus in the primarily manufactured goods that are part of processing and ordinary trade. The huge surplus indicates that China's value added in manufacturing has risen. China's rising value added in processing trade implies that more of the technology-intensive parts and components are now produced in China. There is now fierce competition between China

and the newly industrialised economies of Korea and Taiwan in producing microchips and other sophisticated inputs. Korea and Taiwan still have a technological advantage, but China is closing the gap quickly.

Figure 12: Price Index for East Asia's Exports of Final Electronic Goods



Note: Final electronics goods include computers, telephone equipment, and consumer electronics goods.

Sources: CEPII-CHELEM database, Bureau of Labor Statistics, and author's calculations, 2016.

This competition and mushrooming productivity growth have reduced prices for consumers. Figure 12 shows that the prices of computers, cellphones, and other final electronics products have dropped.

Lessons for Agriculture

Agricultural supply chains have not developed in the same way as manufacturing supply chains have and there are several reasons for this. Asian governments have long viewed agriculture as less of a priority than manufacturing, and have sought to promote manufacturing development at the expense of agricultural development. Many countries such as Indonesia have pursued self-sufficiency in agriculture. Thus, rather than focusing on their comparative advantage, these countries try to produce all crops and impose tariffs on imported crops (Murdoch Commission, 2015). In contrast, regional value chains in manufacturing have reaped large efficiency gains by allocating production to each region based on comparative advantage and by liberalising trade. Asia also has a preponderance of small farms. In China, for instance, 95% of farms are less than 2 ha. Small farm size hinders mechanisation and productivity growth.

So, how can Asia promote productivity growth and expansion of regional value chains? One key step would be to harmonise food quality and safety standards. This would allow freer trade in agricultural goods in Asia. In this case, individual regions could specialise in producing crops that follow their comparative advantage, secure in the knowledge that other countries would trust their products and that they could also safely purchase other crops from abroad. Finding a means to harmonise standards is trickier. Australia and New Zealand have integrated these tasks in the One Biosecurity initiative, but it is hard to see this working more broadly for Asia. Perhaps a regional organisation could oversee harmonisation.

Research and development at universities could be combined with commercial activities and government assistance (Ministry of Economic Affairs, 2012). In Taiwan, when bicycle manufacturers faced intense competition from Chinese exporters, research and development centres, universities, and the government worked together with businesses. The Cycling and Health Tech Industry R&D Center and the National Cheng Kang University worked with the industry to develop environmentally responsible manufacturing techniques. The Metal Institute R&D Center developed lightweight, high-quality metals to use in bicycle manufacturing. Government agencies and corporations helped bicycle manufacturers reduce their inventory levels and implement efficient management systems. The Taiwanese bicycle industry then developed innovative, high value added bicycles that competed with Chinese products on quality rather than on price. Asian countries should reflect long and hard about the proper roles for research institutes, the government, and the commercial sector in promoting agricultural production.

They should also carefully think through the concept of self-sufficiency in agriculture. The combination of focusing on all crops and protecting imports leads to stagnation. Government should find ways to balance legitimate needs for self-sufficiency with approaches that increase agricultural productivity. To increase productivity, more focused policies should be chosen, where possible, over protectionism. For instance, Huang, Wang, and Rozelle (2013) documented how the Chinese government, rather than using protectionism to raise farmers' incomes, put money in each of their bank accounts before planting seasons (Murdoch Commission, 2015). Where appropriate, Asian countries should also promote the movement away from smallholder farms so that farmers can take advantage of economies of scale. Politicians in the past have sometimes sought to exert control over farmers by, for example, rigidly allocating fertilisers and farm machines. In the future, government should encourage off-farm activities for low-productivity small farmers and seek larger farm sizes that could benefit from economies of scale. Stronger property rights for land and for key inputs such as water would also be helpful. This would remove uncertainty and increase farmers' ability to obtain loans.

Finally, well thought out initiatives can help to redirect farmers into more remunerative activities. For instance, in the 1960s, Japan's Oita Prefecture launched the One Village, One Product movement where each village specialised in one productive crop such as shitake mushrooms or *kabosu* (a lime-like fruit). The government provided extension services, capacity building, and technical assistance. Some villages also tried to produce higher value added products from the original good (e.g. wine from plums). Similarly, on the Japanese island of Shikoku, residents have tried to maximise the value they obtain from *sudachi* and *yuzu*, two locally grown citrus fruits. Not only do they obtain high prices domestically and abroad for these fruits, but they use them to make cider, sherbet, *gokkun* (a local drink), and to flavour a variety of foods. They also have a design institute on the island to promote *zudachi* and *yuzu* to international audiences and a research institute to investigate and make known the health benefits of these fruits (see Thorbecke, 2016).

Conclusion

Production networks in the manufacturing sector have emerged and now crisscross East Asia. China is becoming more central within these networks. The networks have multiplied efficiency gains, led technology transfer to developing and emerging countries and caused prices of final goods to plummet. This paper has traced the evolution of these networks over time. Several factors contributed to lowering the cost of linking geographically separated production blocks and the slicing up of the value chain in Asia. China's accession to the World Trade Organization gave investors confidence that China would follow the rule of law. In addition, China's superb infrastructure in the Pearl and Yangtze River Deltas made producing there attractive. The growing human capital in urban China has also led to technology transfer and more of higher value added activities being relocated in China. Low tariffs in the electronics sector have also facilitated the flow of electronic parts and components throughout the region. The paper also discusses other factors that have contributed to fragmenting production in the region.

In contrast to the manufacturing sector, value chains in the agricultural sector are less developed. There are many reasons for this. Asian governments have long viewed agriculture as less of a priority than manufacturing. Countries have also eschewed comparative advantage and used protectionism to pursue self-sufficiency in agriculture. The preponderance of small farms has hindered mechanisation, economies of scale, and productivity growth. While productivity has exploded within Asian value chains in the manufacturing sector and caused prices to tumble, productivity in the agricultural sector has languished. By harmonising biosecurity standards, eschewing protectionism, rethinking agricultural self-sufficiency, focusing on comparative advantage, and fostering

cooperation between research agencies, the government and commercial enterprises could promote value chains and increase agricultural productivity in the region.

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Introduction

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Production activities within these networks can be fragmented into individual modules, and the modules can be allocated to different locations based on differences in comparative

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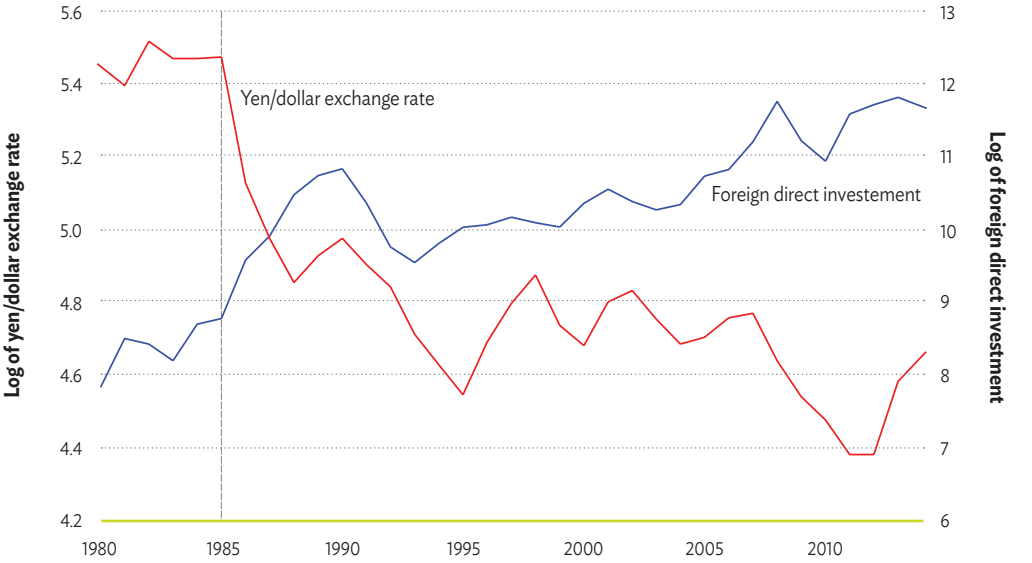
The Emergence of Production Networks in East Asia

On 22 September 1985, France, Germany, Japan, the United Kingdom (UK), and the United States (US) agreed to push down the value of the dollar in an attempt to reduce large US trade deficits with Germany, Japan, and other countries.

The Japanese yen subsequently appreciated by more than 50% and Japanese exporters lost their price competitiveness. To reduce costs, Japanese firms transferred labour-intensive operations to lower-wage countries. They continued to produce technology-intensive parts and components domestically and shipped these abroad for assembly and re-export (Figure 1).

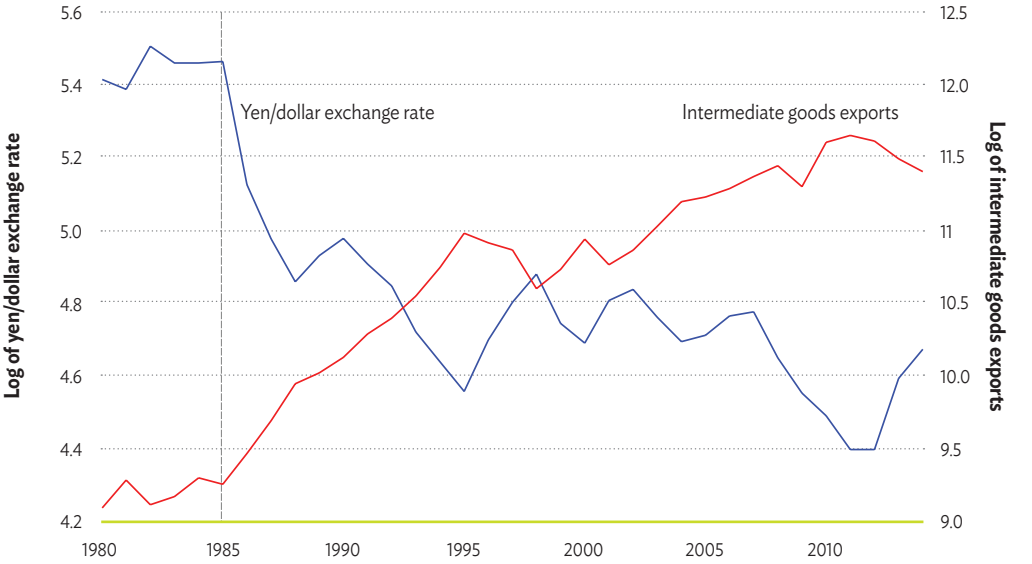
Figure 1 shows that as the yen began appreciating, Japanese FDI increased logarithmically by 50% as Japanese MNCs began transferring factories abroad. Figure 2 shows that as the yen appreciated, exports of parts and components – all intermediate goods – to East Asian neighbors soared. Where did these goods go?

Figure 1: Yen-Dollar Exchange Rate and Japanese Outward Foreign Direct Investment



Source: CEPII-CHELEM database, 2015.

Figure 2: Yen–Dollar Exchange Rate and Japanese Intermediate Goods Exports to East Asia



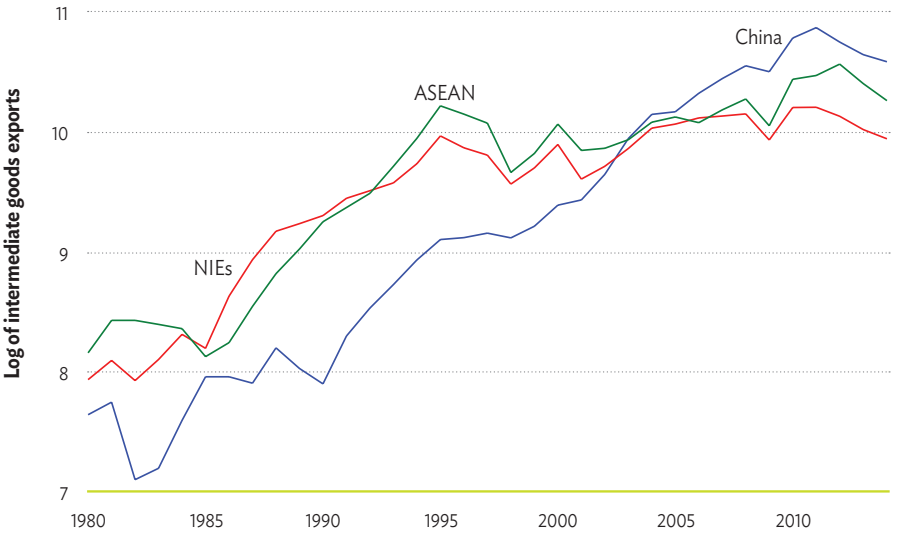
Note: East Asia includes China, Malaysia, Indonesia, the Philippines, Singapore, Republic of Korea, Taiwan, and Thailand.

Source: CEPII-CHELEM database, 2015.

Figure 3 and Figure 4 show that initially, intermediate goods and FDI went largely to the newly industrialised economies (NIEs) of the Republic of Korea and Taiwan. The infrastructure was good in these countries, the work force disciplined and educated, and the governments stable. However, between the Plaza Accord in September 1985 and the middle of 1989, the Korean won appreciated by 30% and the New Taiwan dollar by 45%. In addition, wages skyrocketed in these two economies at the end of the 1980s as the flow of labour from farms to factories dried up (see Yoshitomi, 2003). Performing labour-intensive operations in NIEs became costly for Japanese MNCs. As Figure 3 and Figure 4 indicate, they shifted production to the Association of Southeast Asian Nations (ASEAN) countries.

Within the important electronics value chain, FDI and intermediate goods went to Malaysia, the Philippines, and Thailand, but not to Indonesia. One problem with the latter is the low quality of its roads, ports, and other infrastructure.

Figure 3: Japanese Intermediate Goods Exports to Parts of East Asia



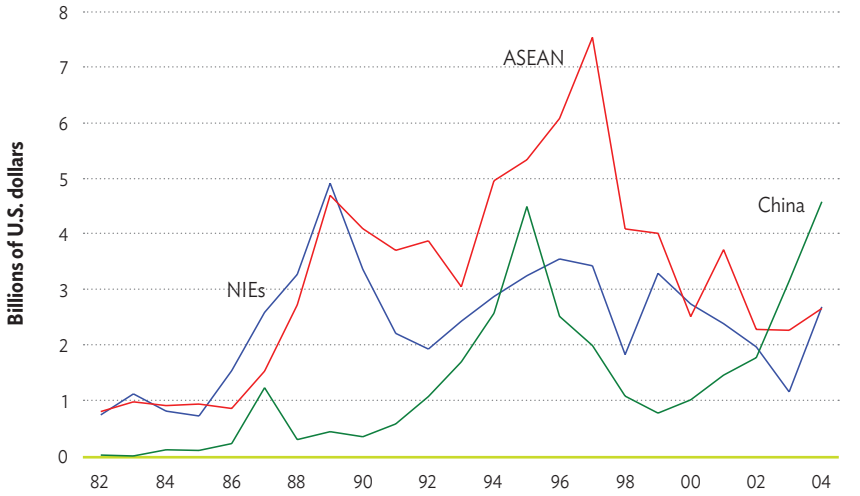
Note: NIEs refers to Republic of Korea and Taiwan. ASEAN refers to Malaysia, Indonesia, the Philippines, Singapore, and Thailand.

Source: CEPII-CHELEM database, 2015.

ASEAN experienced a major crisis in 1997–98. The banking sectors collapsed and there were riots and other problems. The crisis dampened the appetite of Japanese firms to invest in ASEAN. Figure 3 and Figure 4 show the decline of FDI and intermediate goods flowing from Japan to ASEAN after the crisis. While Japanese companies left their factories in ASEAN, they began looking for other locations for new production. Figure 3 and Figure 4 show that China emerged in the 2000s as a leading destination for Japan's overseas production. China joined the World Trade Organization in 2001, and this gave

MNCs confidence to invest in this country because they believed that it would follow the rule of law more closely. In addition, foreign investors were attracted by the high-quality roads, ports, airports, and other infrastructure in the Pearl River Delta and the Yangtze River Delta.

Figure 4: Japanese Outward FDI to Parts of East Asia

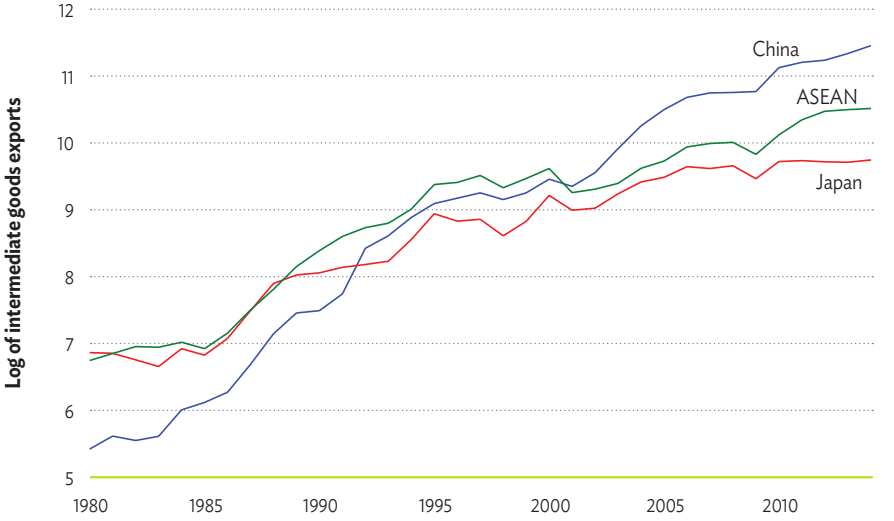


ASEAN = Association of Southeast Asian Nations, FDI = foreign direct investment, NIEs = newly industrialised economies.

Note: NIEs refers to Republic of Korea and Taiwan. ASEAN refers to Malaysia, Indonesia, the Philippines, Singapore, and Thailand.

Source: Japanese Ministry of Finance, 2005.

Figure 5: Intermediate Goods Exports of NIEs to Parts of East Asia



ASEAN = Association of Southeast Asian Nations, NIEs = newly industrialised economies.

Note: NIEs refers to Republic of Korea and Taiwan. ASEAN refers to Malaysia, Indonesia, the Philippines, Singapore, and Thailand.

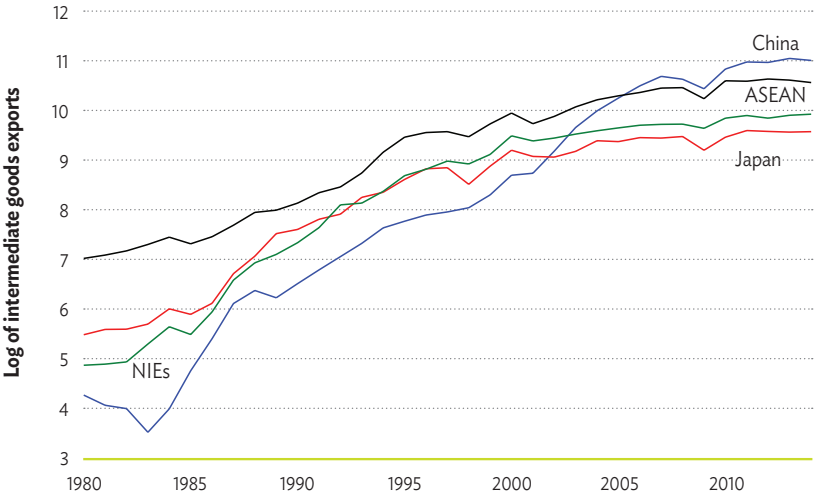
Source: CEPII-CHELEM database, 2015.

As the Republic of Korea (henceforth, Korea) and Taiwan were climbing the technology ladder and as wages in their economies increased, they also began moving factories to lower-wage regions of Asia. Figure 5 shows that before China's accession to WTO, ASEAN was an important location, but more and more productions were relocated to China after 2000. However, as wages have increased in China, MNCs in NIEs have relocated production to Viet Nam. Korea's intermediate goods exports to Viet Nam increased almost four times after 2008 to reach US$8 billion.

ASEAN countries have also been increasingly active in sending parts and components and other intermediate goods to their Asian neighbours. Figure 6 shows that the leading recipient of these goods is China, but many of these flow to other ASEAN countries as well. An example will help clarify how production links in ASEAN work. Hiratsuka (2011) discussed in detail the operations of Hitachi Global Storage Technologies (HGST), a leading producer of hard disk drives (HDD) in Thailand. He documented how HGST procured most parts and components from Indonesia, Malaysia, the Philippines, and Singapore. The close locations meant that supplier firms could send parts and components by overnight express and could also send engineers to improve communication with HGST engineers. These engineers could also come quickly should there be problems with parts. HGST procured media from Malaysia and Singapore; printed circuit boards from Indonesia, the Philippines, and Thailand; pivots from Malaysia, Singapore, and Thailand; voice coils from Indonesia, Malaysia, and Thailand; and bases from Malaysia and Thailand. These parts and components were also procured from countries other than those mentioned. Hiratsuka (2011) noted that employing multiple suppliers increased competition between suppliers and reduced the risk of parts and components being unavailable due to natural disasters, political problems, and other factors. While the parts and components listed above were obtained through arms-length transactions, core components such as heads and suspension were procured through intra-firm trade with HGST's head office in the US and its affiliate in Mexico.

Figure 7 shows total intermediate goods exports from all of East Asia to the individual parts. It makes clear that Japan has been the most upstream location since the 1980s. ASEAN was the most downstream until 2003. Since then, China has more and more become the final link in regional value chains.

Figure 6: ASEAN's Intermediate Goods Exports to Parts of East Asia

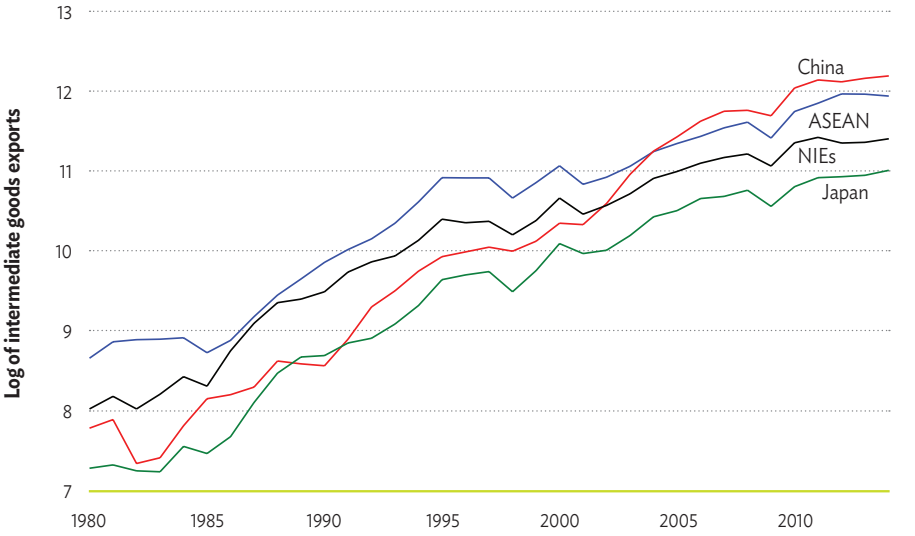


ASEAN = Association of Southeast Asian Nations, NIEs = newly industrialised economies.

Note: NIEs refers to Republic of Korea and Taiwan. ASEAN refers to Malaysia, Indonesia, the Philippines, Singapore, and Thailand.

Source: CEPII-CHELEM database, 2015.

Figure 7: East Asia's Intermediate Goods Exports to Parts of East Asia

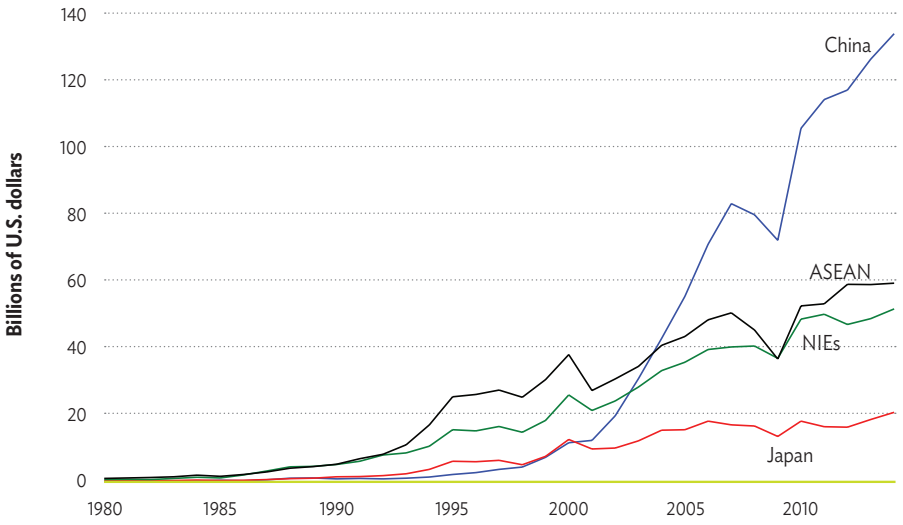


ASEAN = Association of Southeast Asian Nations, NIEs = newly industrialised economies.

Note: NIEs refers to Republic of Korea and Taiwan. ASEAN refers to Malaysia, Indonesia, the Philippines, Singapore, and Thailand. East Asia includes NIEs, ASEAN, Japan, and China.

Source: CEPII-CHELEM database, 2015.

Figure 8: East Asia's Exports of Electronic Parts and Components to Locations in East Asia



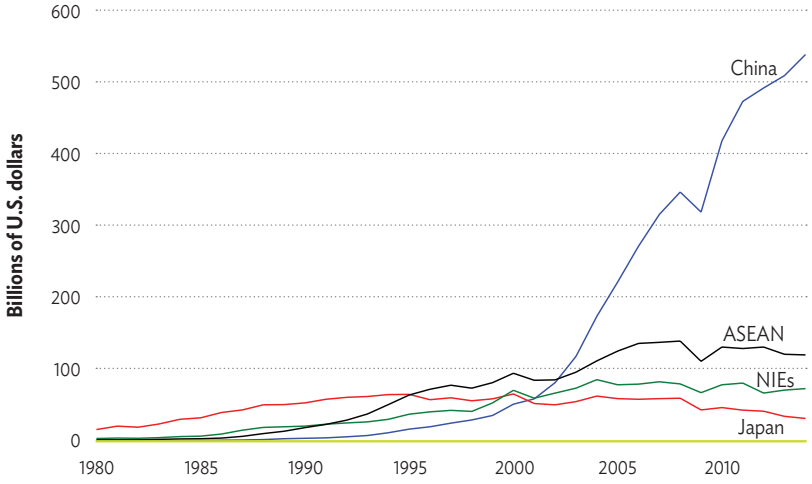
ASEAN = Association of Southeast Asian Nations, NIEs = newly industrialised economies.

Note: NIEs refers to Republic of Korea and Taiwan. ASEAN refers to Malaysia, Indonesia, the Philippines, Singapore, and Thailand. East Asia includes NIEs, ASEAN, Japan, and China. Electronic components come from the HS classification numbers 8540, 8541, and 8542.

Source: CEPII-CHELEM database, 2015.

Far and away, the most important industry within East Asian value chains is the electronics industry. This sector has done well partly because of very low tariffs.

Figure 9: East Asia's Exports of Final Electronic Goods to the World



ASEAN = Association of Southeast Asian Nations, NIEs = newly industrialised economies.

Note: NIEs refers to Republic of Korea and Taiwan. ASEAN refers to Malaysia, Indonesia, the Philippines, Singapore, and Thailand. East Asia includes NIEs, ASEAN, Japan, and China. Final electronic goods include computers, telephones, and consumer electronic goods and correspond to HS classification numbers 8469-73, 8517-22, 8525-39, 8543-48.

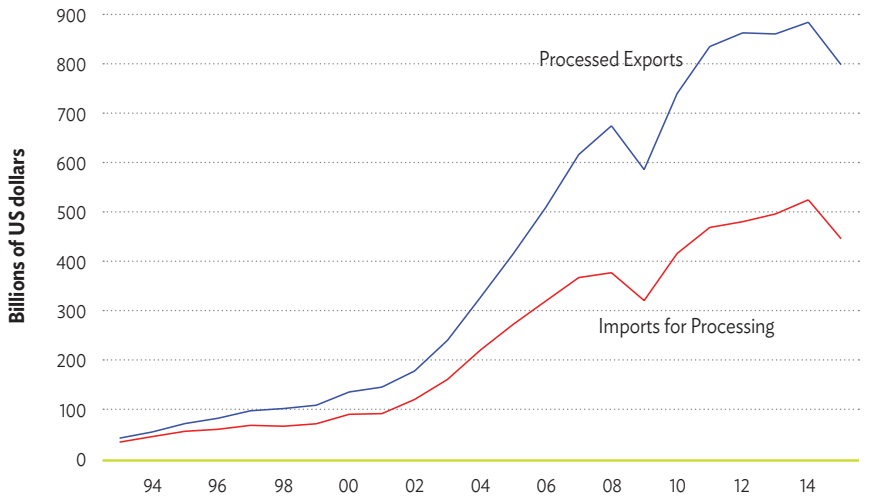
Source: CEPII-CHELEM database, 2015.

To shed further light on the evolution of value chains in the region, Figure 8 shows the flow of electronic parts and components within the region, and Figure 9 shows the exports to the world of the final electronics goods produced using electronic parts and components. These final goods include computers, telephones, and consumer electronics goods. Figure 8 shows that more and more electronic parts and components go to China, and more and more final electronics goods are exported from China. Thus, China is not only the final link but has also become the central country within regional value chains.

China's Ordinary and Processing Trade

To shed light on China's role in global value chains, it is helpful to consider China's two primary trading regimes: processing trade and ordinary trade. Processed exports are produced using parts and components that are imported duty free. Processed exports can only be used to produce goods for re-exports and are not allowed to enter the domestic economy. Ordinary exports are produced using local inputs and using imported inputs that are not imported duty free. Figure 10 plots China's processing imports and exports.

Figure 10: China's Processing Trade, 1993-2015



US = United States

Source: China Customs statistics, 2016.

As the figure shows, the surplus in processing trade keeps increasing. This indicates that more of the value added of sophisticated processed exports come from China. The surplus is wider than the figure indicates, since each year more than US$70 billion of imports for processing are actually produced in China and then shipped out and back in to obtain favourable tax benefits (Xing, 2012).

The increase in China's value added in processed goods reflects the fact that the Chinese government has steered Chinese firms towards higher value-added activities (Republic of China, 2012). In addition, China's capital deepening has permitted more parts and components to be produced domestically (Knight and Wang, 2011). China's industrial clusters and processing supply chains have also become deeper (Kuijs, 2011). Finally, investments in education in China have facilitated technology assimilation from FDI firms and progress towards higher value added activities (see Kiyota, Matsuura, Urata, and Wei, 2006; Yusuf et al., 2003).

Figure 11 plots China's ordinary imports and exports. The figure shows that ordinary exports had grown rapidly, and that the growth rate only started to slow down in 2015. Figure 11 also shows that ordinary imports fell in 2015. This fall was due to the drop in the prices of primary products such as crude oil and iron ore, and to a decrease in import demand because of China's slowdown and because of President Xi Jinping's crackdown on government officials receiving luxury imported goods (Qian and Wen, 2015).

Figure 11: China's Ordinary Trade, 1993-2015

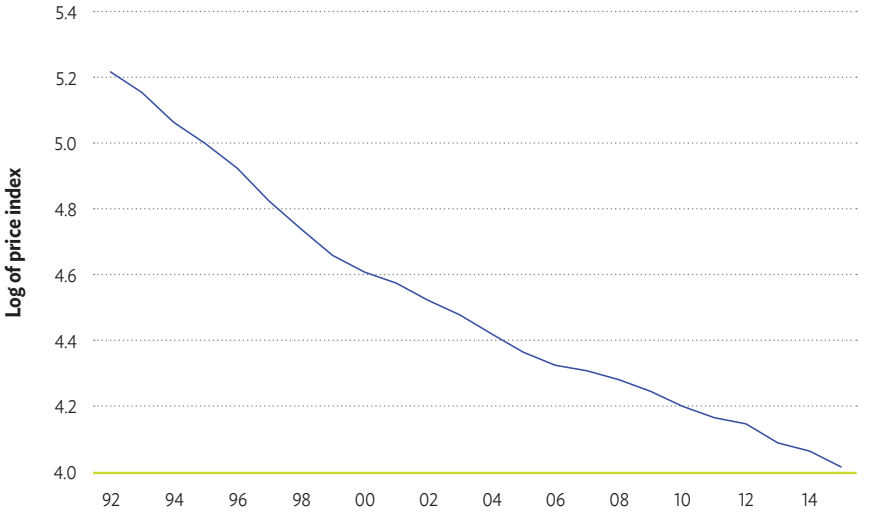
US = United States

Source: China Customs statistics, 2016.

Correcting both processing and ordinary trade for goods produced in China and then round-tripped for tax reasons, China ran a surplus in 2015 of US$422 billion in processing trade and US$330 billion in ordinary trade. China's combined surplus in processing and ordinary trade thus equaled US$752 billion. Thus, China ran a huge surplus in the primarily manufactured goods that are part of processing and ordinary trade. The huge surplus indicates that China's value added in manufacturing has risen. China's rising value added in processing trade implies that more of the technology-intensive parts and components are now produced in China. There is now fierce competition between China

and the newly industrialised economies of Korea and Taiwan in producing microchips and other sophisticated inputs. Korea and Taiwan still have a technological advantage, but China is closing the gap quickly.

Figure 12: Price Index for East Asia's Exports of Final Electronic Goods



Note: Final electronics goods include computers, telephone equipment, and consumer electronics goods.

Sources: CEPII-CHELEM database, Bureau of Labor Statistics, and author's calculations, 2016.

This competition and mushrooming productivity growth have reduced prices for consumers. Figure 12 shows that the prices of computers, cellphones, and other final electronics products have dropped.

Lessons for Agriculture

Agricultural supply chains have not developed in the same way as manufacturing supply chains have and there are several reasons for this. Asian governments have long viewed agriculture as less of a priority than manufacturing, and have sought to promote manufacturing development at the expense of agricultural development. Many countries such as Indonesia have pursued self-sufficiency in agriculture. Thus, rather than focusing on their comparative advantage, these countries try to produce all crops and impose tariffs on imported crops (Murdoch Commission, 2015). In contrast, regional value chains in manufacturing have reaped large efficiency gains by allocating production to each region based on comparative advantage and by liberalising trade. Asia also has a preponderance of small farms. In China, for instance, 95% of farms are less than 2 ha. Small farm size hinders mechanisation and productivity growth.

So, how can Asia promote productivity growth and expansion of regional value chains? One key step would be to harmonise food quality and safety standards. This would allow freer trade in agricultural goods in Asia. In this case, individual regions could specialise in producing crops that follow their comparative advantage, secure in the knowledge that other countries would trust their products and that they could also safely purchase other crops from abroad. Finding a means to harmonise standards is trickier. Australia and New Zealand have integrated these tasks in the One Biosecurity initiative, but it is hard to see this working more broadly for Asia. Perhaps a regional organisation could oversee harmonisation.

Research and development at universities could be combined with commercial activities and government assistance (Ministry of Economic Affairs, 2012). In Taiwan, when bicycle manufacturers faced intense competition from Chinese exporters, research and development centres, universities, and the government worked together with businesses. The Cycling and Health Tech Industry R&D Center and the National Cheng Kang University worked with the industry to develop environmentally responsible manufacturing techniques. The Metal Institute R&D Center developed lightweight, high-quality metals to use in bicycle manufacturing. Government agencies and corporations helped bicycle manufacturers reduce their inventory levels and implement efficient management systems. The Taiwanese bicycle industry then developed innovative, high value added bicycles that competed with Chinese products on quality rather than on price. Asian countries should reflect long and hard about the proper roles for research institutes, the government, and the commercial sector in promoting agricultural production.

They should also carefully think through the concept of self-sufficiency in agriculture. The combination of focusing on all crops and protecting imports leads to stagnation. Government should find ways to balance legitimate needs for self-sufficiency with approaches that increase agricultural productivity. To increase productivity, more focused policies should be chosen, where possible, over protectionism. For instance, Huang, Wang, and Rozelle (2013) documented how the Chinese government, rather than using protectionism to raise farmers' incomes, put money in each of their bank accounts before planting seasons (Murdoch Commission, 2015). Where appropriate, Asian countries should also promote the movement away from smallholder farms so that farmers can take advantage of economies of scale. Politicians in the past have sometimes sought to exert control over farmers by, for example, rigidly allocating fertilisers and farm machines. In the future, government should encourage off-farm activities for low-productivity small farmers and seek larger farm sizes that could benefit from economies of scale. Stronger property rights for land and for key inputs such as water would also be helpful. This would remove uncertainty and increase farmers' ability to obtain loans.

Finally, well thought out initiatives can help to redirect farmers into more remunerative activities. For instance, in the 1960s, Japan's Oita Prefecture launched the One Village, One Product movement where each village specialised in one productive crop such as shitake mushrooms or *kabosu* (a lime-like fruit). The government provided extension services, capacity building, and technical assistance. Some villages also tried to produce higher value added products from the original good (e.g. wine from plums). Similarly, on the Japanese island of Shikoku, residents have tried to maximise the value they obtain from *sudachi* and *yuzu*, two locally grown citrus fruits. Not only do they obtain high prices domestically and abroad for these fruits, but they use them to make cider, sherbet, *gokkun* (a local drink), and to flavour a variety of foods. They also have a design institute on the island to promote *zudachi* and *yuzu* to international audiences and a research institute to investigate and make known the health benefits of these fruits (see Thorbecke, 2016).

Conclusion

Production networks in the manufacturing sector have emerged and now crisscross East Asia. China is becoming more central within these networks. The networks have multiplied efficiency gains, led technology transfer to developing and emerging countries and caused prices of final goods to plummet. This paper has traced the evolution of these networks over time. Several factors contributed to lowering the cost of linking geographically separated production blocks and the slicing up of the value chain in Asia. China's accession to the World Trade Organization gave investors confidence that China would follow the rule of law. In addition, China's superb infrastructure in the Pearl and Yangtze River Deltas made producing there attractive. The growing human capital in urban China has also led to technology transfer and more of higher value added activities being relocated in China. Low tariffs in the electronics sector have also facilitated the flow of electronic parts and components throughout the region. The paper also discusses other factors that have contributed to fragmenting production in the region.

In contrast to the manufacturing sector, value chains in the agricultural sector are less developed. There are many reasons for this. Asian governments have long viewed agriculture as less of a priority than manufacturing. Countries have also eschewed comparative advantage and used protectionism to pursue self-sufficiency in agriculture. The preponderance of small farms has hindered mechanisation, economies of scale, and productivity growth. While productivity has exploded within Asian value chains in the manufacturing sector and caused prices to tumble, productivity in the agricultural sector has languished. By harmonising biosecurity standards, eschewing protectionism, rethinking agricultural self-sufficiency, focusing on comparative advantage, and fostering

cooperation between research agencies, the government and commercial enterprises could promote value chains and increase agricultural productivity in the region.

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