

IDE-JETRO



INPUT TRADE AND PRODUCTION NETWORKS IN EAST ASIA

Edited by
Daisuke Hiratsuka | Yoko Uchida

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Preface

One of the most prominent features of world trade in recent decades has been a rapid growth in trade in intermediate goods. In East Asia, intermediate input trade has grown markedly and at a rate much faster than that of the world average. It follows that this has led to an increase in East Asia's share of world intermediate input trade.

In the context of this remarkable growth, since the early 1990s East Asia as a region has developed production networks in the manufacture of various products where production processes are divided into several stages, and the outcome has been the emergence of sequential production blocks that are separately located across countries, according to comparative advantage in various factors. As a consequence of the development of sequential production, intermediate goods are traded among the countries in the region so as to produce final products. This mechanism has brought about a notable expansion of intermediate trade in East Asia.

Yet despite this phenomenon, so far there have been no rigorous studies on intermediate input trade and production networks within the region. In particular, the causes and extent of intermediate input trade and the resulting production networks in East Asia remain unclear. In 2006, the Institute of Developing Economies (IDE) initiated a two-year project, entitled 'Vertical Specialization and Economic Integration in East Asia'. Its aim is to undertake for the first time rigorous empirical analyses of the growth of intermediate input trade as well as detailed studies that capture the main features and characteristics of production networks in East Asia. To this end, we have used various sources such as trade statistics, firm-level data in the form of basic surveys on Japanese Overseas Business Activities, and data derived from the Asian Input–Output tables. This book is one of the outcomes of the project. It investigates to what extent intermediate input trade has developed within the East Asian region, and it attempts to identify the determinants of intermediate input trade and the formation of associated production networks within the region. We also investigate what kinds of production operations are undertaken by multinational enterprises (MNEs) in East Asia and we show how an understanding of these operations can inform predictions of what is likely to happen in the East

Asian less-developed countries (LDCs) in the years ahead. We thank all the contributors for their support and for their helpful cooperation in the project.

The editors

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1. The development of input trade and production networks in East Asia

Daisuke Hiratsuka and Yoko Uchida

1.1 INTRODUCTION

As noted in the preface, East Asia's rapid growth in intermediate input trade, and the associated emergence of sequential production blocks that are separately located across countries, according to comparative advantage in factors such as technology, factor endowment, trade and investment promotion measures, and market size, has resulted in a huge expansion of intermediate trade in the region. Yet despite this phenomenon, apart from contributions by Kimura and Ando (2005) and Ng and Yeats (1999), so far there have been no rigorous studies, and the causes and extent of intermediate input trade and the resulting production networks in East Asia remain unclear. This book aims to make good this deficiency by presenting rigorous empirical analyses of the growth of intermediate input trade and by capturing the main features and characteristics of production networks in East Asia. We separate the question: 'why and to what extent have intermediate input trade and resulting production networks developed in East Asia?' into three stages, because the subject is too large and complicated to answer otherwise.

First we examine to what extent intermediate input trade has developed within the East Asian region. Several scholars have examined production networks in East Asia. Kimura and Ando (2005), using microdata relating to Japanese firms as well as trade statistics, claim that production networks have developed to a greater extent in East Asia than in any other major region of the world. Ng and Yeats (1999) used parts and components data derived from trade statistics to assess the magnitude of production sharing in East Asia. They showed that production sharing in East Asia has deepened over the years. However, since these studies used a definition that classifies any particular product as either an intermediate or a final good, their findings are not always accurate and they tend to be somewhat limited in scope. In this book, we quantitatively measure to what extent intermediate input trade has increased within East Asia.

Second, we attempt to identify the determinants of intermediate input trade and the formation of associated production networks within the region. During the last few decades, economists, employing various technical advances, have made substantial progress in areas such as increasing returns to scale, the possibility of product differentiation and imperfect competition, theoretical studies of international trade, the location of industry, and multinational enterprises (MNEs). Taking these and other theoretical developments into account, we empirically explore the causes of intermediate input trade and production networks in East Asia, and in doing so, hope that our empirical evidence will provide useful feedback concerning the validity of recently developed theories.

Third, we explore what kinds of production operations are undertaken by MNEs in East Asia. It is widely recognized that MNEs have played an important role in the increase in input trade and in the formation of production networks. We explore how MNEs contribute to the development of production networks in East Asia, with particular reference to the procurement and locational patterns of Japanese affiliates operating within the region.

We find that intermediate trade in East Asia is undergoing a conspicuous growth, especially in electronic and chemical products. It is widely recognized that any increase in intermediate trade is brought about by a decrease in trade costs. We provide confirmation of this phenomenon and we also find that factor endowment differences across the countries of the region are important in explaining East Asia's intermediate trade growth.

In East Asia, sequential production stages are located across the various countries of the region, with each country specializing in each of the production stages concerned, depending on the nature of its particular comparative advantage. Countries that are well endowed with labor produce low-value-added parts whose production requires a relatively low level of technology, while countries well endowed with capital produce high-value-added parts that are based on high technology. This is the production mechanism that has led to an expansion of intermediate trade in East Asia.

Using micro-level analyses of the behavior of Japanese affiliates that operate in East Asia, we empirically confirm that Japanese affiliates procure intermediate goods not only from Japan but also from other East Asian countries and export finished goods to third countries after processing them. In this way, the presence of Japanese affiliates in East Asia helps to foster new industries in third countries of the region. East Asia's production networks are expanding into industrial sectors and across national borders through the diffusion of know-how from Japanese affiliates that have been established within the region. Indeed, regional

production networks can be seen not only in electronics but also in other industries such as garment manufacture and automobile assembly. Even less-developed countries (LDCs), which have not belonged to industrial production networks hitherto, have recently begun to be drawn into the production process.

The following section reviews the existing theoretical and empirical literature relevant to the above three research questions and clarifies the significance of our own contributions. In the third section, we provide a summary of our findings and comment on the implications of each of the book's chapters. In the final section of this introductory survey, we offer our thoughts concerning the future possibility of East Asia's economic integration, taking into account the conclusions arrived at by each of the chapters that make up the book.

1.2 PREVIOUS THEORETICAL AND EMPIRICAL STUDIES AND OUR OWN CONTRIBUTIONS

1.2.1 Development of Intermediate Input Trade

Sequential production across countries has been investigated from a theoretical standpoint by many authors and has been referred to variously as fragmentation (Jones and Kierzkowski, 1990), slicing up the value chain (Krugman, 1996), vertical specialization (Hummels et al., 2001), and the production network (Hanson et al., 2005).

Several studies have attempted to investigate to what extent fragmentation has developed in East Asia. Among them, the contribution by Hummels et al. (2001) has attracted widespread attention, as it provides a measurement of the vertically fragmented production process. The authors of this study calculated a vertical specialization index, which measures the imported inputs that are embodied in another country's exports, using Input–Output tables from the OECD. We ourselves used a similar methodology, but in order to calculate a vertical specialization index for East Asia, we have used the Asian Input–Output tables compiled by the Institute of Developing Economies (IDE).

We have obtained some interesting findings. First, with the exception of Singapore, between 1975 and 2000 most of the East Asian countries increased their vertical specialization export share within the region. Second, vertical specialization export shares in 2000 were higher in Malaysia (0.33), the Philippines (0.28), Singapore (0.31) and Thailand (0.24), compared with the OECD country average of 0.21, as measured by Hummels et al. (2001). Third, vertical specialization has developed

especially in the electronic products and chemical products industries. This study confirms the widespread impression that within East Asia, intermediate input trade increased significantly from 1975 to 2000, especially in electronics and chemical products industries. Moreover, the share of input trade to total trade is larger in East Asia than in the OECD as a whole.

1.2.2 Determinants of Intermediate Input Trade and Production Networks

Why has intermediate input trade and the resulting formation of international fragmentation (production networks) developed in East Asia? In broad terms, there are two explanations for this. One emphasizes trade costs. New economic geography (NEG), or spatial economics, argues that the location of manufacturing changes over time according to trade costs. Krugman and Venables (1995), for example, have examined the location of intermediate goods and final goods output, but they have not explicitly analyzed the location of intermediate goods production. It was Amiti (2005) who extended the literature in NEG by embedding a model with vertical linked industries involving upstream and downstream types of manufacturing. Amiti (2005) argues that the location of upstream and downstream production changes in accordance with trade costs and market sizes. Yi (2003) has discussed to what extent the reduction of trade costs affects intermediate trade, and has predicted that a one-percentage-point reduction in tariffs leads to a multiple of one-percentage-point decline in costs and prices due to at least a doubling of border controls where tariffs are incurred. Amiti suggests that intermediate trade would be encouraged by a small reduction of trade costs.

Other studies have emphasized factor endowment differences. Using a simple two-country trade model, Jones and Kierzkowski (1990) and Deardorff (2001a, 2001b) discussed how, with growth of its output level, a firm was able to promote a switch to a production process characterized by fragmented production blocks. They concluded that fragmentation increases the value of output of any country where it occurs as well as that of the world in general.

Differences in factor endowment and in trade costs seem to be important for East Asia's formation of production networks, but which of the two has been the most important within the region? We investigate the determinants of intermediate input trade in several ways: by using trade data, input-output tables and information derived from fieldwork. We find that the reduction of trade costs primarily affects the expansion of intermediate trade, and that intermediate input trade is highly sensitive

to it. This result is consistent with the findings of Yi (2003). Moreover, we find that differences in factor prices affect bilateral trade among the countries in the region, especially in the electronics industry where production networks are especially well developed. The implication of our study, therefore, is that the reduction of trade costs will be effective in East Asia in circumstances where large differences in factor prices exist.

1.2.3 Main Features of Production Operations by Multinational Enterprises

It is often assumed that MNEs have played a significant role in the growth of international input trade and in the development of production networks. One of our concerns has been to test the validity of this assumption. Ever since the work of Markusen (1984) and Helpman (1984), theoretical studies of MNEs have examined various features of production operation. Markusen (1984) argues that the horizontal production operations by MNEs in foreign countries are similar to those of firms whose objective is to produce goods for the home market. By contrast, Helpman (1984) claims that in vertical production operations, the production process is geographically fragmented by stages of production. Two theoretical models of horizontal and vertical operations are presented in the knowledge-capital (KK) model devised by Markusen (see Markusen et al., 1996; Markusen, 1997, 2002). These models posit two countries, namely the home and host countries. However, since foreign affiliates are nowadays increasing their export ratio to third countries, the model needs to include third countries, too. Ekholm et al. (2007) propose the concept of export-platform FDI (PFDI): a parent country invests in a particular host country with the intention of serving 'third' markets by importing from its home country and exporting final goods from the affiliate in the host country.

In the analysis of the operations of MNEs, because relevant data have been either absent or hard to find, far more attention has been given to theory than to empirical approaches. The data on the operations of MNEs are often not publicly available because they relate to sensitive areas of corporate strategy. Despite this difficulty, some useful empirical studies have been carried out. An example is the work of Hanson et al. (2005) who examined the vertical production relations by which US affiliates import materials and parts from the USA; and export finished products back to the home country. Belderbos et al. (2001) and Kiyota et al. (2008) have examined the determinants of local content so far as Japanese affiliates are concerned. These studies, however, focused on the production relationship between home and host countries, and did not investigate production relations with third countries.

Our own empirical studies have paid attention to the tendency of MNEs to import from third countries and export to third countries, and have been carried out at firm level, using microdata analysis. Using the Basic Survey of Overseas Business Activities by Japanese Firms, we have found that procurement from third countries in terms of value is about 20 percent of the whole, including 15 percent from Asia, as against 60 percent locally and 20 percent from the home base of Japan in the case of firms not procuring items from third countries. This figure is not low if we take border barriers into account. Moreover, we found that procurement by origin is affected by sales by destination: procurement from abroad (Japan or a third country) tends to be sent back abroad. However, at firm level, there is a growing tendency for procurement from third countries as well as from the home country to be replaced by procurement from the host country. On the other hand, in terms of the number of affiliates, procurement from, and sales to, third countries is more widespread than the kind of operation envisaged by Ekholm et al., whereby items are procured from home countries and finished products sold to third countries. Our findings indicate that Japanese affiliates have been deeply engaged in international fragmentation and in production networks within East Asia.

1.3 SUMMARY OF THE CHAPTERS AND THEIR FINDINGS

Chapters 2 and 3 use IDE's Asian Input–Output tables, which provide precise data on intermediate inputs and final goods by destination and by industry. This data set is unique in that it categorizes goods into intermediate and final inputs, and it shows the share of each industry's output that is absorbed by other industries and by final consumers.

Chapter 2, by Hummels and Uchida, is the first study to calculate a vertical specialization index (the import input share that is embodied in the country's exports) for East Asia. Three interesting findings have emerged. First, the degree of vertical specialization varies according to country and is high in Malaysia, the Philippines and Thailand, in which the values range from 0.2 to 0.37. By contrast, China and Indonesia exhibit relatively low vertical specialization shares of less than 0.1. This may reflect the fact that in a large country, a wider range of intermediate inputs can be produced. Second, with the exception of Singapore, the vertical specialization index has been increasing everywhere in the region over time. In particular, between 1990 and 2000, the vertical specialization index increased in Indonesia, Malaysia and the Philippines, all of which are countries where

the electronics industry has developed. Third, the degree varies according to industry: the electronics industry shows the highest vertical specialization index, increasing most between 1990 and 2000. This indicates that vertical specialization has been more advanced in the electronics industry than in other kinds of manufacturing, and that the electronics industry is amenable to fragmentation.

Why does input trade take place? Chapter 3, by Hummels and Puzzello, examines the country- and industry-level determinants of the sourcing of intermediate goods and the extent of vertical specialization. Surprisingly, the chapter concludes that input trade is more likely than final goods trade to be characterized by features that are less sensitive to differences in factor endowment and more sensitive to differences in trade costs. The result is consistent with the argument that input trade may be driven by trade costs and is influenced by the balance between scale economies and trade costs (as in Krugman and Venables, 1995, 1996; Venables, 1996). Our finding suggests that policy efforts to reduce trade costs can encourage fragmentation and the emergence of production networks.

The question arises as to what extent the argument that input trade may be driven by factor endowment differences (as in Arndt, 1997, 1998; Deardorff, 2001a, 2001b) is a valid one. Chapter 4, by Hiratsuka, investigates the determinants of bilateral trade including intermediate trade for the 14 countries of the East Asian region. East Asia is well on the way to becoming the world's factory: its world export shares are very high, amounting in 2006 to about 40 percent for parts and components, 40 percent for capital goods and 30 percent for consumer goods. This chapter investigates the determinants of East Asia's trade, focusing on the relationship between skill differences (factor prices) and bilateral trade. Differences in skill levels have a positive effect on bilateral trade with partners for intra-East Asia trade, and on the other hand, a negative effect so far as interregional trade is concerned. The positive relationship between the skill-level difference and bilateral trade for intra-East Asian regional trade implies that skill- and labor-abundant countries produce skilled-labor-intensive products while unskilled-labor-abundant countries produce unskilled-labor-intensive products. This indicates that vertical production characterized by separated production blocks, which require different levels of skill and technology for the manufacture of a final product, is intensively operated within the region.

Vertical production is mainly operated by MNEs in East Asia and, in particular, in ASEAN (Association of South East Asian Nations). It follows that the relationship between MNEs and trade is an issue that needs investigation. Chapter 5, by Yokota, investigates the relationship between Japanese foreign direct investment (FDI) and the parts and

components trade in East Asia. As the econometric analysis clearly indicates, there is a positive relationship between Japanese FDI and Japanese exports. In other words, Japanese outward FDI may also promote domestic production of parts and components for export, resulting from a vertical linkage structure among Japanese firms. The complementary effect of FDI on parts and components exports is largest in electrical machinery, the size of the impact on electrical machinery being 16 times larger than that on the textile industry. These facts suggest that fragmentation brings about positive effects on production, as theory has predicted (Jones and Kierzkowski, 1990; Deardorff, 2001a, 2001b). At an empirical level, too, it is clear that fragmentation occurs to a greater degree in electronics than in any other industry.

So far, we have examined the extent and determinants of the intermediate input trade in East Asia, but what can be said regarding the actual operations of MNEs in the region? It is widely assumed that fragmentation is mainly the work of MNEs, and the nature of production by MNEs forms the next research issue discussed by the book's authors. Any attempt to analyze MNE behavior must rest on micro-analysis at firm level. Chapters 6 and 7 investigate the behavior of affiliates of Japanese MNEs operating in East Asia. Both chapters use the Basic Survey of Overseas Business Activities, an annual survey of the business activities of overseas Japanese affiliates and parent companies conducted by the Ministry of Economy, Trade and Industry (METI), Government of Japan.

Chapter 6, by Hayakawa and Matsuura investigates the motivations of Japanese MNEs with particular reference to their procurement by origin and their affiliate sales by destination. This study distinguishes three types of affiliate (home, host and third country) according to the origin of their procurements and the destinations of their sales, and we further divide each Japanese affiliate into nine types. In terms of numbers of firms, Japanese affiliates operating in East Asia mainly export abroad (to Japan or third countries). This is quite different from Japanese affiliates operating in North America, whose products are sold mainly in the market of the host country. Furthermore, affiliates supplying overseas markets with exports of final goods from an affiliate in the host country, while procuring from abroad, account for a large proportion of the firms operating in the electronics, information and technology, and precision machinery industries. These observations are consistent with the view that Japanese affiliates have expanded their production and distribution networks in East Asia.

Do Japanese affiliates operating in East Asia procure mainly from the home country, as the vertical production operation theory would lead us to expect? Or do they, like their counterparts in North America, tend to

procure more from their host countries? Chapter 7, by Ozeki, investigates procurement by Japanese multinational affiliates operating in East Asia. An empirical analysis finds that the operating period, share of local sales and degree of agglomeration of Japanese manufacturers have a positive effect on local procurement and a negative effect on purchasing from a third country or from Japan. Another finding is that such determinants have different effects on intra-firm and inter-firm (arm's-length) purchasing activities; agglomeration has a positive effect on arm's-length local procurement and a negative effect on intra-firm purchasing from the home country. These empirical results suggest in particular that the share of local procurement from arm's-length transactions will probably continue to increase, while the share of international procurement and especially from Japan is likely to decrease in the future.

Of course, this must not be taken to mean that production networks in East Asia will disappear in the future. The study results simply mean that when an affiliate is established, it has to procure from abroad. But as time goes by, the affiliate procures increasingly from the host country. That said, the rapid development of intermediate input trade and production networks indicates that the East Asian factory is growing as the international market expands. And in response to the expansion of the market, MNEs continue to expand their production bases, with the result that materials and parts are traded between these new bases and existing production bases and/or the home country.

With the expansion of purchasing from host countries, production of intermediate input goods may to some extent move to lower-income countries. Such a dispersion depends on to what extent low-income countries can reduce trade costs. This leads us to ask whether or not East Asian LDCs such as Cambodia, Laos and Myanmar are likely to become involved in production networks. In relation to this and other related questions, the last two chapters discuss the future development of production networks in East Asia.

Chapter 8, by Kimura, argues that a variety of firm specificity supported by sophisticated inter-firm relationships is essential to an understanding of the mechanics and spatial structure of international production and distribution networks in East Asia. By mapping geographically a two-dimensional fragmentation framework (Kimura and Ando, 2005), the study distinguishes four layers of transactions within production and distribution networks: (i) local; (ii) sub-regional; (iii) regional, and (iv) global. This concept effectively bridges the geographical extensions of production and distribution networks and the nature of transactions in terms of intra-firm versus inter-firm (arm's-length) transactions, as well as technological and managerial conditions. The geographical structure of

production and distribution networks for technology transfers and spillovers suggests that sub-regional production networks can develop together with other production networks such as local and regional production networks.

Chapter 9, by Souknilanh, seeks to answer the question of whether or not the East Asian LDCs will become involved in production networks. The study investigates all manufacturing affiliates in Laos, and categorizes the country's production network into three groups, according to the type of driver involved: (i) those driven by preferential trade arrangements (including the Generalized System of Preferences or GSP); (ii) those driven by tariff barriers; and (iii) those driven by factor endowments. Types (i) and (ii) developed in Laos almost immediately after the country opened its doors to FDI in 1988. Many companies hitherto based in Thailand either relocated garment factories to Laos or set up branches there so as to benefit from the preferential trade arrangements granted to Laos, mainly by the European Union (henceforth EU). On a smaller scale, motorcycle assembly factories were also set up by local and foreign-affiliated manufacturing firms in neighboring countries, in order to overcome high tariffs. Approximately ten years later, from 1997 onwards, networks driven by factor endowments also started to appear, with some Japanese-affiliated factories in Thailand beginning to take advantage of Laos's relative lower wage rates. Other attractions included the almost complete absence of language and currency barriers, and decreasing transport costs, broadly defined. These factors led firms based in Thailand to establish so-called second factories in Laos. A similar kind of fragmentation has appeared in the electronics industry.

1.4 GLOBAL AND REGIONAL PERSPECTIVES ON INTERMEDIATE INPUT TRADE AND INTRA-EAST ASIA TRADE

Our empirical studies confirmed that intermediate input trade is increasing, and that East Asia's production structure is becoming more dependent on intermediate inputs and is becoming fragmented. The expansion of intermediate input trade has been stimulated by the reduction of trade costs in East Asia where there are large differences in factor endowment among the countries that make up the region. In East Asia, sequential production stages are located across countries, with each country specializing in production stages in areas where it enjoys comparative advantage. Labor-abundant countries specialize in producing low-value-added parts, the manufacture of which requires relatively low technology, while capital-

abundant countries produce high-value-added parts that incorporate high technology. This production mechanism has led to a sustained expansion of intermediate trade in East Asia.

The development of international fragmentation or production networks is perhaps mainly the result of zero-tariff scheme arrangements in East Asia. The investment schemes that are in operation exempt firms from import taxes on production for export purposes, while Information Technology Agreements (ITAs) permit participants to completely eliminate duties on IT products. In addition, logistic networks have developed in the region.

MNEs are closely involved with the rapid growth in intermediate input trade and production networks because of their participation in the sequential production system. MNEs have exploited differences in skill and factor prices, and have taken advantage of the variety of policies offered by the various countries of the region. In fact, Japanese MNEs behave as export platforms, both in ASEAN and in China. Meanwhile, procurement from third countries has prevailed, especially in the electronics, information and technology, and precision machinery industries, and in particular in ASEAN.

Given the background of rapid growth in intermediate goods trade and the development of sequential production systems, what kind of perspective can we obtain on the possible contribution of LDCs such as Cambodia, Laos and Myanmar to East Asia's production networks?

According to fragmentation theory and vertical multinational theory, the development of sequential production systems leads to increases in production in both home and host countries. Our empirical studies have confirmed that, over time, Japanese affiliates tend to increase procurements from local sources rather than from their parent country of Japan. On the other hand, Japanese FDI has promoted exports through vertical production networks. These findings indicate that affiliates procure mainly from their host countries, while obtaining some parts from host and third countries, and this in turn suggests that the home country of Japan should move increasingly to more skills-based activities.

Another important issue is whether or not East Asian LDCs can participate in the sequential production system. Theoretically, due to congestion in advanced countries, we can expect some manufacturing products and processes to disperse from higher-wage countries to lower-wage countries. Our own perspective is that with the growth of intermediate trade and the development of production networks, the Asian LDCs can achieve faster development by participating in sub-regional transactions.