

Preliminary draft
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Unprecedented Formation
of International Production/Distribution Networks
in East Asia¹

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Abstract

The international production/distribution networks consist of vertical production chains and distribution networks extended across a number of countries. This paper claims that the international production/distribution networks in East Asia are “unique,” at least at this moment in time, in their significance in the regional economy, their geographical extensiveness involving a large number of countries in the region, and their sophistication of both intra-firm and arm’s-length relationships across different firm nationalities.

The paper starts from reviewing crucial changes in policy framework in the developing East Asian countries a decade ago and then sketching the theoretical thoughts explaining the mechanics of international production/distribution networks. In the empirical part of the paper, overall trade patterns of the major East Asian countries are first analyzed in order to confirm the importance of international trade of machinery parts and components. Then the micro data of Japanese corporate firms are examined to make a closer look at the nature of networks through the pattern of FDI. In addition, the magnitude of economic activities of Japanese firms through different channels of transactions is quantified, using the firm nationality approach. The last part of the paper discusses policy implication of the networks.

1. Introduction

The East Asian region has continued to serve as the world's growth center for four decades. In the background of this "East Asian miracle," the World Bank emphasized in its 1993 report (World Bank (1993)) the existence of well-managed macroeconomic fundamentals and wisely designed microeconomic policies. Over the last decade, the unprecedented formation of international production/distribution networks has been added to the major characteristics of the East Asian economies.

The international production/distribution networks consist of vertical production chains extended across the countries in the region as well as distribution networks throughout the world. Firms belonging to the machinery industries including general machinery, electrical machinery, transport equipment, and precision machinery are major players though some firms in other industries such as textiles and garment also develop such networks. Although the formation of similar networks is observed between Germany and East Europe and between the U.S. and Mexico, the one in East Asia is "unique" at least at this moment in time in the following characteristics: first, they have already become a substantial component of each country's economy in the region. Each country's manufacturing sector and international trade cannot be discussed without the existence of the networks anymore. Second, the networks involve a large number of countries at different income levels. Cross-country differences in factor prices and other location advantages seem to be effectively utilized in the formation of vertical production chains. Third, the networks include both intra-firm and arm's-length relationships, partially across different firm nationalities. Multinational enterprises (MNEs) as well as indigenous firms in each country are forming sophisticated inter-firm relationships.

Although the importance of international production/distribution networks in East Asia seems to be taken for granted in business community, even its existence has not yet been fully recognized in the academic literature. One of the reasons is that traditional statistical figures provide little clue for the mechanics of the networks. International trade data just tell us what is traded between two countries, not indicating who is trading with whom. Foreign direct investment (FDI) data are poor indicators for the magnitude of activities of MNEs. The accumulation of piecemeal information, however, has gradually revealed the reality of the networks.

The formation of international production/distribution networks in East Asia

has been backed up by drastic changes in development strategies of each country. In the mid-1980s and the early 1990s, the East Asian developing economies started applying new development strategies in which the benefit from hosting FDI is aggressively explored. In the new development strategies, the utilization of market forces is emphasized. However, they are not simple laissez-faire policies; rather, new roles of government involvement in the process of development are pursued. East Asia is presenting a model of new development strategies under globalization for LDCs in other parts of the world.

The formation of international production/distribution networks in East Asia has also provided substantial impact on our academic thought on trade and FDI patterns. The traditional comparative advantage theory still has a certain explanatory power when interpreting across-industry location choices based on international differences in technological level and factor prices. However, the enhanced importance of intermediate goods trade as well as industrial clustering has stimulated the development of new theoretical thought in international trade theory, particularly in the literature of fragmentation theory and agglomeration theory. In addition, the sophisticated pattern of intra-firm corporate structure and inter-firm relationship developed in East Asia has inspired research to incorporate the analysis of corporate behavior into international trade theory beyond the traditional approach of trade and FDI.

The purpose of this paper is to confirm the importance of international production/distribution networks in East Asia. Although it is difficult to directly observe the detailed mechanics of the networks with comprehensive statistics, there exist various side-evidences as well as theoretical discussions reinforcing the argument. This paper starts from briefly reviewing drastic changes in policy framework in the Southeast Asian countries and China in the latter half of the 1980s and the early 1990s. Section 3 sketches the current status of theoretical thoughts explaining the mechanics of international production/distribution networks. Then we turn to statistical analysis proving the existence of the networks. Section 4 presents overall trade patterns of major East Asian countries and confirms the importance of machinery trade. Section 5 utilizes the micro data of Japanese corporate firms and makes a closed look at the nature of networks through the pattern of FDI. Section 6 quantifies the magnitude of economic activities of Japanese firms in different channels of transactions following the firm nationality approach proposed by Baldwin and Kimura (1998). Section 7

discusses policy implication of the networks and concludes the paper.

2. Drastic changes in development strategies

Why was an extensive international production/distribution networks formulated in East Asia, not in other regions such as Latin America? One of the crucial factors was the set of policies applied by the East Asian developing economies from the mid-1980s or the early 1990s.²

It is well known that most of the East Asian economies have traditionally applied a “dual track approach”; i.e., trying to foster both import-substituting industries and export-oriented industries at the same time. There was, however, an important difference between forerunners (i.e., Japan, Korea, and Taiwan) and latecomers (i.e., the Southeast Asian countries and China); the latter actively utilized incoming FDI not only in export-oriented industries but also in some major import-substituting industries.

Although the dual track approach has been maintained throughout their path of industrialization in the latecomer countries, the weights between import-substituting industries and export-oriented industries were changed over time. From the 1970s to the mid-1980s, these countries introduced selective FDI primarily in import-substituting industries. Although FDI for export promotion was also invited, potentially competing domestic industries were insulated by policies that limit the activities of foreign companies, for example, to geographically segregated export-processing zones. After major policy changes, however, these countries switched their FDI hosting policy from selective acceptance to basically “accept everybody” policy. While keeping trade protection for import-substituting industries, they started trying to host as many foreign companies as possible and formulate industrial clusters. Such policy changes began to be adopted in Malaysia and Thailand in the mid-1980s and in the Philippines, Indonesia, and China in the early 1990s.

The dual trade approach requires a complicated policy package. To invite export-oriented foreign companies, what a country has to do is simple though difficult; it must provide the world’s best or second best location advantages for incoming investors. Trade protection of course affects location advantages negatively. So as to

² Kimura (2003) discusses new development strategies applied by the East Asian economies more in detail.

partially neutralize negative effects of import-substituting industry protection, the Southeast Asian countries introduce a duty drawback system, i.e., the system of refunds of duties and indirect taxes on imported inputs in export production. Various types of FDI facilitation measures are also crucial to attracting foreign companies. In particular, aggressive policy of inviting foreign small and medium enterprises (SMEs) works effectively in the formation of industrial clusters. These countries concentrate their public resources on the development of economic infrastructure including roads, ports, electricity and water supply, telecommunications, and industrial estate services. In addition, the service improvement of FDI-hosting agencies has yielded considerable facilitation.

These countries do not give up fostering local indigenous firms. However, instead of hastily providing protection for immature local entrepreneurs, they set a short-term priority on quickly building up a critical mass of agglomeration and hooking their economies to international production/distribution networks by aggressively inviting foreign companies. The focus of local industry promotion is shifted to enhancing capability to penetrate into vertical production chains. Although cleaning up inefficient import-substituting industries is still left over, new development strategies with aggressively utilizing incoming FDI bear fruit in the Southeast Asian countries and China. This sets a sharp contrast with LDCs in other parts of the world.

3. Supporting economic logic

What sort of economic logic explains the mechanics of international production/distribution networks? When discussing the international division of labor, the theory of comparative advantage based on the relative advantages in autarky is still valid in a number of circumstances. Technological gap and factor price differences explain location patterns of industries to some extent. However, in interpreting the mechanics of international production/distribution networks, we must at least incorporate three new lines of thought into our analytical framework.

The first line of thought is the fragmentation theory. It is a powerful tool when we analyze patterns of FDI going to LDCs to formulate vertical production links or cross-border production sharing system.³ The traditional international trade theory

³ As for the fragmentation theory, see Jones and Kierzkowski (1990), Arndt and

primarily explains industry-wise location patterns. However, in East Asia, production-process-wise location patterns were often observed. A typical example is semiconductor-related electronics industry. This industry as a whole is obviously capital-intensive or human-capital intensive, but its production activities are finely segmented and located in various places. The fragmentation theory neatly presents the logic behind such a location pattern.

Deardorff (2001a) defines fragmentation as “the splitting of a product process into two to more steps that can be undertaken in different locations but that lead to the same final product.” Suppose that there is initially a big factory located in Japan taking care of all the production activities from upstream to downstream. If we carefully look at individual production blocks, however, we may find that some production blocks require close attention by technicians while others are purely labor-intensive. If we can locate production blocks separately in Japan, Malaysia, and China, for instance, we may save the total production cost. Because the East Asian countries still have substantial differentials in labor costs, fragmentation across different cones formalized by Deardorff (2001b) seems to be particularly useful in understanding the nature of vertical production chains.

Fragmentation becomes economical when the cost of service links (SL) connecting production blocks (PB) is low enough. SL cost includes transport costs, telecommunication costs, and various coordination costs between PBs. SL cost heavily depends on the nature of technology in each industry. Globalization, however, reduces SL cost in general and enables firms in many industries to fragment their PBs further to reduce the total production cost. As SL tend to carry strong external economies of scale, globalization may accelerate concentration and fragmentation at the same time, which may result in a situation where some countries significantly enjoy the fruit of globalization while others do not.

The second line of thought is the agglomeration theory. This is an extension of international trade theory with external economies of scale while introducing the concept of “space” from city planning and other academic fields.⁴ Although the micro-

Kierzkowski (2001), Deardorff (2001a), and Cheng and Kierzkowski (2001).

⁴ As for the agglomeration theory, see Krugman (1991, 1995) and Fujita, Krugman, and Venables (1999).

foundation of spatial agglomeration has not been fully analyzed, the importance of agglomeration as a source of location advantage is increasingly recognized in both empirical and theoretical literature. Economies of scale or agglomeration effects do not necessarily depend on the initial condition under autarky; in an extreme case, a country may start having agglomeration purely by chance. In this sense, the source of gains of trade in the “new” international trade theory is logically different from those in the tradition theory of comparative advantage, and such nature of the “new” theory generates the possibility of the new role of government. Among the factors that generate location advantages for MNEs to invest, agglomeration is one of the crucial elements, particularly in LDCs. Governments in East Asia are obviously conscious of the potential role of government in formulating agglomeration.

The third line of thought is the internalization theory of corporate firms. A firm typically does not do everything from upstream to downstream. It sets its upstream-side boundary by purchasing materials or parts from other firms and determines its downstream-side boundary by selling their products to other firms or consumers. Such a boundary setting decision is here called “internalization decision.” In addition, a firm cuts its internalized activities into thin slices and places these slices at appropriate places. This is called “location decision.” A firm makes internalization decision and location decision at the same time, considering its own firm-specific assets such as technology and managerial know-how. Internalization may have different dimensions. For example, internalization decision would be made across different functional activities such as financial management, personnel management, R&D activities, parts procurement, sales activities, and others.

In East Asia, particularly in China, various kinds of internalization patterns with innovative inter-firm relationships emerge in the effort of concentrating on core competences. Such sophistication is particularly salient in machinery industries. Technological progress in the line of developing “module” accelerates the formation of sophisticated inter-firm relationship. The international trade theory has not yet fully digested elements of ownership advantages and internalization advantages that Dunning’s OLI theory presents.⁵ However, the importance of internalization choices

⁵ As for the OLI theory, see Dunning (1993, pp. 81-). Kimura (2000, 2001) analyzes the micro data of Japanese manufacturing firms and claims that corporate structure and

cannot be neglected when the division of labor is at issue. Fragmentation theory and agglomeration theory must be combined with the internalization theory of corporate firms.

4. Recent trade flows in East Asia

It is a well-known fact that the East Asian economies have rapidly developed intra-regional trade relationships since the early 1980s. METI (2003) presents some basic figures. Intra-regional trade of East Asia grew from US\$104.3 billion in 1981 to US\$333.1 billion in 1991, and then US\$702.8 billion in 2001; i.e., it increased by 3.2 times in 1981-1991 and 2.1 times in 1991-2001. Trade intensity indices among the East Asian economies also had an upward trend, suggesting the development of increasingly closer economic relationships.

Fukao, Ishido, and Ito (2003) decompose trade flows into one-way trade, vertical intra-industry trade, and horizontal intra-industry trade and compare the trade pattern in East Asia with the one in Europe. They find that international trade in East Asia has still a substantial amount of one-way trade but the share of vertical intra-industry trade rapidly increases.

On the top of these findings, we would like to claim that the most important changes in the trade pattern of the region is an explosive increase in trade of machinery parts and components. Table 1 shows the values and shares of exports/imports of machineries in major East Asian economies in 1996 and 2000. Machineries are here defined as HS 84-92; i.e., they include general machinery, electric machinery, transport equipment, and precision machinery. An astounding fact is that the shares of machineries in each country's total exports and imports are very large indeed. Except Japan's imports and Indonesia's exports and imports, the shares of machinery trade are as high as 40 percent or even higher up to 70 percent. Furthermore, the shares of parts and components in machinery trade are also very high; they are 40 percent to 50 percent or even reach 80 percent in cases of the Southeast Asian countries.⁶ And the shares of parts and components are further increasing between 1996 and 2000.

inter-firm relationship are jointly chosen with the location of activities.

⁶ See Table A.1 for definition of parts and components in our study.

==Table 1==

These vividly indicate that the international production/distribution networks, particularly in machinery industries, have become a substantial component of the East Asian economies. Although substantial factor price differences remain across countries in the region, the trade pattern is not simple one-way trade based on international differences in resource endowments anymore. Rather, sophisticated vertical production chains as well as distribution connection are extended to region-wide networks. Fragmentation is an obvious phenomenon. The reduction of service link costs derives from technological progress in logistics and improved policy environment, which makes extensive fragmentation possible. One of the motivations for fragmentation is to take advantage of factor price differences as suggested by Dearnorff (2001b). In addition, however, other elements of location advantages such as service link cost and agglomeration effects are increasingly influential in the location choices of MNEs. Both concentration and fragmentation proceed in seeking an efficient form of production/distribution networks.

Note that no all countries in East Asia are effectively connected with such networks at this moment. The CMLV (Cambodia, Myanmar, Laos, and Vietnam) countries have not been fully involved with the networks yet. These countries have substantially low wage levels but are not entirely successful in attracting labor-intensive production processes. This fact suggests that government policies to reduce service link costs and encourage agglomeration are crucially important in order for a country to hook up itself to international production/distribution networks.

5. Evidence from the micro data of Japanese firms

Commodity trade data are useful in examining location patterns of industries but do not unfortunately tell us who is trading with whom. To understand the mechanics of international production/distribution networks, analyzing corporate firms' behavior is crucially important.

Corporate firms in the forerunners of development in the region, Japan, Korea, and Taiwan have had strong technological competitiveness in machinery manufacturing. Machines are typically made of a large number of parts and components, and the competitiveness in machines depends on both the quality/cost of parts and components

and managerial ability of vertical production networks. Corporate firms in Japan, Korea, and Taiwan have been particularly strong in these aspects. When these firms became mature enough to compete in international arena and the Southeast Asian countries and China prepared for proper policy environment in the mid-1980s and the 1990s, the formation of international production/distribution networks was a natural consequence.

The networks consist of both intra-firm geographical extension and inter-firm relationships. Up to the 1980s, an important component of the Japanese economic system was its subcontracting system (*shitauke* in Japanese) or long-term relationships between large downstream assemblers and upstream SMEs.⁷ However, the inter-firm relationship has drastically changed since Japanese firms started to actively conduct FDI. It is often observed that both large assemblers and SMEs make FDI together to form a certain size of agglomeration in Southeast Asia or China. Even in such cases, upstream-downstream relationships become more competitive, non-exclusive ones. With cost consideration, many Japanese firms are open to extend their production chains to firms with other nationalities as long as the technological level meets.

It is very difficult to trace the nature of such corporate relationships by statistical figures. However, firm-level micro data for Japanese corporate firms provide some clue to understanding what is going on. Tables in this section are those constructed from either of the two sets of micro data, which are conducted by Ministry of International Trade and Industry (MITI), Government of Japan: 1) the F/Y 1996 and F/Y 2001 Basic Survey of Business Structure and Activity and 2) the F/Y 1999 Survey (the 27th Basic Survey) of Overseas Business Activities of Japanese Companies. The first firm-level database provides detailed information on parent firms located in Japan and also the number, industry, and regional location of their foreign affiliates. In Tables 2 to 5, constructed from this database, foreign affiliates are defined as those with no less than 20 percent Japanese ownership. The second database presents information on the performance of foreign affiliates. In Table 6, obtained from this database, foreign affiliates include both “affiliates abroad” with no less than 10 percent ownership by Japanese parent firms and “affiliates of affiliates abroad” with no less than 50 percent ownership by such “affiliates abroad” (call both of them “Japanese affiliates

⁷ As for Japanese subcontracting system, see Kimura (2002).

abroad” hereinafter). A more detailed explanation of these databases is given in the Appendix.

Table 2 presents (a) the number of parent firms with foreign affiliates and the number of foreign affiliates; (b) the number of parent firms with affiliates in East Asia and the number of affiliates in East Asia; (c) the number of parent firms with affiliates in North America and the number of affiliates in North America; and (d) the number of parent firms with affiliates in Europe and the number of affiliates in Europe, by the industry of parent firms and by the industry of affiliates in 2000.⁸ In 2000, 3,773 out of 27,655 firms located in Japan (in the data set) totally have 18,943 foreign affiliates. Among them, 2,994 firms have 10,224 affiliates in East Asia. That is, as many as 80 percent of the Japanese firms going abroad has at least one affiliate in East Asia, and 54 percent of the foreign affiliates of Japanese firms are located in East Asia.

==Table 2==

Japanese manufacturing parent firms, particularly machinery parent firms are active investors in East Asia; close to 70 percent of the Japanese parent firms with affiliates in East Asia are in the manufacturing sector (Industries 120 to 320) and half of them are in the machinery sector (290 to 320). The pattern observed for affiliates in East Asia by the industry of affiliates also reveals how dominant manufacturing activities are in East Asia, which is clearly different from the patterns for affiliates in North America or Europe. In East Asia, 61.5 percent of the affiliates in the region are manufacturing, regardless of the industries of their parent firms, while 38.1 percent of the affiliates in North America and 30.9 percent of the affiliates in Europe are.⁹ Taking into account that the number of affiliates increased in the five years, 1995-2000, from 9,132 to 10,224 in East Asia though it decreased from 3,928 to 3,499 in North America and from 3,019 to 2,913 in Europe, manufacturing activities are dominant and have been intensified in East Asia in terms of both Japanese parent firms and their affiliates.

Japanese SMEs with regular workers of less than 300 have largely contributed

⁸ See Table A.2 for industry classification.

⁹ See Kimura and Ando (2003) for comparative study between Latin America and East Asia, based on the micro data of Japanese corporate firms.

to such expansion of manufacturing activities in East Asia by Japanese firms. Table 3 presents the number of Japanese parent firms with affiliates in East Asia, North America, and Europe in 2000 by the size of parent firms and by the number of affiliates. This is done for all sectors as well as for only the manufacturing sector. The table shows that more than 40 percent of the Japanese firms going to East Asia are SMEs while the shares are much lower in North America and Europe. Furthermore, the fact that a considerable number of firms, including SMEs, have plural affiliates in East Asia also supports that Japanese SMEs are actively involved in manufacturing activities in the region. Such active FDI by Japanese SMEs in East Asia have contributed to forming a critical mass of industrial clusters.

==Table 3==

As suggested by Table 2, Japanese parent firms do not necessarily establish affiliates in their own industries where they have main activities.¹⁰ In general, parent firms have various activities across industries and establish foreign affiliates in order to conduct a subset of those activities. Table 4 provides the detailed information on sector switching between parent firms and their affiliates in East Asia; Table 4 (a) includes all sized Japanese firms with affiliates and Table 4 (b) focuses on SMEs. The rows denote the industry of parent firms while the columns the industry of foreign affiliates. Thus, diagonal cells of the tables indicate the number of non-sector-switching affiliates while off-diagonal cells denote the number of sector-switching affiliates.

==Table 4==

In East Asia, 75 percent of the affiliates owned by all sized manufacturing parent firms are in the manufacturing sector.¹¹ Among them, we observe many sector-

¹⁰ A firm often has various activities at the same time. The industrial classification of a firm located in Japan is determined by the largest activities the concerned firm conducts in terms of the value of sales.

¹¹ In the case of manufacturing SMEs, the share of manufacturing affiliates is much higher; as many as 87 percent of their affiliates are manufacturing.

switching manufacturing affiliates with manufacturing parent firms (in non-diagonal cells for industries 120 to 340 in both rows and columns), in particular sector-switching machinery affiliates with manufacturing parent firms (in non-diagonal cells for industries 120 to 340 in rows and industries 290 to 320 in columns). In addition, even manufacturing SMEs have sector-switching manufacturing affiliates, particularly sector-switching machinery affiliates in East Asia, unlike to the case in North America or Europe where only a small number of sector-switching manufacturing are observed. For either large parent firms or SMEs, such behavior is typical in manufacturing activities aimed at supplying intermediate goods for other firms or for their own affiliates. It implies that Japanese firms have played an important role in developing vertical production networks in the region.

Moreover, manufacturing parent firms also have non-manufacturing affiliates, particularly in the wholesale trade sector. Sector-switching non-manufacturing affiliates with manufacturing parent firms (in cells for industries 120 to 340 in rows and industries 480 and others in columns) make up 25 percent of the affiliates owned by all-sized manufacturing parent firms and 13 percent of the affiliates owned by manufacturing SMEs, suggesting that another strategy in East Asia is to establish global production/distribution networks by internalizing wholesale trade activities. Note that these ratios are much smaller than in North America (49 percent for all sized firms and 48 percent for SMEs) and Europe (60 percent and 51 percent).

Before moving to the performance of Japanese affiliates abroad, let us formally analyze the characteristics of Japanese parent firms going to East Asia. Table 6 reports (a) the results of logit regression analysis for Japanese parent firms in all sectors and (b) the results for Japanese manufacturing parent firms. The dependent variable for regression No.1 in both tables is whether a firm has foreign affiliate(s) or not. Similarly, the dependent variable for regression No.2/No.3/No.4 is whether a firm has affiliate(s) in East Asia/North America/Europe. The independent variables are the number of regular workers (in log), tangible assets per regular workers, foreign sales, R&D expenditure, and advertisement expenditure.¹² The results of the case for the

¹² Note that variables for foreign sales, R&D expenditure, and advertisement expenditure are the ratios to total sales. Table A.3 provides the basic statistics of the data for Japanese parent firms with those not included in our regression.

whole foreign affiliates show that firms with foreign affiliates are likely to have large employment size, capital-intensive technology, large foreign sales, and large R&D expenditure. The coefficients for both the firms' size and R&D expenditure in the case of affiliates in East Asia are much smaller than those in the case of North America and Europe. It can be concluded that firms going to East Asia are relatively small as we have descriptively discussed, and thus less R&D intensive, compared with firms going to North America or Europe.

==Table 5==

Table 6, in turn, focuses on the performance of Japanese affiliates in East Asia, North America, and Europe. The table presents (a) the destination of sales and (b) origin of purchases by Japanese affiliates in East Asia. Most of the goods and services produced by Japanese affiliates in East Asia go to the local market, to Japan, or to other East Asian countries (expressed as "E. Asia" in the table): 49.6 percent for local, 21.9 percent for Japan, and 21.2 percent for countries within the region except local and Japan. Contrary to popular opinion, sales to North America by Japanese affiliates in East Asia (expressed as "North A." in the table) are small (3.4 percent). Sales to Europe are also small (2.6 percent). Japanese affiliates in East Asia purchase most goods and services from the local market (41.1 percent), or import them from Japan (33.4 percent) or other East Asian countries (20.7 percent). Japan's share is slightly higher than in sales, probably due to the supply of complicated machinery parts and components produced in Japan. The share of purchases from North America is quite small. These reveal that more than 90 percent of the sales and purchases by Japanese affiliates are among the East Asian countries, including Japan, and suggest the presence of a strong intra-regional production network in East Asia.

==Table 6==

In the case of North America and Europe, in contrast, sales to Japan are quite small; 5.2 percent and 5.8 percent, respectively. In addition, more than half of the sales of the affiliates in the regions are from affiliates in non-manufacturing sector (59.2 percent for North America and 63.4 percent for Europe), particularly in wholesale trade

sector (47.5 percent and 44.2 percent). This indicates that they aim to sale products locally or countries nearby rather than to form vertical chains of production network, unlike to East Asia.

The empirical observation we have discussed may not directly indicate the new three lines of thought. However, active FDI by Japanese SMEs, the existence of many sector-switching manufacturing affiliates, and intra-regional trade by Japanese affiliates indeed imply how such logics work in developing international production/distribution network in East Asia.

6. Evidence from the firm nationality approach

The last section tried to capture the activities of Japanese firms in East Asia by analyzing affiliate holdings and by-destination sales/by-origin purchases. These statistical figures, however, does not directly indicate the magnitude of Japanese firms' activities in exporting from Japan and producing in East Asia. To quantify Japanese firms' activities in different locations and embodied value added contents in international transactions, the firm nationality approach, which is proposed by Baldwin and Kimura (1998) and Kimura and Baldwin (1998), is useful.

When Japanese firms plan to sell their products to foreigners, they have several choices: to produce in Japan and export; to establish foreign affiliates for production and sell locally or to the third countries; to establish foreign affiliates for distribution and sell locally through them; and so on. The amount of gross sales does not necessarily reflect the importance of each transaction because intermediate inputs are counted multiple times. One of the ways to quantify the importance of transactions is to introduce the concept of value added contents.

To capture the whole activities of Japanese firms in East Asia on a value added basis, this section employs a three-country setting, which is provided by Kimura (1998). The three-country setting thinks of three geographical territories, i.e., Japan, Asia,¹³ and the rest of the world (ROW) as well as three nationals, i.e., Japanese, Asians, and foreigners (the national of ROW). "Japanese" consist of Japanese-owned firms located in Japan, households and governments located in Japan, and foreign affiliates of

¹³ Asia stands for Asian countries east of Pakistan in this section.

Japanese firms (FAJFs) located in Asia and ROW.¹⁴ Asians and foreigners are defined in the symmetric way. Three nationals reside in three different locations, and thus 9 blocks are drawn as in Figures 1 and 2. Conceptually, transactions within a block and between blocks are illustrated as 81 (9 times 9) arrows in total. We can, however, fill out 14 arrows of transactions because only statistical data from the Japanese side are readily available.

The numbers shown for 14 arrows in Figure 1 stand for the estimated amount of sales by Japanese in 2000, and the numbers in Figure 2 are the estimated Japanese value added contents of each transaction added at the starting point of the corresponding arrow in 2000. Table 7 provides the summary table and the estimation method of each estimate. Additional explanation of estimation method and data description is given in the Appendix as well. Table 8 presents estimates of the value added contents embodied in sales by Japanese to Asians in Asia and to foreigners in ROW, estimated based on Table 7.

==Figure 1==

==Figure 2==

==Table 7==

==Table 8==

Although these figures are only approximate estimates with a number of reservations on the data set, the value added account provides useful insights on the activities of Japanese MNEs. Major findings are the following three. First, activities of Japanese firms have gradually shifted from Japan to Asia. When we focus on Japanese firms who sell products to Asians in Asia, value added contents of “to produce in Japan and distributing through FAJF in Asia” and value added contents and the share of “to produce in Asia and sell locally” increased from 1996 to 2000 (increase in the share by 2.1 percent) while the share of “to produce in Japan and export directly” decreased by 3.7 percent.¹⁵ Also, when we compare value added contents of “to

¹⁴ Note that "Japanese" in this definition is different from those on the residency basis or those in the sense of factor holders; we treat FAJF as controlled by Japanese and count the whole activities of FAJF as activities by Japanese.

¹⁵ The same analysis (Figures 1 and 2 and Tables 7 and 8) was also conducted for 1996,

produce in Asia and sell locally” and “to produce in Japan and distributing through FAJF in Asia”, the former is larger in 2000 though was smaller in 1996. This implies that importance of local value added has relatively enhanced rather than inputs from Japan.

Second, international production/distribution networks consist not only of Japanese firms but also of the mixture of firms of different nationalities. When we again focus on Japanese firms who sell products to Asians in Asia, the channel for direct exports to Asia from Japan is still important as the share of “to produce in Japan and export directly” suggests; 62.0 percent in 1996 and 58.3 percent in 2000. This high ratio, however, should not be interpreted as that they are all Japanese final consumer goods. Among direct exports from Japan to Asia, capital goods for “Asian” firms are certainly large. In addition, intermediate inputs, particularly machinery parts and components, for “Asian” firms are large; combined with information on Japan’s export in Table 1, roughly one-third to half of them are machinery parts and components.

Third, connection with North America or Europe is thin for both exports and imports. Among several channels for Japanese firms to sell products, the shares of “to produce in ROW and export to Asia” and “to produce in Asia and export to ROW” are pretty small. Considering that those who largely consist of ROW are North America and Europe, these low ratios imply weak connection with North America or Europe, confirming again that contrary to popular opinion, sales to North America by Japanese affiliates in East Asia are small.

7. Current policy issues

This paper claimed the importance of international production/distribution networks in East Asia, and we hope that it was effectively conducted. In fact, the formation of the networks carries profound policy implication. This concluding section provides brief discussion on this matter.

The dual track approach has so far worked pretty well in East Asia. Figure 3 presents over-time changes in the customs duty import ratios in East Asian developing countries. This is the ratio of total customs duty revenue of a country to the c.i.f.-based import value. It is immediately noticed that the ratios are much smaller than

but the results were omitted in the paper.

average tariff figures that we usually observe. Moreover, the ratios have clear decreasing trends over time. These phenomena are partly due to tariff reduction for IT-related products in the 1990s and also due to the effective usage of duty drawback system. In fact, MNEs in export-oriented industries are now paying very small amount of tariffs in these countries. Such a policy package has allowed them to attract both import-substituting FDI and export-oriented FDI so far.

==Figure 3==

However, further activating the international production/distribution networks requires new policy setting. First, fostering import-substituting industries was not after all very successful with a few exceptions, and the cost of protection gradually becomes unbearable. Indeed, Southeast Asian countries and China still have high tariffs for a number of import-substituting industries. To substitute imports by domestic production, governments of these countries have for long provided trade protection for domestic firms or incoming foreign companies. However, trade protection cannot still be removed because of the long-lasting poor competitiveness of these industries. The protection cost is borne by consumers and other industries including export-oriented industries. It cannot be continued forever, and policymakers gradually recognize that it is now the time to reorganize these industries in a more competitive environment. These industries include automobiles, domestic electric appliances, petrochemicals, and iron and steel.

Second, even if tariffs are properly removed, business environment of East Asia is still far from borderless. Cross-border transaction costs become high for various reasons. Physical infrastructure for transportation and telecommunications is one of the important factors. Trade facilitation for customs clearance and other bureaucratic procedures is another vital element. As a more abstract form of transaction costs, legal systems and economic institutions such as standards, intellectual property rights protection, and dispute settlement facilities, are also crucial. To keep attracting FDI and encourage the formulation of agglomeration, policies beyond simple tariff removal become essential.

Third, the sophistication of networks and the development of agglomeration require extensive involvement of local indigenous firms. Thus, the focus of local

industry promotion is not placed on infant industry protection for import substitution anymore. Rather, the issue is what the government can do in order to make local indigenous firms penetrate into vertical production chains. Policymakers know that impatient performance requirements for foreign companies such as local contents requirement and technology transfer requirement have not worked very well. Government-financed technology development centers for local technicians have also had lukewarm results in many cases. The government should ultimately make effort in enhancing human resources for both entrepreneurs and engineers, but human capital development takes time. The role of government is obviously important, but there is no easy policy to reach the goal.

These three issues are, to the authors' opinion, natural consequences of the formation of the international production/distribution networks, and we hope that policymakers in this region have clear mind in confronting with these issues. The East Asian countries are now actively engaging the effort toward formulating regional trade arrangements. The contents of such arrangements are expected to reflect necessary policy reform in the East Asian countries.

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Appendix 1: data sources for section 5

The Basic Survey of Business Structure and Activity (Kigyo Katsudo Kihon Chosa in Japanese) is the MITI survey, first conducted for F/Y 1991, then for F/Y 1994, and annually since then. The prime purpose of the survey is to capture the overall structure of Japanese corporate firms in light of their diversification, internationalization, inter-firm linkages, and strategies on R&D and information technology.

The Basic Survey has several attractive features. First, the samples in the survey are comprehensive, covering firms with more than 50 workers, capital of more than 30 million yen, and establishments in mining, manufacturing, wholesale/retail trade, and restaurants. Foreign affiliates covered in the survey are those with no less than 20 percent Japanese ownership. Whether the affiliate is wholly-owned, majority-owned, or 20-50 percent-owned can be identified if necessary. Second, the ratios of questionnaire returns are high; the actual ratios are not disclosed, but are about 90 percent to 95 percent. Statistics collected by the Government of Japan are legally classified into two categories: designated statistics (*shitei toukei*) and approved statistics (*shounin toukei*). The Basic Survey is the first type, and thus firms in the survey must return the questionnaires under the Statistics Law. Third, it provides firm-level data rather than on an establishment basis. Although establishment-level data are useful in analyzing production activities, firm-level data are much more appropriate to examine corporate activities as a whole.

With regards to industry classification, this paper categorizes all sectors other than manufacturing and wholesale trade as “others” sector because most Japanese firms investing abroad are in the manufacturing and wholesale trade sectors.

The Survey of Overseas Business Activities of Japanese Companies is also conducted by MITI. The survey has been conducted annually since F/Y 1970 to capture overseas business activities of Japanese companies. In particular, the extensive surveys conducted every three years since F/Y 1980 include more detailed information on overseas business activities.

Firms targeted by the survey are those with Japanese affiliates abroad of Japanese firms, except firms in finance, insurance, or real estates. The Survey of Overseas Business Activities is of the approved type, so that the effective return ratios tend to be as low as 60 percent. In the case of the F/Y 1999 Survey, only 2,151 out of 3,841 parent firms returned the questionnaires (the returned ratio is 56.0 percent), and

the number of Japanese affiliates abroad covered is 13,017. As explained in section 5, Japanese affiliates abroad include both “affiliates abroad” with no less than 10 percent ownership by Japanese parent firms and “affiliates of affiliates abroad” with more than 50% ownership by such “affiliates abroad”, but the survey can distinguish the former and the latter if necessary.

The industry classification of the Survey of Overseas Business Activities is different from that of the Basic Survey. To make them comparable, the latter industry classification is matched with the former.

Appendix 2: estimation method and data sources for section 6

The detailed estimation method is described in Table 7. As it shows, Japanese value added in exports of Japanese-owned firms is calculated by subtracting the import component in the exports. The proportion of the import component in exports (8.504%) is obtained from Management and Coordination Agency (1999) (*1995 Input-Output Tables*). Exports of Japanese-owned firms are calculated by subtracting exports of JAFF from exports of Japan. The data for exports of JAFF are available from METI (2002a). Assuming that the ratio of value added to sales is the same no matter where the sales destination is, we obtain the Japanese value added in exports of Japanese-owned firms to FAJF in Asia (7,205,530 million JP Yen), to FAJF in ROW (21,084,637 million JP Yen), to Asians in Asia (3,613,841 million JP Yen), and to foreigners in ROW (3,132,287 million JP Yen). There is no information on exports to foreigners in Asia or exports to Asians in ROW.

Value added earned by FAJF in Asia (33,020,906 million JP Yen) is calculated as sales minus purchases, which are available from METI (2002b). Assuming again that the ratio of value added to sales is the same no matter where the sales destination is, we obtain the value added by FAJF in goods and services sold to Japanese located in Japan (1,611,093 million JP Yen), to Japanese located in Asia (2,409,228 million JP Yen), to Japanese located in ROW (83,975 million JP Yen), to Asians located in Asia (3,613,841 million JP Yen), and to foreigners located in ROW (335,899 million JP Yen). Data are not available for sales by FAJF to Asians in Japan and ROW, or those to foreigners in Japan and ROW. Value added by FAJF in ROW in goods and services sold to various places is estimated in the same way, using the ratio of value added to sales.

METI (2002a) defines Japanese affiliates of foreign firms as those with foreign share of more than one-third. Therefore, exports of JAFFs in the analysis are those of such affiliates. METI (2002b) defines Japanese affiliates abroad as both “affiliates abroad” with no less than 10 percent ownership by Japanese parent firms and “affiliates of affiliates abroad” with more than 50% ownership by such “affiliates abroad” as mentioned above. Thus, sales and purchases by FAJFs in the analysis are those by such affiliates. In METI (2002b), it is known that exports in sales and imports in purchases by FAJFs are overstated because FAJFs are sometimes reported as exports/imports when the ultimate destinations/origins are foreign countries. We therefore regard 30 percent of sales and purchases to/from Japan and ROW in manufacturing as of local transactions. Moreover, there is no available information the magnitude of transactions among FAJFs in METI (2002b). We therefore use 0.4 (0.6) as a proxy of the ratio of sales to FAJFs (Asians) in local sales by FAJFs in Asia, 0.2 (0.8) as a proxy of the ratio of sales to FAJFs (foreigners) in sales to ROW by FAJFs in Asia, 0.4 (0.6) as a proxy of the ratio of sales to FAJFs in Asia (Asians) in sales to Asia by FAJFs in ROW, and 0.2 (0.8) as a proxy of the ratio of sales to FAJFs (foreigners) in local sales by FAJFs in ROW.

Since both METI (2002a) and METI (2002b) are approved statistics, the returned ratios are not so high. As for METI (2002a), 1,935 out of 3,742 parent firms returned the questionnaires (the returned ratio is 51.7 percent). In the case of METI (2002b), 2,157 out of 3,430 parent firms returned the questionnaires (the returned ratio is 62.9 percent), and the number of Japanese affiliates abroad covered is 14,991.

Table 1 Importance of Machinery Trade in the East Asian Economies

	Exports		Imports			Exports		Imports	
	1996	2000	1996	2000		1996	2000	1996	2000
China					Malaysia				
<u>Value (US\$1000)</u>					<u>Value (US\$1000)</u>				
Total	151046318	249201432	138831036	225091657	Total	78308476	98224808	77901213	81287187
Machinery (HS84-92)	40190931	90297514	58949579	99658137	Machinery (HS84-92)	44883017	63267346	48816398	53650999
Parts and components in machinery goods	15050765	38202227	26684923	63312444	Parts and components in machinery goods	26416051	41143650	33052487	42676537
<u>Share</u>					<u>Share</u>				
of machinery goods in total	26.6%	36.2%	42.5%	44.3%	of machinery goods in total	57.3%	64.4%	62.7%	66.0%
of parts and components in total	10.0%	15.3%	19.2%	28.1%	of parts and components in total	33.7%	41.9%	42.4%	52.5%
of parts and components in machinery goods	37.4%	42.3%	45.3%	63.5%	of parts and components in machinery goods	58.9%	65.0%	67.7%	79.5%
Hong Kong					Philippines				
<u>Value (US\$1000)</u>					<u>Value (US\$1000)</u>				
Total	27426223	23531493	201282410	214039820	Total	20537617	38072479	34697094	33802416
Machinery (HS84-92)	10178998	7793123	83881726	101939603	Machinery (HS84-92)	12058695	29466121	18657072	18289222
Parts and components in machinery goods	7360808	6465171	40664744	61409399	Parts and components in machinery goods	9543414	23197724	12381556	14666666
<u>Share</u>					<u>Share</u>				
of machinery goods in total	37.1%	33.1%	41.7%	47.6%	of machinery goods in total	58.7%	77.4%	53.8%	54.1%
of parts and components in total	26.8%	27.5%	20.2%	28.7%	of parts and components in total	46.5%	60.9%	35.7%	43.4%
of parts and components in machinery goods	72.3%	83.0%	48.5%	60.2%	of parts and components in machinery goods	79.1%	78.7%	66.4%	80.2%
Indonesia					Singapore				
<u>Value (US\$1000)</u>					<u>Value (US\$1000)</u>				
Total	49811786	62117778	42923875	33509943	Total	122882738	137803198	131337708	134544130
Machinery (HS84-92)	5305267	11216465	18128354	9621840	Machinery (HS84-92)	86464800	98882015	82698546	87923302
Parts and components in machinery goods	2216286	5747222	9311469	5250261	Parts and components in machinery goods	45255689	62969704	51240888	61854808
<u>Share</u>					<u>Share</u>				
of machinery goods in total	10.7%	18.1%	42.2%	28.7%	of machinery goods in total	70.4%	71.8%	63.0%	65.3%
of parts and components in total	4.4%	9.3%	21.7%	15.7%	of parts and components in total	36.8%	45.7%	39.0%	46.0%
of parts and components in machinery goods	41.8%	51.2%	51.4%	54.6%	of parts and components in machinery goods	52.3%	63.7%	62.0%	70.4%
Japan					Thailand				
<u>Value (US\$1000)</u>					<u>Value (US\$1000)</u>				
Total	410944244	479244574	349185062	379661760	Total	55672988	68780636	72311216	61445996
Machinery (HS84-92)	307646521	358833056	98088775	121601005	Machinery (HS84-92)	22414630	31390017	36457745	28930835
Parts and components in machinery goods	145594106	173334390	42244407	61066645	Parts and components in machinery goods	12095832	19715977	21896420	20888062
<u>Share</u>					<u>Share</u>				
of machinery goods in total	74.9%	74.9%	28.1%	32.0%	of machinery goods in total	40.3%	45.6%	50.4%	47.1%
of parts and components in total	35.4%	36.2%	12.1%	16.1%	of parts and components in total	21.7%	28.7%	30.3%	34.0%
of parts and components in machinery goods	47.3%	48.3%	43.1%	50.2%	of parts and components in machinery goods	54.0%	62.8%	60.1%	72.2%
Korea									
<u>Value (US\$1000)</u>									
Total	129696331	172264221	150320064	160477507					
Machinery (HS84-92)	70265289	102656292	61430373	66402184					
Parts and components in machinery goods	31300305	50000665	31107314	42506546					
<u>Share</u>									
of machinery goods in total	54.2%	59.6%	40.9%	41.4%					
of parts and components in total	24.1%	29.0%	20.7%	26.5%					
of parts and components in machinery goods	44.5%	48.7%	50.6%	64.0%					

Data source: Authors' calculation, based on PC-TAS.

Table 2 Japanese Parent Firms and Foreign Affiliates by Industry, 2000 F/Y

(a) Parent Firms with Foreign Affiliates

Industry	By Industry of Parent Firm		By Industry of Affiliate	
	Number of Parent Firms	%	Number of Foreign Affiliates	%
Manufacturing sector				
120	107	2.8	299	1.6
130	26	0.7	218	1.2
140	53	1.4	132	0.7
150	56	1.5	109	0.6
160	16	0.4	30	0.2
170	26	0.7	40	0.2
180	42	1.1	115	0.6
190	58	1.5	143	0.8
200	253	6.7	1450	7.7
210	16	0.4	81	0.4
220	138	3.7	362	1.9
230	44	1.2	233	1.2
240	6	0.2	7	0.0
250	67	1.8	218	1.2
260	55	1.5	191	1.0
270	77	2.0	404	2.1
280	150	4.0	427	2.3
290	378	10.0	1821	9.6
300	489	13.0	2608	13.8
310	283	7.5	1526	8.1
320	96	2.5	426	2.2
340	69	1.8	320	1.7
Sub total	2505	66.4	11160	58.9
Non-manufacturing sector				
050	10	0.3	23	0.1
480	864	22.9	6460	34.1
540	129	3.4	351	1.9
Other	265	7.0	949	5.0
Sub total	1268	33.6	7783	41.1
Total	3773	100.0	18943	100.0

(b) Parent Firms with Affiliates in East Asia

Industry	By Industry of Parent Firm		By Industry of Affiliate	
	Number of Parent Firms	%	Number of Affiliates in East Asia	%
Manufacturing sector				
120	85	2.8	183	1.8
130	17	0.6	74	0.7
140	43	1.4	96	0.9
150	52	1.7	96	0.9
160	12	0.4	18	0.2
170	25	0.8	36	0.4
180	25	0.8	56	0.5
190	36	1.2	81	0.8
200	204	6.8	867	8.5
210	11	0.4	36	0.4
220	126	4.2	254	2.5
230	41	1.4	128	1.3
240	6	0.2	7	0.1
250	58	1.9	159	1.6
260	46	1.5	115	1.1
270	69	2.3	282	2.8
280	127	4.2	277	2.7
290	286	9.6	810	7.9
300	429	14.3	1598	15.6
310	222	7.4	752	7.4
320	75	2.5	226	2.2
340	55	1.8	145	1.4
Sub total	2050	68.5	6296	61.6
Non-manufacturing sector				
050	3	0.1	3	0.0
480	697	23.3	3350	32.8
540	86	2.9	205	2.0
Other	158	5.3	370	3.6
Sub total	944	31.5	3928	38.4
Total	2994	100.0	10224	100.0

(c) Parent Firms with Affiliates in North America

Industry	By Industry of Parent Firm		By Industry of Affiliate	
	Number of Parent Firms	%	Number of Affiliates in North A.	%
Manufacturing sector				
120	35	2.2	56	1.6
130	14	0.9	52	1.5
140	12	0.8	16	0.5
150	4	0.3	9	0.3
160	2	0.1	2	0.1
170	1	0.1	3	0.1
180	13	0.8	22	0.6
190	28	1.8	34	1.0
200	132	8.3	242	6.9
210	6	0.4	11	0.3
220	40	2.5	62	1.8
230	24	1.5	44	1.3
240	0	0.0	0	0.0
250	19	1.2	28	0.8
260	20	1.3	35	1.0
270	27	1.7	63	1.8
280	44	2.8	88	2.5
290	205	12.9	411	11.7
300	215	13.5	434	12.4
310	178	11.2	383	10.9
320	47	3.0	79	2.3
340	39	2.5	76	2.2
Sub total	1105	69.4	2150	61.4
Non-manufacturing sector				
050	4	0.3	6	0.2
480	340	21.4	1085	31.0
540	39	2.5	65	1.9
Other	104	6.5	193	5.5
Sub total	487	30.6	1349	38.6
Total	1592	100.0	3499	100.0

(d) Parent Firms with Affiliates in Europe

Industry	By Industry of Parent Firm		By Industry of Affiliate	
	Number of Parent Firms	%	Number of Affiliates in Europe	%
Manufacturing sector				
120	12	1.3	31	1.1
130	10	1.1	49	1.7
140	5	0.6	5	0.2
150	2	0.2	2	0.1
160	1	0.1	1	0.0
170	0	0.0	0	0.0
180	5	0.6	8	0.3
190	14	1.5	20	0.7
200	85	9.3	256	8.8
210	4	0.4	8	0.3
220	15	1.6	39	1.3
230	18	2.0	48	1.6
240	0	0.0	0	0.0
250	13	1.4	18	0.6
260	6	0.7	13	0.4
270	15	1.6	38	1.3
280	15	1.6	31	1.1
290	130	14.2	468	16.1
300	148	16.2	436	15.0
310	87	9.5	256	8.8
320	34	3.7	89	3.1
340	31	3.4	80	2.7
Sub total	650	71.1	1896	65.1
Non-manufacturing sector				
050	1	0.1	1	0.0
480	193	21.1	871	29.9
540	23	2.5	45	1.5
Other	47	5.1	100	3.4
Sub total	264	28.9	1017	34.9
Total	914	100.0	2913	100.0

Data source: MITI database.

Table 3 Foreign Affiliate Ownership Patterns of Japanese Parent Firms, 2000 F/Y (number of parent firms)

(a) East Asia

Parent Firms: All Sectors

Number of Regular workers of Parent Firm	Number of Affiliates in East Asia										Total	%	
	1	2	3	4	5	6	7	8	9	10			More than 10
50 to 99	301	67	25	12	1	2	1	.	.	.	1	410	13.7
100 to 199	413	101	34	23	7	1	2	.	2	.	.	583	19.5
200 to 299	196	92	30	12	8	10	3	2	1	.	1	355	11.9
300 to 499	242	99	36	28	18	8	6	4	2	.	4	447	14.9
500 to 999	209	117	65	42	27	20	5	2	4	2	10	503	16.8
More than 1,000	136	107	77	54	55	45	27	38	16	19	122	696	23.2
Total	1497	583	267	171	116	86	44	46	25	21	138	2994	100.0

Parent Firms: Manufacturing Sector

Number of Regular workers of Parent Firm	Number of Affiliates in East Asia										Total	%	
	1	2	3	4	5	6	7	8	9	10			More than 10
50 to 99	185	34	11	5	1	.	1	.	.	.	.	237	11.6
100 to 199	285	66	20	9	2	.	1	.	1	.	.	384	18.7
200 to 299	153	61	19	5	5	9	1	.	.	.	.	253	12.3
300 to 499	176	68	29	18	9	5	4	1	.	.	2	312	15.2
500 to 999	158	86	41	30	18	16	3	2	2	1	3	360	17.6
More than 1,000	80	71	56	39	50	39	19	32	13	16	89	504	24.6
Total	1037	386	176	106	85	69	29	35	16	17	94	2050	100.0

(b) North America

Parent Firms: All Sectors

Number of Regular workers of Parent Firm	Number of Affiliates in North America										Total	%	
	1	2	3	4	5	6	7	8	9	10			More than 10
50 to 99	90	13	2	.	.	.	.	.	.	1	.	106	6.7
100 to 199	185	14	2	1	.	.	1	.	.	.	.	203	12.8
200 to 299	129	18	2	.	.	.	.	.	.	.	.	149	9.4
300 to 499	183	30	10	2	1	2	.	.	1	.	.	229	14.4
500 to 999	210	58	20	6	3	1	1	2	.	.	2	303	19.0
More than 1,000	271	126	69	39	28	17	10	7	7	1	27	602	37.8
Total	1068	259	105	48	32	20	12	9	8	2	29	1592	100.0

Parent Firms: Manufacturing Sector

Number of Regular workers of Parent Firm	Number of Affiliates in North America										Total	%	
	1	2	3	4	5	6	7	8	9	10			More than 10
50 to 99	40	6	.	.	.	.	.	.	.	.	.	46	4.2
100 to 199	110	6	.	1	.	.	.	.	.	.	.	117	10.6
200 to 299	96	11	2	.	.	.	.	.	.	.	.	109	9.9
300 to 499	124	18	6	2	.	1	.	.	.	.	.	151	13.7
500 to 999	158	41	16	5	2	.	.	1	.	.	.	223	20.2
More than 1,000	201	97	55	36	20	12	9	6	7	1	15	459	41.5
Total	729	179	79	44	22	13	9	7	7	1	15	1105	100.0

(c) Europe

Parent Firms: All Sectors

Number of Regular workers of Parent Firm	Number of Affiliates in Europe										Total	%	
	1	2	3	4	5	6	7	8	9	10			More than 10
50 to 99	26	2	.	1	.	.	.	.	.	.	.	29	3.2
100 to 199	58	8	2	1	.	.	.	.	.	.	.	69	7.5
200 to 299	43	11	2	.	.	.	.	.	.	.	.	56	6.1
300 to 499	84	21	8	3	1	3	.	.	.	.	.	120	13.1
500 to 999	113	24	16	4	2	2	.	1	1	1	3	167	18.3
More than 1,000	178	93	55	37	17	18	14	8	10	9	34	473	51.8
Total	502	159	83	46	20	23	14	9	11	10	37	914	100.0

Parent Firms: Manufacturing Sector

Number of Regular workers of Parent Firm	Number of Affiliates in Europe										Total	%	
	1	2	3	4	5	6	7	8	9	10			More than 10
50 to 99	9	.	.	.	.	.	.	.	.	.	.	9	1.4
100 to 199	30	6	.	.	.	.	.	.	.	.	.	36	5.5
200 to 299	27	6	2	.	.	.	.	.	.	.	.	35	5.4
300 to 499	61	14	5	.	.	2	.	.	.	.	.	82	12.6
500 to 999	80	15	12	2	2	.	.	1	.	1	1	114	17.5
More than 1,000	132	80	47	30	14	14	11	6	9	8	23	374	57.5
Total	339	121	66	32	16	16	11	7	9	9	24	650	100.0

Data source: MITI database.

Table 4 Sector Switching Between Parent Firms and Their Affiliates in East Asia

(a) Industries of Japanese Parent Firms and Affiliates in East Asia, 2000 F/Y (number of affiliates)

Industry of Parent Firm	Industry of Affiliate in East Asia																										Total	
	050	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	340	480	540	Other		
050	2																									1	3	
120		145	1							2															20	3	12	183
130		5	28							12															19	1	9	74
140				70	7			2				2									1	2		2	10			96
150				5	73				2			2									1				12	1		96
160						14	1																1	2				18
170						2	25																1	8				36
180								45				2								1					5		3	56
190									63													1		6	4	1	6	81
200	1	9	2	43	4	1		1	3	520	3	15	2		4		4	7	6	8	1	3	10	174	5	41	867	
210										2	2	4								1				9	4	14	36	
220										7		184	6		1		1	2	2	8	1		5	33	1	3	254	
230			1							1		3	89					2	1		4	1	3	15	5	3	128	
240														6									1					7
250	2			1						1		4			87		1	7	1	3	1	4	2	21	12	12	159	
260	3														1	51	3	10	2	8	4			7			26	115
270	3									1		2	1		1		161	14	3	30	14		2	30			20	282
280	1	1		1		2			1		4				2		14	161	7	27	5	1	8	34	1	7	277	
290		4								10		4			1	8	1	15	362	65	20	18	15	214	10	63	810	
300				2	2		1		1	5	12				5	1	3	6	79	1009	6	17	9	308	13	119	1598	
310							1				2				2	5		9	22	25	569		3	59	5	50	752	
320				1						2	1				3			1	6	14		131	2	56	2	9	226	
340				1					1		10	1						2		2		3	66	48	6	5	145	
480	9	115	11	83	157	13	8	14	9	142	11	60	22	3	70	47	32	63	39	266	34	22	56	1516	80	468	3350	
540	1	3		1	12	1	1	1		1		1		2			2	2		3		1	7	12	100	54	205	
Other		2			3	5				3	1	1			2	1		2	12	4	3		2	11	6	312	370	
	22	284	43	208	258	38	37	63	80	709	17	313	121	11	179	113	222	303	543	1475	664	202	199	2627	256	1237	10224	

(b) Industries of Japanese Parent SMEs and Affiliates in East Asia, 2000 F/Y (number of affiliates)

Industry of Parent Firm	Industry of Affiliate in East Asia																										Total	
	050	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	340	480	540	Other		
050	2																											2
120		41								1															4		3	49
130			2																									2
140				29	2																				6			37
150				4	43					2														5	1			55
160						7	1																1					9
170						2	15																1	5				23
180								12				1							1					4				18
190									18													1	5	4		4		32
200									1	80	1	1			1		1	6	2					8	2	1	104	
210											1													3				4
220									2		72	2					1	1	2	3	1			9	1	1	95	
230												22											1	2				25
240														6									1					7
250															23								2	4				30
260																12			1		1		2	2		1		18
270																	58				2		1	3				65
280				1					1		4							72	4	1	1		7				91	
290		2										2			1	1	1	8	109	10	4	4	7	23		7	179	
300				1					1		5						2	5	1	232		4	5	37	4	6	303	
310											1							1	3	3	45		2	3		1	61	
320				1											1					5		34	5			1	47	
340				1							7							1		1		3	24	4			41	
480	1	22	1	18	57	4	3	5	8	23	3	24	9	2	8	2	14	17	14	40	10	10	18	401	17	43	774	
540	1	1		1										2			1	1		3			1	4	9	7	31	
Other										2					1				3	1	3			2	1	50	63	
	4	66	3	56	102	13	19	17	31	108	5	117	33	10	37	15	78	114	140	301	65	56	69	545	35	126	2165	

Data source: MITI database

Table 5 Logit Estimation: Japanese Parent Firms, 1995 F/Y

(a) Parent Firms: All Sectors

Variable	Dependent Variables			
	Having Foreign Affiliates = 1; Not Having Foreign Affiliates = 0	Having Affiliates in East Asia = 1; Not Having Affiliates in East Asia = 0	Having Affiliates in North America= 1; Not Having Affiliates in North America= 0	Having Affiliates in Europe = 1; Not Having Affiliates in Europe = 0
	(1)	(2)	(3)	(4)
Constant	-5.547 *** (-42.82)	-5.713 *** (-42.77)	-8.302 *** (-45.23)	-11.085 *** (-40.40)
Number of regular workers (log)	0.694 *** (31.00)	0.693 *** (30.22)	0.960 *** (32.91)	1.236 *** (30.83)
Tangible assets per regular workers	0.010 *** (6.55)	0.003 * (1.66)	0.009 *** (5.10)	0.007 *** (2.85)
Foreign sales: ratio to total sales	7.132 *** (25.06)	5.146 *** (22.84)	5.288 *** (23.61)	5.564 *** (23.12)
R&D expenditure: ratio to total sales	9.565 *** (8.50)	6.160 *** (6.02)	12.479 *** (10.06)	11.031 *** (8.51)
Advertisement expenditure: ratio to total sale	-0.122 (-0.14)	-1.546 (-1.19)	1.656 (1.42)	2.757 * (1.92)
Log likelihood	-5948.385	-5425.176	-3366.289	-1823.668
Number of observations	13623	13623	13623	13623

(b) Parent Firms: Manufacturing Sector

Variable	Dependent Variables			
	Having Foreign Affiliates = 1; Not Having Foreign Affiliates = 0	Having Affiliates in East Asia = 1; Not Having Affiliates in East Asia = 0	Having Affiliates in North America= 1; Not Having Affiliates in North America= 0	Having Affiliates in Europe = 1; Not Having Affiliates in Europe = 0
	(1)	(2)	(3)	(4)
Constant	-5.769 *** (-35.19)	-5.924 *** (-35.63)	-8.302 *** (-37.83)	-11.628 *** (-33.81)
Number of regular workers (log)	0.775 *** (26.97)	0.770 *** (26.74)	1.078 *** (28.72)	1.340 *** (26.60)
Tangible assets per regular workers	0.006 *** (2.93)	0.000 (0.09)	0.010 *** (4.61)	0.008 *** (2.77)
Foreign sales: ratio to total sales	6.200 *** (20.10)	4.275 *** (17.61)	4.899 *** (19.35)	5.065 *** (18.26)
R&D expenditure: ratio to total sales	6.341 *** (5.51)	3.469 *** (3.39)	9.834 *** (7.48)	9.265 *** (6.99)
Advertisement expenditure: ratio to total sale	0.846 (0.79)	-0.030 (-0.03)	2.570 (1.60)	1.798 (1.56)
Log likelihood	-3994.629	-3715.727	-2291.635	-1275.963
Number of observations	8577	8577	8577	8577

Data source: MITI database.

Notes:

Numbers in parentheses are t-statistics.

*** Significant at the 1 percent level.

* Significant at the 10 percent level.

Table 6 Intra-Regional Production Networks: Sales and Purchases by Japanese Affiliates, 1998 F/Y

(a) Sales: East Asia

Industry	Number of Affiliates	%	Total Sales (Million Yen)	%	Share in Total Sales					
					Local	Japan	Third Countries (Total)			
							E. Asia	North A.	Europe	
Manufacturing Sector										
120+130	162	2.6	343929	1.5	69.1	16.2	14.7	6.4	3.3	3.5
140+150	399	6.4	503397	2.2	43.6	30.2	26.1	12.2	4.9	7.4
160	23	0.4	17204	0.1	15.3	56.3	28.3	24.0	0.9	0.1
170	14	0.2	7073	0.0	52.8	34.3	12.9	8.8	4.0	0.0
180	36	0.6	50256	0.2	74.2	12.5	13.3	9.0	3.5	0.0
190	27	0.4	27536	0.1	77.8	0.4	21.8	11.5	0.4	5.5
200	529	8.5	1414684	6.1	69.8	6.7	23.5	15.7	5.0	1.5
210	17	0.3	36418	0.2	21.2	65.7	13.1	2.9	0.0	10.2
220	109	1.8	92230	0.4	64.7	20.1	15.2	9.7	1.7	2.9
230	54	0.9	107614	0.5	41.4	34.3	24.3	13.2	4.9	5.1
240	16	0.3	7196	0.0	4.5	21.2	74.3	22.5	44.0	7.8
250	160	2.6	334130	1.4	69.7	17.2	13.2	8.8	3.5	0.8
260	166	2.7	423491	1.8	85.4	2.9	11.7	6.5	2.6	0.1
270	110	1.8	281041	1.2	55.9	15.6	28.6	26.3	0.9	1.0
280	121	1.9	97240	0.4	70.9	13.4	15.7	11.9	1.9	1.4
290	315	5.1	688971	3.0	32.4	40.7	27.0	14.8	5.5	4.6
300	916	14.7	5191673	22.3	32.3	32.9	34.8	24.9	5.3	3.0
310	478	7.7	2140129	9.2	81.0	11.1	7.9	2.2	3.5	1.5
320	100	1.6	464375	2.0	27.2	45.9	26.9	23.1	1.5	2.0
330+340	83	1.3	95985	0.4	22.3	63.6	14.1	2.8	7.5	2.9
Non-Manufacturing Sector										
050	11	0.2	22074	0.1	32.9	67.1	0.0	0.0	0.0	0.0
480	957	15.4	8524268	36.7	41.3	19.4	39.3	33.0	2.2	2.8
540	170	2.7	731660	3.1	88.5	5.8	5.7	5.4	0.1	0.2
Others	1240	20.0	1632575	7.0	70.1	15.0	14.9	9.8	2.6	1.9
Total	6213	100.0	23235149	100.0	49.6	21.9	28.4	21.2	3.4	2.6

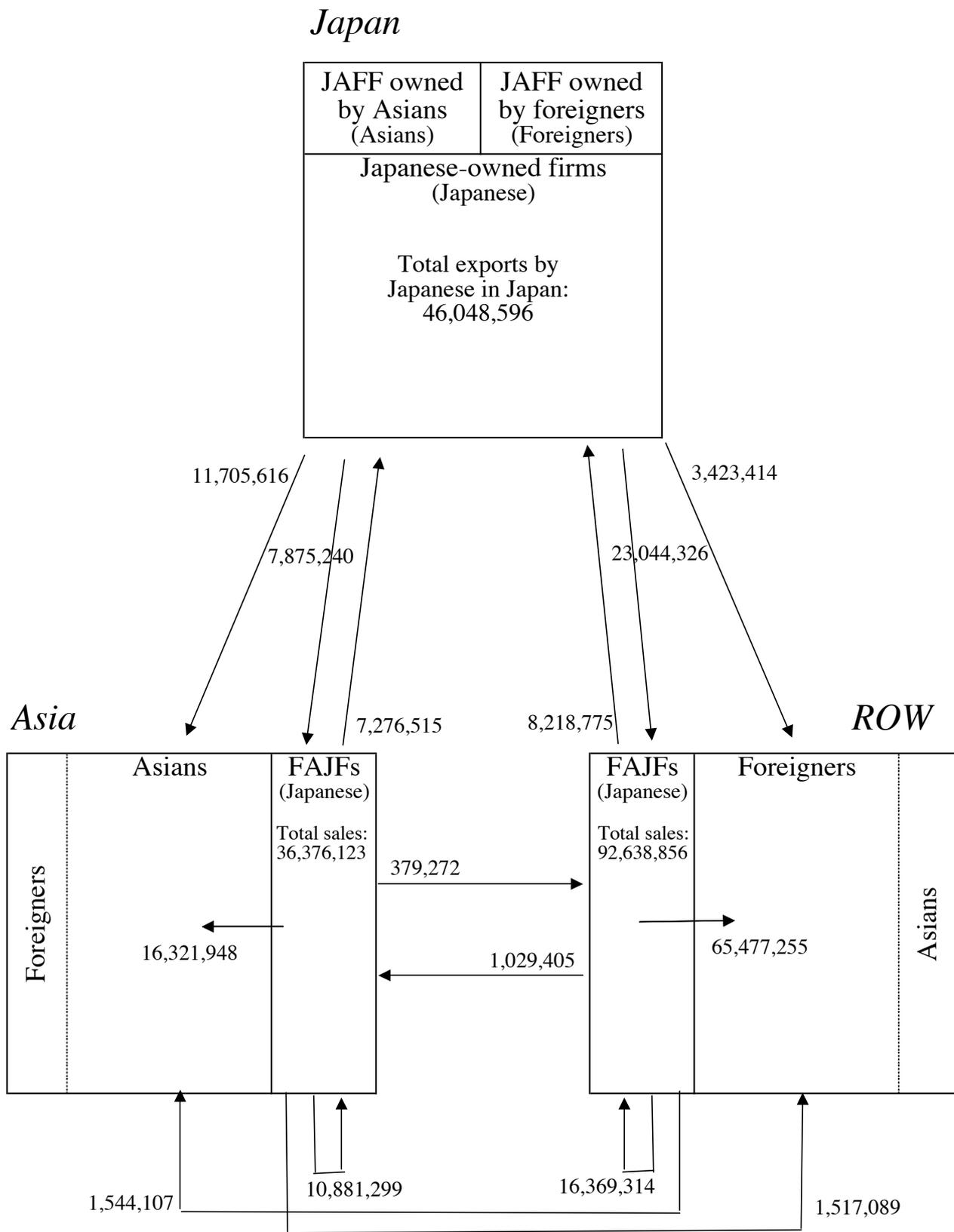
(b) Purchases :East Asia

Industry	Number of Affiliates	%	Total Purchases (Million Yen)	%	Share in Total Purchases					
					Local	Japan	Third Countries (Total)			
							E. Asia	North A.	Europe	
Manufacturing Sector										
120+130	162	2.6	137424	0.9	78.8	6.6	14.6	8.0	0.4	0.5
140+150	399	6.4	254218	1.7	54.0	26.6	19.4	13.1	2.3	0.8
160	23	0.4	7818	0.1	94.0	2.7	3.3	0.0	0.0	3.3
170	14	0.2	4821	0.0	75.2	13.8	11.0	7.9	0.0	3.0
180	36	0.6	15328	0.1	62.5	20.5	17.0	14.1	1.8	1.1
190	27	0.4	2694	0.0	73.7	16.6	9.8	0.0	1.9	7.8
200	529	8.5	579333	3.8	53.6	19.4	27.0	13.3	6.8	1.9
210	17	0.3	32061	0.2	21.7	18.0	60.4	45.4	10.3	3.9
220	109	1.8	38584	0.3	68.0	25.7	6.3	5.1	0.2	0.5
230	54	0.9	24259	0.2	57.4	23.6	19.0	17.1	0.3	1.6
240	16	0.3	5282	0.0	10.0	6.8	83.2	41.2	9.8	3.2
250	160	2.6	140533	0.9	41.3	31.5	27.2	23.1	3.3	0.5
260	166	2.7	229136	1.5	19.2	70.0	10.8	10.4	0.0	0.2
270	110	1.8	155313	1.0	44.1	31.7	24.2	19.0	0.3	1.1
280	121	1.9	47014	0.3	67.8	29.0	3.2	1.7	0.3	1.1
290	315	5.1	400705	2.6	57.7	32.2	10.1	8.8	0.8	0.4
300	916	14.7	3711079	24.4	35.8	37.0	27.2	26.3	0.4	0.2
310	478	7.7	1380996	9.1	53.4	37.2	9.4	6.1	2.5	0.7
320	100	1.6	271580	1.8	40.2	41.2	18.6	14.5	2.6	1.5
330+340	83	1.3	63645	0.4	55.1	37.7	7.1	5.9	0.4	0.7
Non-Manufacturing Sector										
050	11	0.2	354	0.0	98.4	1.6	0.0	0.0	0.0	0.0
480	957	15.4	6333657	41.6	28.4	35.2	36.4	28.3	1.5	2.7
540	170	2.7	597713	3.9	75.0	21.4	3.6	1.1	2.3	0.2
Others	1240	20.0	789214	5.2	70.9	17.9	11.2	9.1	0.1	0.8
Total	6213	100.0	15222761	100.0	41.1	33.4	25.5	20.7	1.5	1.3

Data source: MITI database.

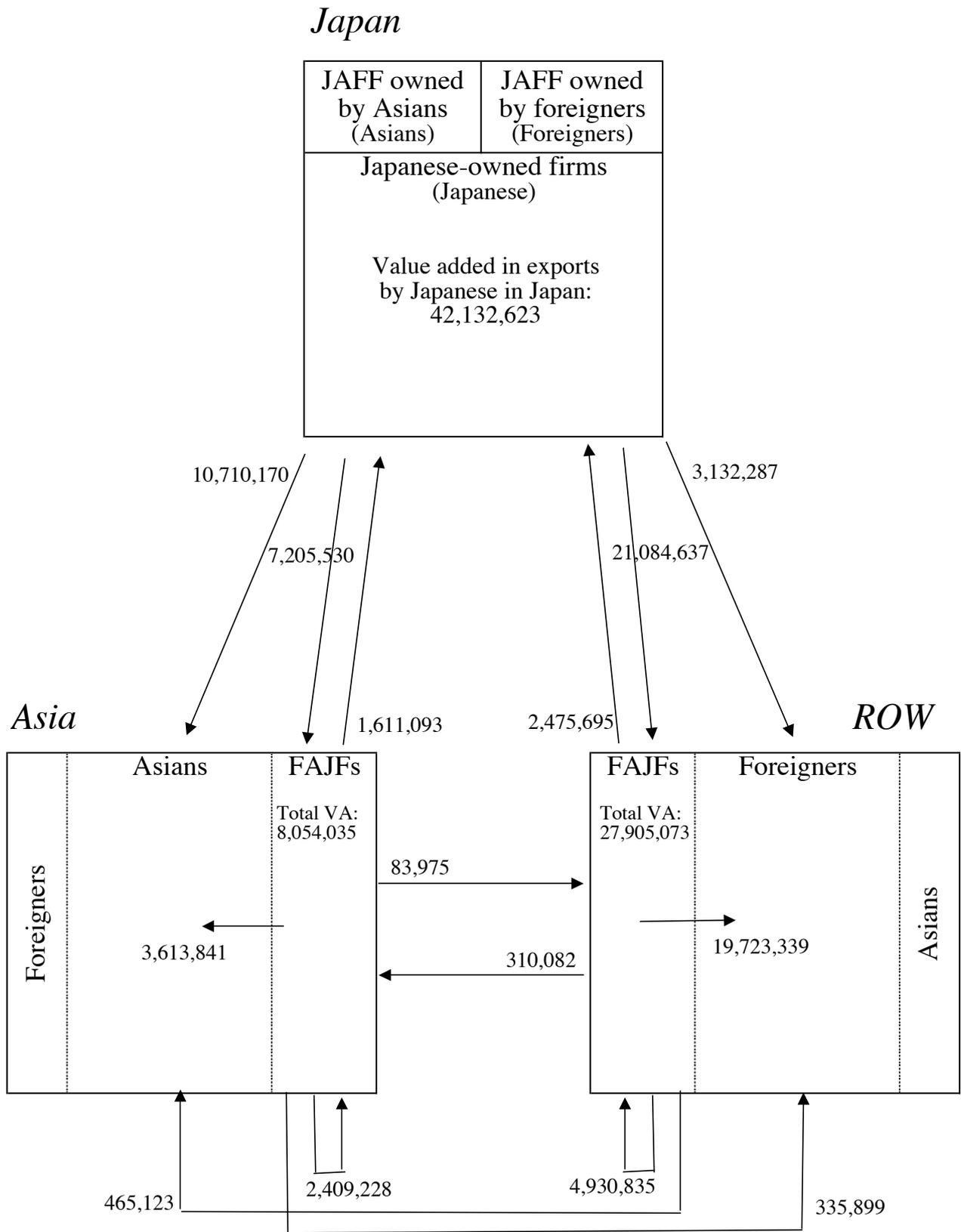
Figure 1 Sales to Asians and Foreigners by Japanese: Three-country Setting (2000)

(Unit: Million JP Yen)



Data source: Table 7.

Figure 2 Japanese value added embodied in sales to Asians and foreigners by Japanese: Three-country setting (2000)
(Unit: Million JP Yen)



Data source: Table 7.

Table 7 Exports versus FDI by Japanese-owned Firms

(Unit: Million JP Yen)

Category	2000		
	Exports	Value-added (VA)	(%)
[1] Japanese value added in exports of Japanese-owned firms in Japan	46,048,596	42,132,623	100.0
[1-1] In exports to FAJFs (Japanese)	30,919,567	28,290,167	
[1-1-1] located in Asia	7,875,240	7,205,530	17.1
[1-1-2] located in ROW	23,044,326	21,084,637	50.0
[1-2] In exports to Asians (non-Japanese)	11,705,616	10,710,170	
[1-2-1] located in Asia	11,705,616	10,710,170	25.4
[1-2-2] located in ROW	n.a.	n.a.	
[1-3] In exports to foreigners (non Japanese&Asian)	3,423,414	3,132,287	
[1-3-1] located in Asia	n.a.	n.a.	
[1-3-2] located in ROW	3,423,414	3,132,287	7.4
[2] Value added by FAJFs in Asia	36,376,123	8,054,035	100.0
[2-1] In goods and services sold to Japanese	18,537,086	4,104,295	
[2-1-1] located in Japan	7,276,515	1,611,093	20.0
[2-1-2] located in Asia (other FAJFs in Asia)	10,881,299	2,409,228	29.9
[2-1-3] located in ROW (other FAJFs in ROW)	379,272	83,975	1.0
[2-2] In goods and services sold to Asians (non-Japanese)	16,321,948	3,613,841	
[2-2-1] located in Japan	n.a.	n.a.	
[2-2-2] located in Asia	16,321,948	3,613,841	44.9
[2-2-3] located in ROW	n.a.	n.a.	
[2-3] In goods and services sold to foreigners (non Japanese&Asian)	1,517,089	335,899	
[2-3-1] located in Japan	n.a.	n.a.	
[2-3-2] located in Asia	n.a.	n.a.	
[2-3-3] located in ROW	1,517,089	335,899	4.2
[3] Value added by Japanese affiliates in ROW	92,638,856	27,905,073	100.0
[3-1] In goods and services sold to Japanese	25,617,494	7,716,611	
[3-1-1] located in Japan	8,218,775	2,475,695	8.9
[3-1-2] located in Asia (other FAJFs in Asia)	1,029,405	310,082	1.1
[3-1-3] located in ROW (other FAJFs in ROW)	16,369,314	4,930,835	17.7
[3-2] In goods and services sold to Asians (non-Japanese)	1,544,107	465,123	
[3-2-1] located in Japan	n.a.	n.a.	
[3-2-2] located in Asia	1,544,107	465,123	1.7
[3-2-3] located in ROW	n.a.	n.a.	
[3-3] In goods and services sold to foreigners (non Japanese&Asian)	65,477,255	19,723,339	
[3-3-1] located in Japan	n.a.	n.a.	
[3-3-2] located in Asia	n.a.	n.a.	
[3-3-3] located in ROW	65,477,255	19,723,339	70.7

Definition:

FAJF: Foreign affiliates of Japanese firms that include "affiliates abroad" with no less than 10 percent ownership by Japanese parent firms and "affiliates of affiliates abroad" with more than 50% ownership by such "affiliates abroad".

JAFF: Japanese affiliates of foreign firms with foreign share of more than one-third.

ROW: All countries other than Japan and Asia (region).

Japanese: Households and governments in Japan + all firms located in Japan - JAFF + FAJF .

Asians: Households and governments in Asia + Asian-owned firms located in Asia. + affiliates of firms owned by Asians in Japan and ROW .

Foreigners: Households and governments in ROW + foreign-owned firms located in ROW + affiliates of foreign firms in Japan and Asia

(Continue)

Method of estimation:

1. $([\text{Japanese total exports}] - [\text{Exports by JAFF}]) \times (1 - 0.08504) = [1-1.] + [1-2.] + [1-3.]$
- 1-1. $[1-1-1.] + [1-1-2.]$
- 1-1-1. $([\text{Imports from Japan by FAJF in Asia}] - [\text{Imports from JAFF by FAJF in Asia (n.a.)}]) \times (1 - 0.08504)$
- 1-1-2. $([\text{Imports from Japan by FAJF in ROW}] - [\text{Imports from JAFF by FAJF in ROW (n.a.)}]) \times (1 - 0.08504)$
- 1-2. $[1-2-1.] + [1-2-2.]$
- 1-2-1. $([\text{Japanese exports to Asia}] - [\text{Exports to Asia by JAFF (available only for exports to Asia)}]) \times (1 - 0.08504) - [1-1-1.] - [1-3-1.]$
- 1-2-2. $[\text{Japanese exports to p.c. nationals located in ROW (n.a.)}] \times (1 - 0.08504)$
- 1-3. $[1-3-1.] + [1-3-2.]$
- 1-3-1. $[\text{Japanese exports to foreigners located in Asia (n.a.)}] \times (1 - 0.08504)$
- 1-3-2. $([\text{Japanese exports to ROW}] - [\text{Exports to ROW by JAFF}]) \times (1 - 0.08504) - [1-1-2.] - [1-2-2.]$
2. $[\text{Sales by FAJF in Asia}] - [\text{Purchases by FAJF in Asia}] = [2-1.] + [2-2.] + [2-3.]$
- 2-1. $[2-1-1.] + [2-1-2.] + [2-1-3.]$
- 2-1-1. $[2.] \times [\text{Ratio of sales to Japan by FAJF in Asia}] - [2-2-1.] - [2-3-1.]$
- 2-1-2. $[2.] \times ([\text{Ratio of local sales by FAJF in Asia}] \times [\text{Ratio of sales to FAJF in local sales by FAJF in Asia (proxy: 0.4)}])$
- 2-1-3. $[2.] \times ([\text{Ratio of sales to ROW by FAJF in Asia}] \times [\text{Ratio of sales to FAJF in ROW in sales to ROW by FAJF in Asia (proxy: 0.2)}])$
- 2-2. $[2-2-1.] + [2-2-2.] + [2-2-3.]$
- 2-2-1. $[\text{Value added in goods and services sold to JAFF (owned by Asians) by FAJF in Asia (n.a.)}]$
- 2-2-2. $[2.] \times [\text{Ratio of local sales by FAJF in Asia}] \times [\text{Ratio of sales to Asians in local sales by FAJF in Asia (proxy: 0.6)}] - [2-1-2.] - [2-3-2.]$
- 2-2-3. $[\text{Value added in goods and services sold to Asians located in ROW by FAJF in Asia (n.a.)}]$
- 2-3. $[2-3-1.] + [2-3-2.] + [2-3-3.]$
- 2-3-1. $[\text{Value added in goods and services sold to JAFF (owned by foreigners) by FAJF in Asia (n.a.)}]$
- 2-3-2. $[\text{Value added in goods and services sold to foreigners located in Asia by FAJF in Asia (n.a.)}]$
- 2-3-3. $[2.] \times [\text{Ratio of sales to ROW by FAJF in Asia}] \times [\text{Ratio of sales to foreigners in sales to ROW by FAJF in Asia (proxy: 0.8)}] - [2-1-3.] - [2-2-3.]$
3. $[\text{Sales by FAJF in ROW}] - [\text{Purchases by FAJF in ROW}] = [3-1.] + [3-2.] + [3-3.]$
- 3-1. $[3-1-1.] + [3-1-2.] + [3-1-3.]$
- 3-1-1. $[3.] \times [\text{Ratio of sales to Japan by FAJF in ROW}] - [3-2-1.] - [3-3-1.]$
- 3-1-2. $[3.] \times ([\text{Ratio of sales to Asia by FAJF in ROW}] \times [\text{Ratio of sales to FAJF in Asia in sales to Asia by FAJF in ROW (proxy: 0.4)}])$
- 3-1-3. $[3.] \times ([\text{Ratio of local sales by FAJF in ROW}] \times [\text{Ratio of sales to FAJF in local sales by FAJF in ROW (proxy: 0.2)}])$
- 3-2. $[3-2-1.] + [3-2-2.] + [3-2-3.]$
- 3-2-1. $[\text{Value added in goods and services sold to JAFF (owned by Asians) by FAJF in ROW (n.a.)}]$
- 3-2-2. $[3.] \times [\text{Ratio of sales to Asia by FAJF in ROW}] \times [\text{Ratio of sales to Asians in sales to Asia by FAJF in ROW (proxy: 0.6)}] - [3-1-2.] - [3-3-2.]$
- 3-2-3. $[\text{Value added in goods and services sold to Asians located in ROW by FAJF in ROW (n.a.)}]$
- 3-3. $[3-3-1.] + [3-3-2.] + [3-3-3.]$
- 3-3-1. $[\text{Value added in goods and services sold to JAFF (owned by foreigners) by FAJF in ROW (n.a.)}]$
- 3-3-2. $[\text{Value added in goods and services sold to foreigners located in Asia by FAJF in ROW (n.a.)}]$
- 3-3-3. $[3.] \times ([\text{Ratio of local sales by FAJF in ROW}] \times [\text{Ratio of sales to foreigners in sales to ROW by FAJF in ROW (proxy: 0.8)}]) - [3-1-3.] - [3-2-3.]$

Data sources: METI (2001) for exports of Japan; METI (2002a) for exports of JAFF; MITI (2002b) for sales and purchases of FAJF.

Management and Coordination Agency (1999, pp.406) for the import inducement coefficient of export in Japan for 1995: 0.08504.

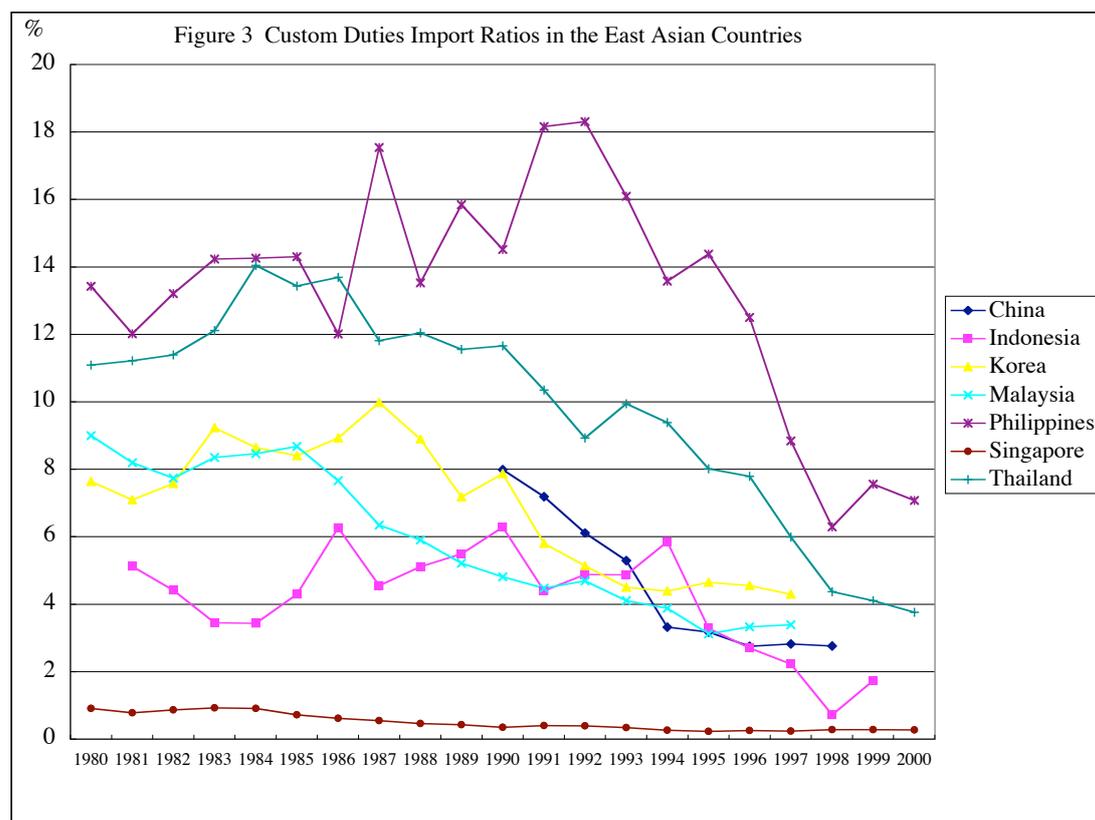
Table 8 Major Channels for Japanese Firms to Sell Products Abroad

(Unit: Million JP Yen)

	2000	
	VA contents	(%)
For Japanese firms to sell products to Asians in Asia (total of below):	18,373,691	100.0
To produce in Japan and export directly	10,710,170	58.3
To produce in Japan and distribute through FAJF in Asia	3,233,118	17.6
To produce in Japan and distribute through FAJF in ROW	351,439	1.9
To produce in Asia and sell locally	3,613,841	19.7
To produce in ROW and export to Asia	465,123	2.5
For Japanese firms to sell products to foreigners in ROW (total of below):	38,394,682	100.0
To produce in Japan and export directly	3,132,287	8.2
To produce in Japan and distribute through FAJF in ROW	14,902,647	38.8
To produce in Japan and distribute through FAJF in Asia	300,511	0.8
To produce in ROW and sell locally	19,723,339	51.4
To produce in Asia and export to ROW	335,899	0.9

Note: minor indirect channels such as "to produce in Japan and to distribute through FAJF in ROW and then through FAJF in Asia" are omitted.

Data source: the above figures are estimated based on Table 7.



Drawn from Ando and Esteveordal (2003) (Original data source: World Bank Indicators 2002 (CD-ROM)).

Table A.1 Definition of Parts and Components

HS classification
840140, 840290, 840390, 840490, 840590, 8406, 8407, 8408, 8409, 8410, 8411, 8412, 8413, 8414, 841520, 841590, 8416, 8417, 841891, 841899, 841990, 842123, 842129, 842131, 842191, 842199, 842290, 842390, 842490, 8431, 843290, 843390, 843490, 843590, 843680, 843691, 843699, 843790, 843890, 843991, 843999, 844090, 844190, 844240, 844250, 844390, 8448, 845090, 845190, 845240, 845290, 845390, 845490, 845590, 8466, 846791, 846792, 846799, 846890, 8473, 847490, 847590, 847690, 847790, 847890, 847990, 8480, 8481, 8482, 8483, 8484, 8485, 8503, 850490, 8505, 850690, 8507, 850890, 850990, 851090, 8511, 8512, 851390, 851490, 851590, 851690, 851790, 8518, 8522, 8529, 853090, 8531, 8532, 8533, 8534, 8535, 8536, 8537, 8538, 8539, 8540, 8541, 8542, 854390, 8544, 8545, 8546, 8547, 8548, 8607, 8706, 8707, 8708, 870990, 8714, 871690, 8803, 8805, 9001, 9002, 9003, 900590, 900691, 900699, 900791, 900792, 900890, 900990, 901090, 901190, 901290, 9013, 9014, 901590, 901790, 902490, 902590, 902690, 902790, 902890, 902990, 903090, 903190, 903290, 9033, 9110, 9111, 9112, 9113, 9114, 9209

Table A.2 Industry Classification

Manufacturing sector

120	Food processing
130	Beverages, tobacco, and animal feed
140	Textiles
150	Apparel
160	Wood and wood products
170	Furniture and fixtures
180	Pulp, paper, and paper products
190	Publishing and printing
200	Chemicals
210	Petroleum and coal products
220	Plastic products
230	Rubber products
240	Leather and leather products
250	Ceramics, clay, and stone products
260	Iron and steel
270	Nonferrous metal
280	Metal products
290	General machinery
300	Electric machinery
310	Transport equipment
320	Precision machinery
330	Arms
340	Other manufacturing

290+300+310+320 Machinery sector

Non-manufacturing sector

050	Mining
480	Wholesale trade
540	Retail trade
Other	Services and other

Table A.3 Basic Statistics of the data for Japanese Parent Firms in 1995

(a) Firms located in Japan

Variable	Number of observations	Mean	Standard deviation	Min	Max
Number of regular workers	16773	512.19	1941.83	50	72837
Tangible assets per regular worker (million yen)	16761	9.88	17.00	0	915.89
Total sales (million yen)	16773	33628.44	279201.20	70	14200000
Foreign sales (1:positive, 0:zero)	16773	0.27	0.45	0	1
Foreign sales (ratio to total sales)	16773	0.03	0.10	0	1
Total purchase (million yen)	16773	22674.51	252775.00	0	14000000
Purchase from abroad (1:positive, 0:zero)	16773	0.27	0.44	0	1
Purchase from abroad (ratio to total purchase)	16561	0.05	0.15	0	1
Gross value added (ratio to total sales)	16773	0.41	0.27	-7	1
Operating surplus (ratio to total sales)	16773	0.02	0.30	-33	0.74
R&D expenditure (1:positive, 0:zero)	13632	0.45	0.50	0	1
R&D expenditure (ratio to total sales)	13632	0.01	0.02	0	0.73
Advertisement expenditure (ratio to total sales)	16773	0.01	0.02	0	1.60
Commissioning production (1:yes, 0:no)	13632	0.66	0.47	0	1
Number of foreign affiliates	16773	1.08	11.53	0	827
Number of affiliates in East Asia	16773	0.54	4.20	0	253
Number of affiliates in Latin America	16773	0.07	1.87	0	161
Number of affiliates in North America	16773	0.23	2.79	0	198
Number of affiliates in Europe	16773	0.18	2.51	0	162

(b) Japanese Parent Firms with Foreign Affiliates

Variable	Number of observations	Mean	Standard deviation	Min	Max
Number of regular workers	3486	1271.43	3869.17	50	72837
Tangible assets per regular worker (million yen)	3486	12.89	22.84	0	915.89
Total sales (million yen)	3486	104309.90	601269.10	178	14200000
Foreign sales (1:positive, 0:zero)	3486	0.75	0.43	0	1
Foreign sales (ratio to total sales)	3486	0.10	0.16	0	1
Total purchase (million yen)	3486	69449.01	548688.40	0	14000000
Purchase from abroad (1:positive, 0:zero)	3486	0.67	0.47	0	1
Purchase from abroad (ratio to total purchase)	3478	0.10	0.19	0	1
Gross value added (ratio to total sales)	3486	0.44	0.30	-7	1
Operating surplus (ratio to total sales)	3486	0.02	0.60	-33	0.41
R&D expenditure (1:positive, 0:zero)	3192	0.70	0.46	0	1
R&D expenditure (ratio to total sales)	3192	0.02	0.03	0	0.63
Advertisement expenditure (ratio to total sales)	3486	0.01	0.02	0	0.33
Commissioning production (1:yes, 0:no)	3192	0.79	0.41	0	1
Number of foreign affiliates	3486	5.20	24.86	1	827
Number of affiliates in East Asia	3486	2.62	8.91	0	253
Number of affiliates in Latin America	3486	0.32	4.08	0	161
Number of affiliates in North America	3486	1.13	6.04	0	198
Number of affiliates in Europe	3486	0.87	5.45	0	162

(c) Japanese Parent Firms with Affiliates in East Asia

Variable	Number of observations	Mean	Standard deviation	Min	Max
Number of regular workers	2753	1417.63	4133.67	50	72837
Tangible assets per regular worker (million yen)	2753	12.08	15.81	0	268.84
Total sales (million yen)	2753	120973.20	671687.20	178	14200000
Foreign sales (1:positive, 0:zero)	2753	0.77	0.42	0	1
Foreign sales (ratio to total sales)	2753	0.10	0.16	0	1
Total purchase (million yen)	2753	81840.01	615774.80	0	14000000
Purchase from abroad (1:positive, 0:zero)	2753	0.69	0.46	0	1
Purchase from abroad (ratio to total purchase)	2747	0.10	0.18	0	1
Gross value added (ratio to total sales)	2753	0.43	0.31	-7	1
Operating surplus (ratio to total sales)	2753	0.02	0.68	-33	0.32
R&D expenditure (1:positive, 0:zero)	2535	0.70	0.46	0	1
R&D expenditure (ratio to total sales)	2535	0.02	0.03	0	0.60
Advertisement expenditure (ratio to total sales)	2753	0.01	0.02	0	0.25
Commissioning production (1:yes, 0:no)	2535	0.81	0.40	0	1
Number of foreign affiliates	2753	6.18	27.89	1	827
Number of affiliates in East Asia	2753	3.32	9.91	1	253
Number of affiliates in Latin America	2753	0.38	4.59	0	161
Number of affiliates in North America	2753	1.17	6.79	0	198
Number of affiliates in Europe	2753	1.01	6.11	0	162

(d) Japanese Parent Firms with Affiliates in North America

Variable	Number of observations	Mean	Standard deviation	Min	Max
Number of regular workers	1640	2110.51	5432.12	51	72837
Tangible assets per regular worker (million yen)	1640	14.78	18.53	0	240.89
Total sales (million yen)	1640	189267.30	865977.00	544	14200000
Foreign sales (1:positive, 0:zero)	1640	0.83	0.38	0	1
Foreign sales (ratio to total sales)	1640	0.14	0.18	0	0.98
Total purchase (million yen)	1640	126554.30	794559.50	0	14000000
Purchase from abroad (1:positive, 0:zero)	1640	0.70	0.46	0	1
Purchase from abroad (ratio to total purchase)	1637	0.11	0.20	0	1
Gross value added (ratio to total sales)	1640	0.46	0.25	0	1
Operating surplus (ratio to total sales)	1640	0.04	0.06	-1	0.41
R&D expenditure (1:positive, 0:zero)	1510	0.78	0.41	0	1
R&D expenditure (ratio to total sales)	1510	0.02	0.04	0	0.63
Advertisement expenditure (ratio to total sales)	1640	0.01	0.02	0	0.33
Commissioning production (1:yes, 0:no)	1510	0.78	0.41	0	1
Number of foreign affiliates	1640	9.05	35.82	1	827
Number of affiliates in East Asia	1640	3.83	12.78	0	253
Number of affiliates in Latin America	1640	0.62	5.93	0	161
Number of affiliates in North America	1640	2.40	8.63	1	198
Number of affiliates in Europe	1640	1.70	7.84	0	162

(e) Japanese Parent Firms with Affiliates in Europe

Variable	Number of observations	Mean	Standard deviation	Min	Max
Number of regular workers	857	3212.65	6816.82	50	72837
Tangible assets per regular worker (million yen)	857	15.97	35.57	0	915.89
Total sales (million yen)	857	319515.50	1179758.00	716	14200000
Foreign sales (1:positive, 0:zero)	857	0.90	0.30	0	1
Foreign sales (ratio to total sales)	857	0.18	0.20	0	0.98
Total purchase (million yen)	857	214728.20	1089492.00	0	14000000
Purchase from abroad (1:positive, 0:zero)	857	0.77	0.42	0	1
Purchase from abroad (ratio to total purchase)	856	0.13	0.21	0	1
Gross value added (ratio to total sales)	857	0.48	0.25	0	1
Operating surplus (ratio to total sales)	857	0.05	0.05	0	0.31
R&D expenditure (1:positive, 0:zero)	799	0.84	0.36	0	1
R&D expenditure (ratio to total sales)	799	0.03	0.04	0	0.63
Advertisement expenditure (ratio to total sales)	857	0.01	0.02	0	0.25
Commissioning production (1:yes, 0:no)	799	0.78	0.41	0	1
Number of foreign affiliates	857	14.93	48.74	1	827
Number of affiliates in East Asia	857	6.22	17.19	0	253
Number of affiliates in Latin America	857	1.14	8.16	0	161
Number of affiliates in North America	857	3.15	11.89	0	198
Number of affiliates in Europe	857	3.52	10.56	1	162

Notes: Gross value added is calculated as follows: total sales-total purchases.
Data source: MITI database.