Industrial Networks between China and the Countries of the Asia-Pacific Region

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Hiroshi Kuwamori* and Nobuhiro Okamoto†

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Keywords: input-output analysis, backward linkage, industrial network
JEL classification: D57, R15

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This paper investigates the changes in the structures of industrial networks that have occurred in the Asia-Pacific region in line with the rapid growth of the Chinese economy. Analyses using international input-output tables revealed that during the 1990s, there was a significant increase in the dependence of Asian countries' manufacturing industries, such as textiles and electronics, on China's industries, though industries in Japan and the United States remain important as the main suppliers of industries in Asian countries.

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1. Introduction

China succeeded in establishing foundations for industrialization because, unlike other nations in Asia, it fostered heavy and chemical industries at a time when the country was still in a planned economy phase. Since embarking on reforms and open door policies, the country has achieved economic development by encouraging the growth of labor-intensive types of manufacturing as the nation's leading export industries, thus demonstrating its comparative advantage in line with the transformation to a market economy. In the 1990s, China achieved economic growth at annual rates of almost double digits, a rate of expansion that was far higher than the rates of economic growth of other Asian countries.

During the course of establishing the foundations for heavy and chemical industries, China reformed its state-owned enterprises and introduced capital and technology from abroad, becoming both in name and reality a "world market" and a "world factory".

Where international trade is concerned, China (including Hong Kong) became Japan's largest trading partner for Japan (in 2004), while Japanese firms have shifted the emphasis of their activities from ASEAN to China. In the meantime, China has been going ahead with free trade agreements (FTAs) with ASEAN, and in 2001 joined the WTO. China, moreover, has steadily raised its prominence within the Asian economy.

Recent years have seen the publication of many academic articles devoted to the study of China's strategies towards the formation of FTAs and economic integration in East Asia. Of

particular interest is a series of studies that have stemmed from an intensive research project implemented by the Institute of Developing Economies (IDE). Contributions include those by Ohnishi ed. (2006), Hiratsuka ed. (2006) and Tamamura ed. (2006), which are distinguished by detailed case studies, theoretical interpretation, and analysis in the context of Japan-China relations respectively.

What seems to be lacking in these studies, however, is that they fail to give clear, vivid pictures of industrial reorganization in East Asia, a topic that is touched on only in the introduction of individual case studies and in the course of theoretical discussion. With this deficiency in mind, this paper aims to extract the characteristics of industrial networks in the Asia-Pacific region with special reference to the relationships between China and other Asian countries. More specifically, we will address the following questions. First, is it possible to dynamically interpret the Chinese economy emerging in East Asia, and subsequent changes, by analyzing industrial networks? Second, is it possible to grasp quantitatively and comprehensively the implications for the East Asian region of the rise of the Chinese economy and the resultant reorganization of industry? In order to explore these questions, input-output analysis will be employed as our analytical framework. As our main data, we will use the Asian international input-output tables for the years 1990 and 2000, covering 10 countries and 16 industrial sectors.[1]

The structure of the paper is as follows. In Section 2, the emergence of China's industries in

[1] See Appendix 1 for layout and member countries of the table and for sector description, see Appendix 2.

the economy of the Asia-Pacific region will be illustrated. In Section 3 and Section 4 the industrial networks within the region will be analyzed by using two different methodologies, namely Leontief multipliers and qualitative input-output analysis, respectively. The final section is devoted to an attempt to interpret the findings, albeit in hypothetical terms, of the empirical research that has been deployed.

2. Emergence of China's industries in the economy of the Asia-Pacific region

Before analyzing the structure of the linkages between China and the other Asian countries, it is important to understand the relative importance of China's industries in the economy of the Asia-Pacific region. Normally, the share of gross domestic product (GDP) or trade volumes of a country in the region is used to evaluate the relative importance of a country (or an industry) in the region's economy. In this paper, the significance of China's industries will be evaluated by measuring the influence of China's industries on gross output of the region, an objective that cannot be captured by using conventional methods. In order to measure the influence of China's industries on the economy of the Asia-Pacific region, the hypothetical extraction method (HEM) is employed. The basic concept of the HEM will be firstly introduced, and the measurement results will then be discussed.

2.1 Hypothetical extraction method

The basic idea of HEM was originally presented by Strassert (1968) and Schultz (1976, 1977). Suppose that there exist two regions (1 and 2) and n industries. The basic interregional input-output model can be expressed as follows.[2]

$$(1)\quad X = (I - A)^{-1} F$$

where

$$\underset{2n\times 1}{X} = \begin{pmatrix} X^1 \\ X^2 \end{pmatrix}; \quad \underset{2n\times 2n}{I} = \begin{pmatrix} I_n & O \\ O & I_n \end{pmatrix}; \quad \underset{2n\times 2n}{A} = \begin{pmatrix} A^{11} & A^{12} \\ A^{21} & A^{22} \end{pmatrix}; \quad \underset{2n\times 1}{F} = \begin{pmatrix} F^1 \\ F^2 \end{pmatrix}$$

To measure the influence of industries in region 1, we define an augmented matrix that extracts all three submatrices in which region 1 has an influence.

$$(2)\quad A^e = \begin{pmatrix} O & O \\ O & A^{22} \end{pmatrix}$$

The hypothetical output in which the industries in region 1 do not exist thus becomes

$$(3)\quad X^e = (I - A^e)^{-1} F$$

[2] There are several variations in HEM. For detailed discussions, see Miller and Lahr (2001). In this paper, the variation of 'Case 1' in Miller and Lahr (2001) is employed.

where

$$X^e = \begin{pmatrix} X^{1e} \\ X^{2e} \end{pmatrix}$$

From (1) and (3), the change (decrease) of output by extracting the industries in region 1 is calculated as

$$(4)\quad \Delta X = X^e - X = [(I - A^e)^{-1} - (I - A)^{-1}]F$$

ΔX is the decrease of gross output when country 1 does not exist in the region and thus indicates the magnitude of impact of country 1 on the region's economy. Therefore, by calculating the values of (4) for each member country of the Asian table, the influence of China's industries on the economy in the region can be evaluated.

2.2 Results

The calculation results of the HEM measures defined by (4) for 1990 and 2000 are reported in Table 1. The column "Country extracted" indicates that the country has been removed from the system in the manner shown in (2). The column "Change of other countries' output" indicates the percentage changes in total output of the other nine countries when the country in the left column is eliminated.

For example, in 1990, the output of the nine Asian countries shown in the table reduces by 1.581% when the entire industrial activity of the United States is removed.

From the results presented in Table 1, two major facts can be observed as regards changes in industrial linkages in the Asia-Pacific region. First, overall linkages among the countries of the region strengthened between 1990 and 2000. It can be seen from the results reported under "all industries" that the impact of each country's industries (except those of Japan) on other member countries increased from 1990 to 2000. Second, there was a strengthening in the influence of China's industries on other countries' outputs. The impact of "all industries" of China on other member countries' output increased by nearly four times from 1990 (0.166%) to 2000 (0.653%), this being the highest rate of growth among the Asian countries listed in the table. China's ranking also climbed, from seventh in 1990 to third in 2000. The same trend can be observed at industry level. During the 1990s, China's electrical goods and electronics industry, in particular, significantly increased its importance in the economy of the Asia-Pacific region, as can be seen from its impact on other member countries' output, which increased from 0.033% in 1990 to 0.229% in 2000. Third, another important result is that by 2000, the influence of China's textile industry on other countries exceeded that of Japan. It is obvious from Table 1 that the influence of the United States and Japan on the economies of the Asia-Pacific region is outstanding in every industrial category. However, in 2000, the impact of China's textiles industry was double that of Japan, a sharp contrast with the situation in 1990.

To sum up, while there was a strengthening in industrial linkages among all the countries of the Asia-Pacific region, the relative importance of China's industries in the region increased significantly during the 1990s. In particular, China's textiles industry has come to play a major role in the region.

3. Industrial linkages between China and Asian countries

The results of the application of HEM clearly showed the increase during the 1990s in the relative importance of China's industries in the economy of the Asia-Pacific region. In this section, changes in the structure of the linkages between China and other Asian countries - linkages that underlie the rapid expansion of China's industries - will be explored in detail.

Although trade volumes are often used to capture the structure of international linkages among industries (see for example Boon, 1998; and Ernst and Guerrieri, 1998), linkage structures can also be formed through other channels such as foreign direct investment and technology transfers, and the effects of these activities will be reflected in the structures of production. It follows that international trade flows can describe only limited aspects of international industrial linkages. To overcome such limitations of conventional methods, this section attempts to identify the characteristics of industrial networks by calculating the Leontief multipliers. We will focus in particular on three important industries, namely the textiles industry, electrical and electronics

manufacturing, and the transport equipment industry.

3.1 Methodology

Measuring backward linkage effects

In the literature, various linkage measures have been proposed to identify the sectors important for economic development.[3] These measures include: (1) direct input coefficients (Chenery and Watanabe, 1958; Yotopoulos and Nugent, 1973), (2) Leontief multipliers (Rasmussen, 1957), (3) the variability index (Rasmussen, 1957), and (4) the hypothetical extraction method (Strassert, 1968; Shultz, 1977; Miller and Lahr, 2001). This paper employs the Leontief multiplier as it is the most intuitive of the methods available and allows the construction of diagrams of the industrial linkages among Asian countries. The definition of the Leontief multiplier is as follows:

$$(5) \quad L_j^{rs} = \sum_j b_{ij}^{rs}$$

where b_{ij}^{rs} is the element of the inverse matrix $(I-A)^{-1}$. i and j denotes industries ($i, j = 1,2,\cdots,n$) and r and s are regions (countries). Therefore, L_j^{rs} can be interpreted as the 'interregional backward linkage effect' of industry j in region s on industries in region r.

[3] Although there are two kinds of linkage effects, namely forward linkage effects and backward linkage effects, we will confine our attention to backward linkage effects as the forward linkage effect measured from input-output analysis is based on unrealistic assumptions.

More intuitively, the Leontief multiplier indicates the required level of industrial output in region r when one unit of additional final demand occurs in industry j in region s. The share of L_j^{rs} to the total backward linkage effect thus can be calculated as

$$(6)\quad l_j^{rs} = \frac{L_j^{rs}}{L_j^{s}} = \frac{\sum_j b_{ij}^{rs}}{\sum_r \sum_j b_{ij}^{rs}}$$

Diagrammatic expressions of backward linkage effects

In order to capture the characteristics of the structure of linkages among the industries of the countries in the Asia-Pacific region, the backward linkage effects defined in (6) can also be illustrated diagrammatically as in Figure 1.

Figure 1 Diagrammatic expression of backward linkage effects

(textiles industry)

In the diagram, which illustrates the case of the textiles industry, a broken arrow extends from country A to country B. The percentage figures in parentheses under the country name represent

the share of demand that can be met by domestic industries when one extra unit of final demand occurs in the textiles industry in that particular country. In the above example, 86.5% of induced demand can be satisfied by industries in country A when one unit of additional final demand to the textiles industry occurs. The remaining 13.5% of induced demand must be satisfied by industries in other countries. In the above example, between 3% and 5% of the induced demand is satisfied by industries in country B. The arrow is drawn as a fine solid line when the rate of dependency on country B is between 5% and 10%, and takes the form of a thick solid arrow when the dependency rate is more than 10%.

These diagrammatic expressions of backward linkage effects provide us with very useful information. First, the degree of concentration of arrows identifies the international division of labor in the Asia-Pacific region. A country with many outgoing arrows is highly dependent on other countries' industries to satisfy induced demand. On the other hand if a country has many incoming arrows, the industries in that country function as suppliers to industries in other countries. Second, the changes of directions and thickness of the arrows from 1990 to 2000 tell us how the structures of the linkages among the countries of the region have changed over time. Thus diagrammatic representations of the kind shown in Figure 1 can be a powerful tool for extracting the characteristics of the structures of the inter-country linkages in particular industries.

3.2 Results

The calculation results of l_j^{rs} for selected industries are summarized in Appendix 3. The diagrammatic expressions of these results are presented in Figures 2, 3, 4 and 5.

All industries

As an illustration of the overall trend, Figure 2 portrays the structure of linkages in all industries in the region. The Figure illustrates the existence of the following three features. First, in 1990, industries in Asian countries were highly dependent on industries in Japan and the United States and in the diagram, these two countries were the major destinations of arrows from Asian countries. The dependency on Japan is especially remarkable. Second, examination of the two diagrams shows that the dependence on Japan and the United States remained much the same even in 2000. Third, in both the 1990 and 2000 parts of the diagram, there are no incoming and outgoing arrows to or from China, which shows that in both of these years, China's industries did not have strong linkages with industries in any other country of the Asia-Pacific region. As is shown in the figures in parentheses, China's industries are highly self-sufficient and most of the demand for industrial products is satisfied by domestic industries. This reflects the economic structure that was formed during the closed period of the planned economy that prevailed until 1978. Figure 2 leads us to conclude that the structure of industrial linkages within the Asia-Pacific region is robust and that no significant changes occurred during the 1990s.

However, such aggregate pictures may mask important structural changes at individual industry level, and it is to this aspect that the discussion now turns.

Textiles industry

Figure 3 shows the regional structure of linkages in the textiles industry. In the 1990 part of the diagram, Japan, the United States and Taiwan attract many arrows from other Asian countries. This indicates that the Asian countries depended on suppliers in Japan, the United States and Taiwan to satisfy their textiles industry demand. In other words, these three countries functioned as suppliers (directly and indirectly) to textiles industries in other Asian countries. However during the 1990s, this structure changed. In the 2000 section of the diagram, there are fewer arrows going to Japan and the United States than there were in 1990, while China became the major destination of arrows from many Asian countries. This indicates that in many Asian countries, textiles manufacturers switched from Japanese, American, and Taiwanese suppliers to Chinese ones. For example, in 1990, the Philippines textiles industry depended heavily on suppliers in Japan (5.0%), the United States (7.9%) and Taiwan (9.1%) to satisfy induced final demand, while its dependence on Chinese suppliers was only 1%. However, by 2000, its dependence on Japan and the United States had dropped significantly (to 3.7% and 4.4% respectively) while instead, the dependence on China had increased to 4.3%. This implies that during the ten-year period, China replaced Japan and the United States as the major supplier to the Philippines' textiles industry.

Electrical goods and electronics industry

The electrical goods and electronics industry presents a picture that differs from that of the textiles industry (see Figure 4). In 1990, the network structure of the electrical goods and electronics industry was simple, in that in the Asian countries, the industry was highly dependent on Japan and the United States to satisfy the demand induced by the final demand for electrical products in each country. Although some countries such as the Philippines, Malaysia and Thailand also depended on electrical industries in Singapore, the magnitudes of dependency were quite small compared with Japan and the United States.

The diagram for 2000 shows that three remarkable changes occurred after 1990. First, the network structure that existed in 1990 continued basically unchanged through to 2000. This can be seen in the diagram, in which many countries extend arrows to Japan and the United States in both the 1990 and 2000 sections. A second feature of the diagram is that, in addition to Japan and the United States, countries such as Korea and China emerged as new destinations of arrows from other Asian countries. Third, the share of dependence on domestic industries dropped in most of the Asian countries. This implies progress in the diversification of procurement throughout the Asia-Pacific region. Electrical goods and electronics industries in Japan and the United States remained major suppliers to their counterparts in Asian countries, but diversification of procurement has progressed in many Asian countries, while Korea and China have also emerged as suppliers by replacing the domestic industries in each country. As a result, the linkage structure within the region has become

increasingly complex.

Transport equipment

Among the three industries analyzed in this section, the transport equipment industry shows the most stable linkage structure. In the diagram, in 1990, Japan and the United States were the only destinations of arrows. The dependency on industries in Japan is especially conspicuous, as is shown by the thick solid lines that show a dependency rate of more than 10% of total induced demand. These extended from most of the countries in 1990. In 2000, many countries came to depend not only on industries in Japan but on industries in the United States, and this pattern has remained constant since 1990. By contrast with the other two industries, the Chinese industries has not functioned as a supplier to other Asian countries. This may suggest that while Chinese manufacturing is capable of accommodating the technologies of the textiles and electronics industries, it is not quite so advanced in the case of the transport equipment industry, which requires a higher level of technological development than the other two industries.

3.3 Summary

This section has attempted to sketch the main characteristics of the linkage structures of selected industries in the Asia-Pacific region by measuring backward linkage effects. The major findings can be summarized as follows.

The measurement of backward linkage effects identified some important features regarding industrial networks in the Asia-Pacific region. First, the measurement results on overall industry revealed a robust linkage structure, remaining in place throughout the 1990s, in which industries in most of the Asian countries are highly dependent on industries in Japan and the United States to meet domestic demand. However, analyses at the level of individual industries revealed different patterns.

Textiles industry: Between 1990 and 2000, the textiles industries in the Asian countries shifted their dependence from industries in Japan, the United States and Taiwan to those in China.

Electrical goods and electronics industry: The electrical goods and electronics industries in Asian countries diversified their suppliers. While in 1990 electronics industries in all of the Asian countries depended only on industries in Japan and the United States, in 2000, industries in Korea, China and Singapore emerged as suppliers rather than as merely domestic manufacturers. This implies progress in the international division of labor in electrical goods and electronics manufacturing, and as a result, the network structure within the region has become increasingly complex.

Transport equipment: A robust linkage structure in which Asian transport equipment industries were highly dependent on their counterparts in Japan and the United States remained in place throughout the 1990s. In 2000, some shifts in dependence from Japan to the United States became apparent, but the diagrams showed little change between 1990 and 2000 relative to the

diagrams for the other two industries. China does not play a significant role as a supplier in this industry.

That said, the industry level analyses suggest a change in the role of China's industries in the industrial networks of the Asia-Pacific region. Along with its emergence as a production base, China rapidly increased its importance as a supplier to the textiles and electronics industries in other Asian countries. However, China does not possess a sufficiently high level of technology to supply the transport equipment industry and thus transport industries in Asian countries have continued to depend on Japan and the United States. For industries in China, therefore, upgrading the technological level will thus be an important prerequisite for further development.

4. Qualitative Input-Output Analysis

In Section 3, the industrial networks of some selected industries in the Asia-Pacific region were revealed by measuring backward linkage effects. In this section, we will attempt to extract the industrial networks by using an alternative methodology, namely qualitative input-output analysis (QIOA). Analyses by applying two different methodologies will provide us with a more robust and comprehensive picture of Asia's industrial networks.

4.1 Methodology

We use the methodology of QIOA introduced by Aroche-Reyes (1996) to identify the structure of spatial input-output linkages. QIOA aims to reveal the underlying structure of an input-output table by identifying the intermediate transactions that are important. The step-by-step methodology of our analysis can be presented as follows: (1) Identify "important cells" in the technical coefficient matrix using a mathematical formula; (2) Convert the technical coefficient matrix into a corresponding binary matrix (i.e. adjacency matrix), in which entries of the important cells take value of unity and the unimportant ones, zero. The adjacency matrix shows a structure of important linkages but at the same time it only shows which sectors are directly linked together through the important linkages; (3) Take indirect linkages into consideration, too. Suppose that there exist important transaction flows from sector j to sector k, and from sector k to sector l. Therefore the linkages from sector j to sector k and from sector k to sector l are identified as important. Then suppose that there also exists an important linkage from sector j to sector l (through sector k). We also take into account such indirect linkages using a graph theoretical method; (4) Obtain a total structure of important linkages by taking both directly and indirectly important linkages into consideration. Compare the structures at different time points to elucidate how the skeleton of spatial input-output linkages has changed during the period of analysis.

We begin with a formula that can be used to identify important cells in the technical coefficient matrix A. Following Aroche-Reyes (1996), we adopt a formula introduced by Schintke

and Stäglin (1988) and Jilek (1971). The formula aims at finding important cells in A judging by the impact on the elements of the Leontief inverse matrix when an element in A changes in a given proportion. The tolerable limit r_{ij} of change in each technical coefficient a_{ij} is computed by the following equation, so that the output in any related sector varies at most by 1%, while final demand remains fixed. The equation is

$$(7) \quad r_{ij} = \frac{100}{a_{ij}[b_{ji} + 100(b_{ii}/\tau_i)\tau_j]}$$

where b_{ji} denotes the corresponding entry in the Leontief inverse matrix, and τ_i and τ_j denote the gross output of sector i and j respectively. If the technical coefficient a_{ij} increases by more than the tolerable limit r_{ij}, then output in a related sector will increase by more than 1%. Therefore the less r_{ij} is, the smaller is the change in a_{ij} required to have large effects on the output of related sectors. We identify such entries as important cells (to put it differently, the linkage from sector i to sector j is held to be important). Conventionally an entry in A is identified as important when r_{ij} is not greater than 20% (Aroche-Reyes, 1996, 2002; Ghosh and Roy, 1998).

Next, we turn to the equation

$$(8) \quad (I - A)^{-1} = A^0 + A^1 + A^2 + A^3 \cdots$$

where $A^0 \equiv I$. We convert each matrix layer A^i ($i = 0,\ 1,\ 2,\ \cdots$) to the corresponding adjacency matrix W^i ($i = 0,\ 1,\ 2,\ \cdots$). The conversion of A into W is implemented based on the following equation

$$(9)\quad w_{ij}\begin{cases} = 1, & if \quad r_{ij} < 20 \\ = 0, & if \quad r_{ij} \geq 20 \end{cases}$$

where $W = (w_{ij})$ and r_{ij} is the tolerable limit of change for a_{ij} defined by equation (7). For the layer of which order is higher than 2, the following equation (10) is applied to convert A^k into W^k.

$$(10)\quad W^k = W^1 W^{k-1}$$

The last step is to obtain the qualitative Leontief inverse matrix Ψ. The derivation of the matrix is based on the following equation (11)

$$(11)\quad \Psi = W^0 + W^1 + W^2 + W^3 + \cdots$$

where $W^0 = I$. Note that the matrix multiplications in (10) and the summation of W^k in (11) should be done in Boolean fashion. An entry ψ_{ij} in Ψ will be unity if sectors i and j are connected through a path, regardless of the number of steps needed to go from i to j (Aroche-Reyes, 1996). We regard them as important among all linkages in the following analysis. The resulting structures of important linkages will be shown by diagrams in the next section.

In some cases, we will want to know about the role of a sector in the structures. For this purpose, we compute a centrality index (CI) for each sector in each structure. Following Aroche-Reyes (1996), we define the CI of a sector as the ratio of the in-degree to the out-degree of the sector. A sector is categorized as a sink, central, or source if the CI is greater than, equal to, or less than unity, respectively. A sink sector has relatively more input linkages than output linkages. It is located at the top of the hierarchy of intermediate transactions among sectors and/or supplies more final goods rather than intermediate goods. A source sector has relatively more output linkages than input linkages. It is important as a supplier of intermediate goods (typically raw materials) to many sectors in the economy. The central sectors have an intermediate character between the sink and the source.[4]

It is worthwhile pointing out that we work with layers derived from the technical coefficient matrix A, not with layers derived from the intermediate transaction matrix Z. In other words, in

[4] The in-degree and the out-degree of sector i are the i-th column sum and the i-th row sum of the adjacency Leontief inverse matrix respectively.

this present analysis, we concentrate mainly on the technical relationship between production sectors. The latter approach arose from the Minimal Flow Analysis introduced by Schnabl (1994), in which the volume and structure of final demand is also taken into consideration.[5]

4.2 Findings

4.2.1 The Number of Important Cells

The calculation results are presented in Table 2. As shown in Table 2, the number of important cells in all regions fell from 912 in 1990 to 854 in 2000, a decline that was accompanied by a fall over the same period in the number of important cells in the interregional transaction from 162 to 142. According to the measures of backward linkage effects conducted in studies such as Meng *et al*. (2006), the degree of interregional dependence increased over time in each country, and the influential coefficient within some countries increased. These facts may suggest that the number of important cells fell because those exclusively linked to particular sectors were linked to more than one sector. On the other hand, the number of important cells among manufacturing sectors, which are reported in Table 3, increased from 53 to 73. This implies that the technical relationship among production sectors in Asia has strengthened, though the number of important cells as a whole has fallen.

China has by far the greatest number of important cells, its total having increased from 133 in

[5] For this application, see Hioki *et al.* (2005) and Okamoto and Tamamura (2005).

1990 to 135 in 2000, and the linkage within China itself is fairly strong. In this connection, it is also significant that the backward linkage effects of China are greater than those of any other Asian country (Meng *et al.*, 2006).

Japan also has a large number of important cells, and the number of incoming linkages with Japan as a recipient of the linkages, is also larger than in any other country, 79 in 1990 and 51 in 2000. The United States accounts for the second largest number of incoming linkages. We can see here a structure in which various countries depend on the intermediate goods of Japan and the United States as the recipients of the linkages in the Asia-Pacific region. Even so, the trends exhibited by these two countries are somewhat different. While the number of incoming linkages for Japan fell by 10% over the ten years, the figure for the United States remained more or less constant over the same period, falling only slightly from 44 to 42. The degree of dependence of the Asia-Pacific countries on Japan has been declining.

So far as outgoing linkages are concerned, Malaysia and Singapore provided, as of 1990, some 40% of the linkages to other countries. In 2000, the countries other than Korea, Japan and the United States were responsible for some 30% of the linkages with other countries. This allows us to conclude that the regional linkages among Asian countries have strengthened during the period in question.

4.2.2 Networks among Countries

Figure 6 shows the networks of individual countries, and has been drawn up on the basis of Table 2. It is apparent that in 1990, China and the other Asian-Pacific countries with the exception of Korea and the United States depended on Japan. By contrast, Taiwan and ASEAN except for Indonesia depended on the United States. The figure also shows an Asian network consisting of the Philippines → Singapore → Indonesia/Thailand, and another network among the ASEAN countries consisting of Singapore → Malaysia → Thailand.

By 2000, the number of countries having networks dependent on Japan had fallen, and consisted of only Indonesia, Malaysia, the Philippines and Taiwan. In the meantime, Korea and Indonesia began to depend on the United States. The technological linkages concerning intermediate manufactured goods had shifted from Japan to the United States. Indonesia increased its dependency on Malaysia, as well as on the two Northeast Asian countries of Korea and China. Among the ASEAN states, two networks can be seen: one consisting of Indonesia / the Philippines / Thailand → Malaysia, and the other of Indonesia / Thailand → Singapore, indicating an increasing presence of Malaysia and Singapore as recipients of the linkages.

4.2.3 Networks of the Manufacturing Sector in Asian Countries

Figures 7 through 10 show networks in terms of each manufacturing sector. The following outstanding features characterized the situation in 1990: (1) each country depended on various

intermediate goods produced by the manufacturing sector in Japan; (2) a wide range of manufacturing sectors in Taiwan, the Philippines, Malaysia and Singapore depended on electrical and electronic intermediate goods supplied by the United States.

The metal products, electrical goods and electronics and other manufacturing sectors in Taiwan depend on products supplied by the Japanese electrical goods and electronics industry, and the same is true of the transport equipment industry. As for Indonesia, its various manufacturing sectors, metal products, and machinery sectors depend on the three industries in Japan, namely food processing, metal products, and machinery. The food processing, chemical and machinery sectors in Malaysia rely on intermediate goods supplied by various light industries in Japan. It can also be seen that the Singaporean metal products sector is dependent on goods supplied by Japanese industries such as chemicals, machinery, and transport equipment. Sectors dependent on the American electrical goods and electronics industry include metal products, and electrical goods and electronics in Taiwan; metal products, electrical goods and electronics manufacturing in the Philippines; six categories – ranging from non-metallic mineral products to other manufacturing sectors – in Malaysia; and non-metallic mineral products, metal products, electrical goods and electronics, and transport equipment industries in Singapore.

Notable features in 2000, on the other hand, are: (1) increased concentration in the electrical goods and electronics sector among industries dependent on Japanese suppliers; (2) heightened linkages of various Korean industrial categories to the American electrical goods and electronics

sector; (3) linkages to the electrical goods and electronics industry in Singapore and Malaysia are heightened within ASEAN; and (4) dependence on Chinese manufacturers of various light industries of Indonesia, and of the fabric and textiles sector in Taiwan.

Several linkages disappeared during the ten years between 1990 and 2000. These included the dependence of the Philippine metal products sector on the Japanese metal products and machinery manufacturers; dependence of the Malaysian food processing, metal products, and machinery sectors on Japanese light manufacturing; and the dependence of the Singaporean chemical sector on the Japanese chemical, metal products, transport equipment and other manufacturing categories.

On the other hand, the other light manufacturing, and chemical and non-metallic mineral products sectors of Taiwan have come to rely on Japanese and American electrical goods and electronics suppliers, while the chemical, non-metallic mineral products, metal products, electrical goods and electronics, and other manufacturing sectors of Korea began to depend on American manufacturers of electrical goods and electronics and accordingly, there has emerged a concentration of linkages to the electrical goods and electronics sectors of Japan and the United States.

The ASEAN countries as a whole have come to rely on the metal products and the electrical goods and electronics sectors in the Philippines, on the machinery industry in Indonesia and on electrical goods and electronics manufacturing in Malaysia, that is, a mutual dependence has arisen. The machinery sector in Indonesia began to rely on electrical goods and electronics suppliers in

Singapore, and the electrical goods and electronics sectors in Malaysia and Singapore are linked to each other.

As for China, its machinery industry was dependent on the Japanese chemical sector in 1990, but, by 2000, this linkage had disappeared. On the other hand, other light manufacturing in Indonesia came to depend on China's food processing, other light manufacturing, chemical, non-metallic mineral products, and electrical goods and electronics suppliers, while the chemical industry of Taiwan began to depend on the Chinese textiles sector, and the textile sector of Taiwan was linked to the textiles, chemical and other manufacturing categories in China.

Let us now consider the stable networks of the Asia-Pacific region. Stable networks may affect production unless intermediate goods produced in other countries are made technical use of; this suggests the presence of closer or more important technical linkages.

So far as sectors dependent on Japan are concerned, the metal products, electrical goods and electronics, and other manufacturing sectors of Taiwan depend on the Japanese electrical goods and electronics industry, and the other light manufacturing and metal products sector of Indonesia rely on several manufacturing sectors in Japan.

Meanwhile, the metal products and electrical goods and electronics sectors of Taiwan, the Philippines, Malaysia and Singapore are all linked to the American electrical goods and electronics industry.

The electrical goods and electronics industries of Malaysia and Singapore are mutually

dependent, and are also linked to a number of other industrial categories.

4.2.4 Summary

The findings from the QIOA described above can be summarized as follows.

- Linkages among manufacturing sectors have certainly strengthened. Manifestations of this include the dependence of Korean sectors on their American counterparts, the reliance of Indonesian manufacturing on China, and that of Taiwanese industry on China.
- The focus of the linkages of the manufacturing sectors is beginning to shift from Japan to the United States. Some sectors in Malaysia, the Philippines, and Singapore have registered a reduction in the degree of their dependence on Japan.
- Among the ASEAN member states, the linkage between Singapore and Malaysia is intimate; it can be said that a strong interdependence has emerged between the electrical goods and electronics industries of the two countries.
- There are few linkages indicating China's dependence on other manufacturing countries. Rather, Taiwan and Indonesia have begun to create dependent linkages with China.
- The nucleus of the pattern of linkages in the manufacturing sectors is provided by the electrical goods and electronics industry, in which Japan and the United States play the central roles.

5. Conclusions

The development of the Chinese economy has been in many ways unique. Other countries in Asia, whose primary task after the war was to achieve decolonization from advanced nations, and to break away from their monoculture economies, succeeded in industrialization via export-oriented strategies, and shifted their focus from the export of primary products to labor-intensive processing and assembly-line industries where they enjoyed comparative advantage. For the economic development of these countries, the import of intermediate goods from Japan was indispensable, and the American market was also necessary for the success of manufactured exports. This process of development is called the “East Asian model”. China, on the other hand, adopted large-scale projects with the assistance of the former Soviet Union and promoted the industrialization of the heavy and chemical sectors when the Chinese Communist Party came to power shortly after the Second World War. China also rapidly strove towards self-sufficient development of the heavy and chemical industries through the Third Front Construction Program. Following the reforms of Deng Xiaoping and the adoption of “Open Door” policies, China began to follow the East Asian model of development, promoting labor-intensive processing and assembling industries, where foreign-owned companies located in special economic zones as well as local firms in the coastal areas have been able to equally benefit from comparative advantage. This trend was reinforced through the adoption of the “Coastal Area Development Strategy” in 1987. After 1990, the Chinese economy underwent rapid growth and exports increased rapidly. Because China has successfully developed its

labor-intensive industries while retaining heavy and chemical types of manufacturing, it will have considerable opportunities for further economic development in the future so long as it can manage to strike a balance between the heavy and the light industrial sectors.

The process of self-sufficient industrialization is clearly reflected in the findings of our analysis. In 1990, China's important linkages were all contained within the country. In its vast land, the export strategy deployed in some coastal areas did not immediately lead to the creation of linkages overseas. Linkages affecting production lay within domestic industries only.

By 2000, however, the situation had begun to change substantially. Chinese industries were now technologically important for Taiwanese textiles production and for other categories of light manufacturing in Indonesia. These changes suggest that the level of industrial technology in China is now superior to that of Indonesia, a country which is relatively backward by comparison with the rest of ASEAN. Moreover, Chinese industrial technology became necessary for the labor-intensive industries in Taiwan as a result of a large amounts of investment in China.

In Asia as a whole, at the center of the manufacturing networks lies the electrical goods and electronics industry. Since in this sector the technological levels of Japan and the United States are superior, the electrical industries in other countries need to import electronic components with high value added from these two developed countries. On the other hand, Singapore and Malaysia, while depending on Japan and the United States, manufacture electrical goods and electronics components using their medium-level technologies, and serve as cores at the other extremity of the industrial

networks.

The Information Technology Outlook 2006 published by OECD reports that exports of IT-related goods and services from China exceeded those from Japan and the EU in 2003, and those from the United States in 2004, so that China became the largest supplier in the world (evening edition of *Nihon Keizai Shimbun*, October, 23, 2006). Since China focuses on added-profit trade, it may have been already integrated into the industrial networks linked to the Japanese and American electrical goods and electronic industries, or to the same industries in Malaysia and Singapore.

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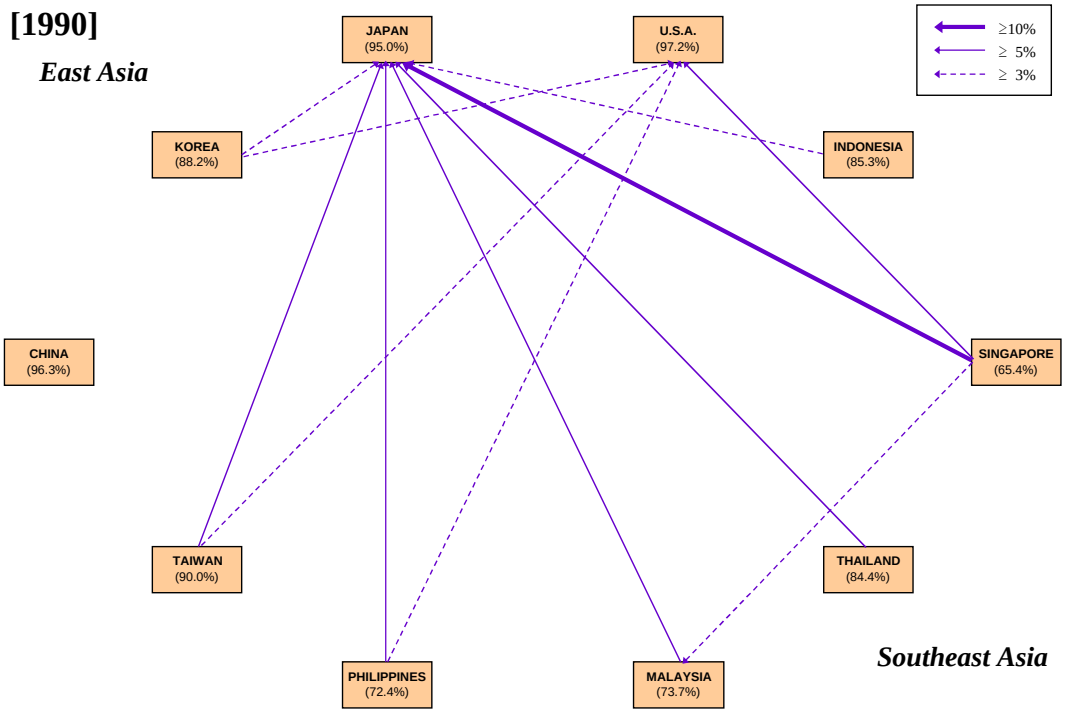
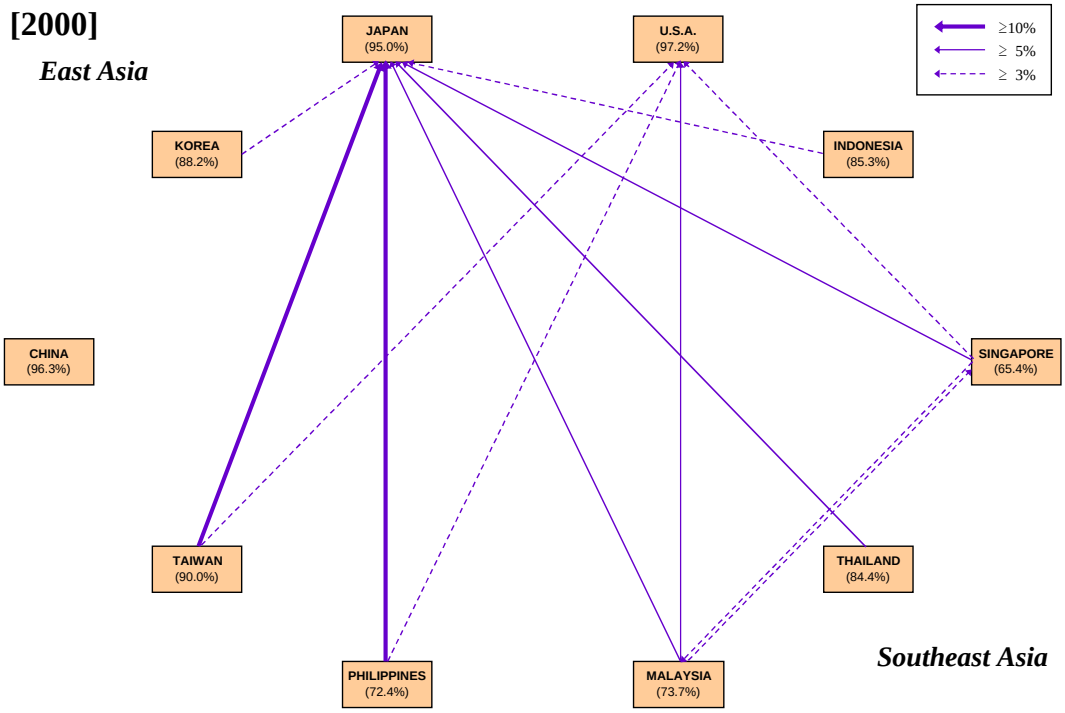
Table 1 Results of HEM

1990			2000		
Rank	Country extracted	Change of other countries' outputs	Rank	Country extracted	Change of other countries' outputs
[All industries]					
1	U.S.A.	-1.581%	1	U.S.A.	-2.514%
2	Japan	-1.121%	2	Japan	-0.914%
3	Korea	-0.350%	3	China	-0.653%
4	Taiwan	-0.280%	4	Korea	-0.426%
5	Singapore	-0.221%	5	Taiwan	-0.405%
6	Thailand	-0.168%	6	Malaysia	-0.310%
7	China	-0.166%	7	Singapore	-0.251%
8	Malaysia	-0.101%	8	Thailand	-0.189%
9	Indonesia	-0.075%	9	Philippines	-0.112%
10	Philippines	-0.061%	10	Indonesia	-0.079%
[Textiles]					
1	U.S.A.	-0.091%	1	U.S.A.	-0.100%
2	Japan	-0.077%	2	China	-0.071%
3	Korea	-0.043%	3	Japan	-0.036%
4	China	-0.036%	4	Korea	-0.032%
5	Taiwan	-0.027%	5	Taiwan	-0.025%
6	Thailand	-0.026%	6	Thailand	-0.019%
7	Philippines	-0.017%	7	Indonesia	-0.016%
8	Indonesia	-0.017%	8	Malaysia	-0.015%
9	Malaysia	-0.016%	9	Philippines	-0.012%
10	Singapore	-0.013%	10	Singapore	-0.008%
[Electrical goods and electronics]					
1	U.S.A.	-0.317%	1	U.S.A.	-0.706%
2	Japan	-0.192%	2	Japan	-0.276%
3	Philippines	-0.177%	3	China	-0.229%
4	Singapore	-0.114%	4	Taiwan	-0.225%
5	Korea	-0.105%	5	Malaysia	-0.202%
6	Taiwan	-0.090%	6	Korea	-0.195%
7	Thailand	-0.042%	7	Singapore	-0.151%
8	Malaysia	-0.041%	8	Thailand	-0.089%
9	China	-0.033%	9	Philippines	-0.065%
10	Indonesia	-0.011%	10	Indonesia	-0.014%
[Transport equipment]					
1	U.S.A.	-0.323%	1	U.S.A.	-0.561%
2	Japan	-0.115%	2	Japan	-0.113%
3	Korea	-0.050%	3	China	-0.058%
4	Thailand	-0.041%	4	Korea	-0.054%
5	Taiwan	-0.035%	5	Taiwan	-0.032%
6	China	-0.026%	6	Thailand	-0.030%
7	Indonesia	-0.021%	7	Malaysia	-0.017%
8	Singapore	-0.017%	8	Indonesia	-0.014%
9	Malaysia	-0.015%	9	Singapore	-0.013%
10	Philippines	-0.010%	10	Philippines	-0.011%

Source: Authors' caluculation from the Asian international input-output tables for 1990 and 2000.

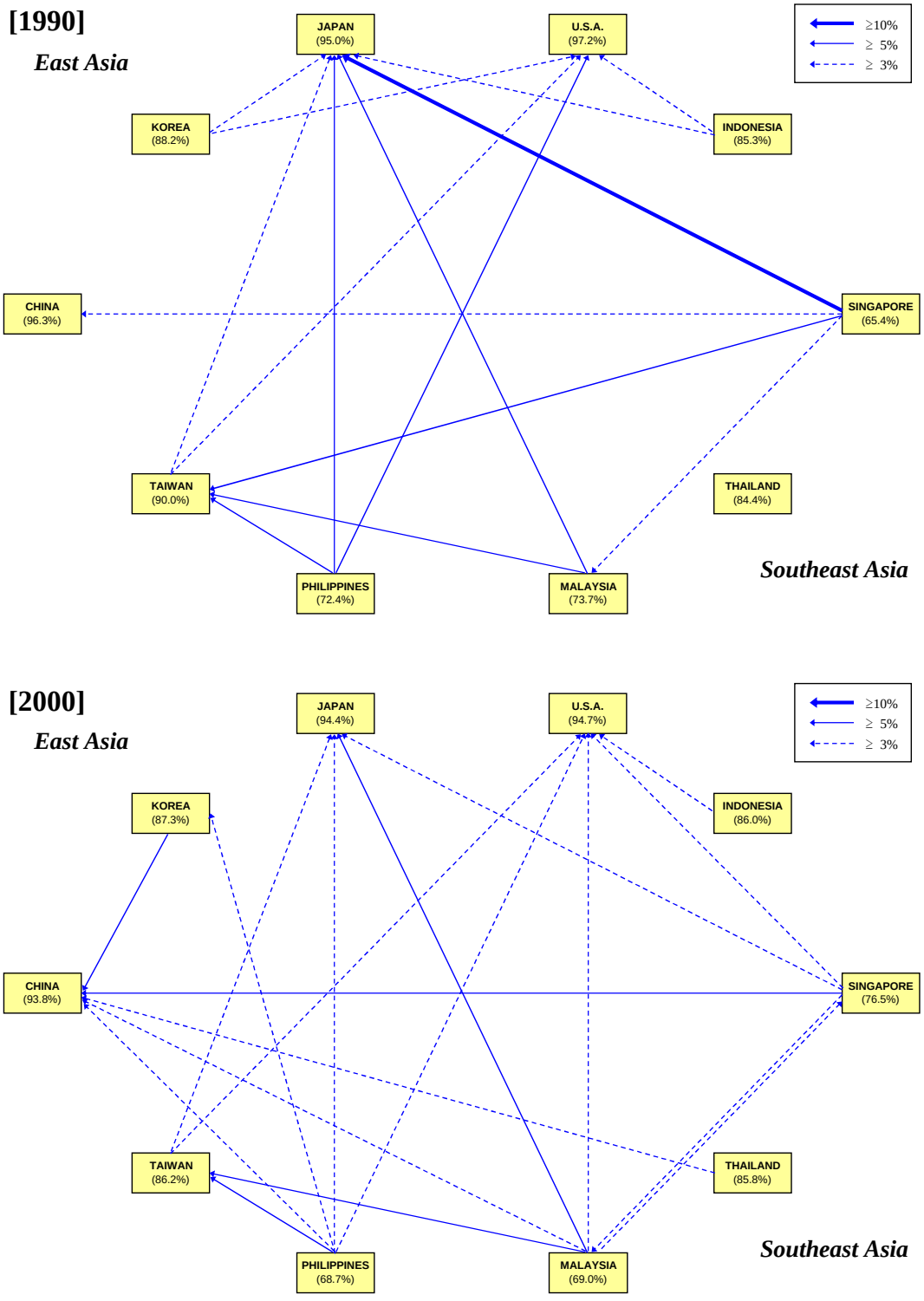
Figure 2 Linkage structures (all industries)





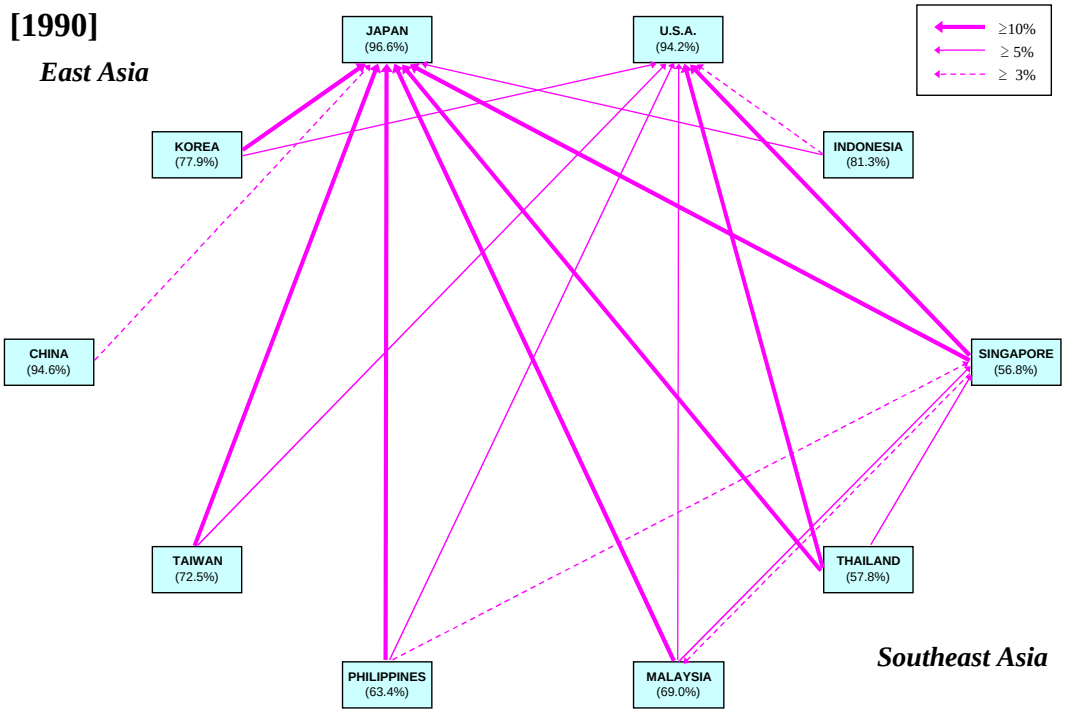
Source: Drawn by the authors.

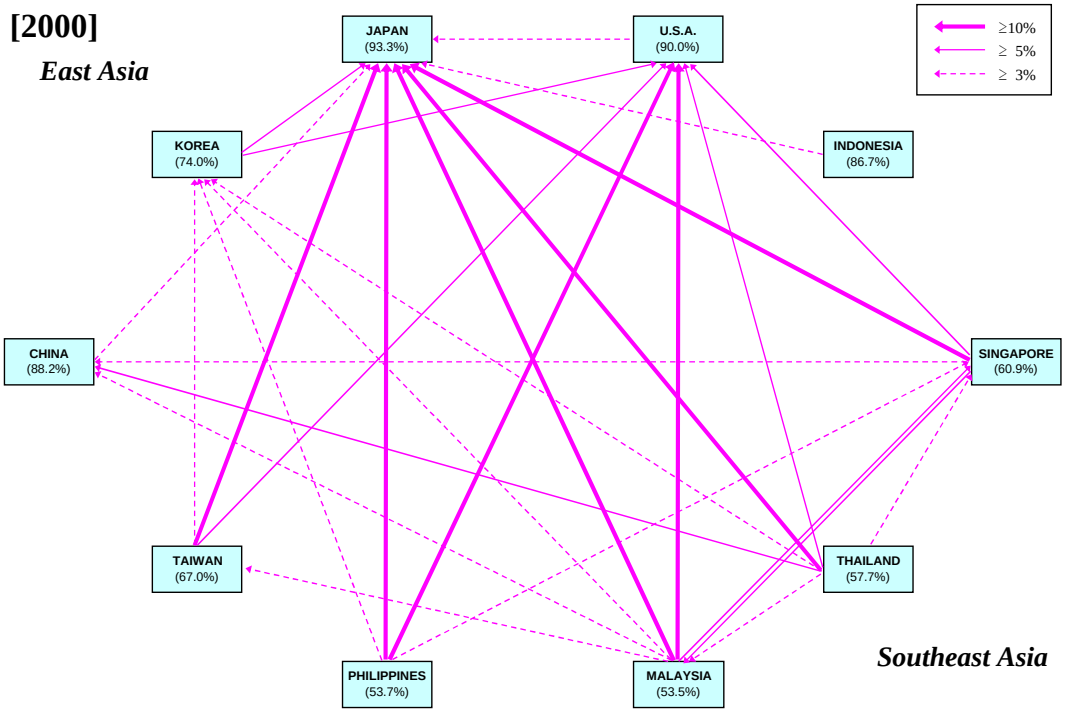
Figure 3 Linkage structures of textiles industry



Source: Drawn by the authors.

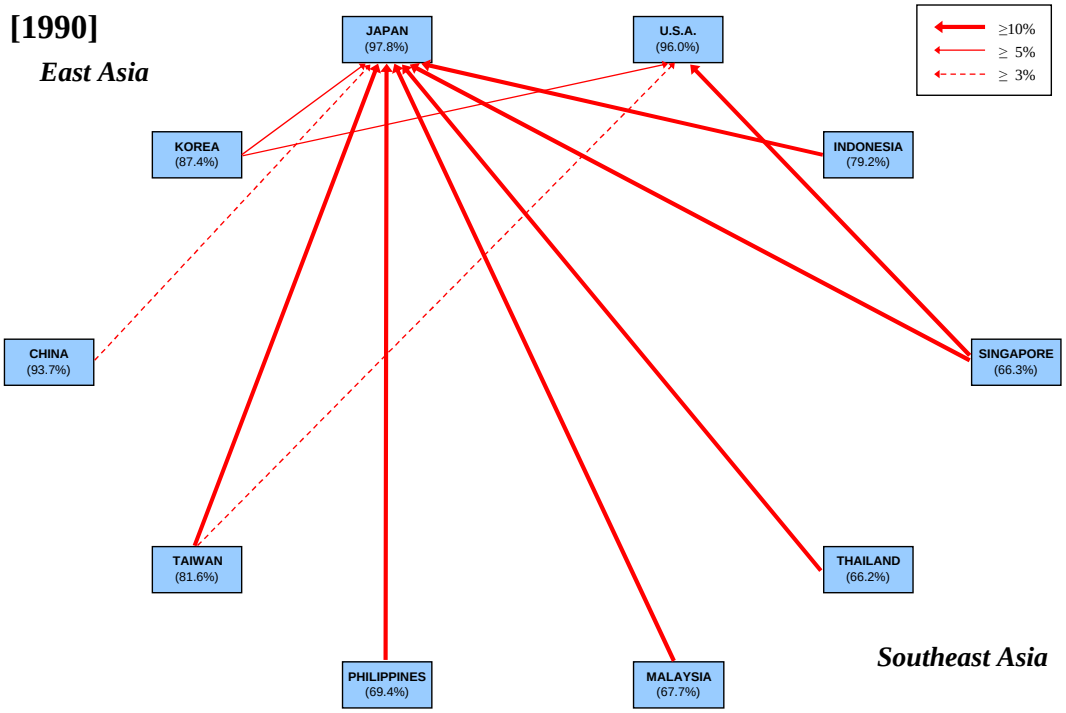
Figure 4 Linkage structures of electrical goods and electronics industry

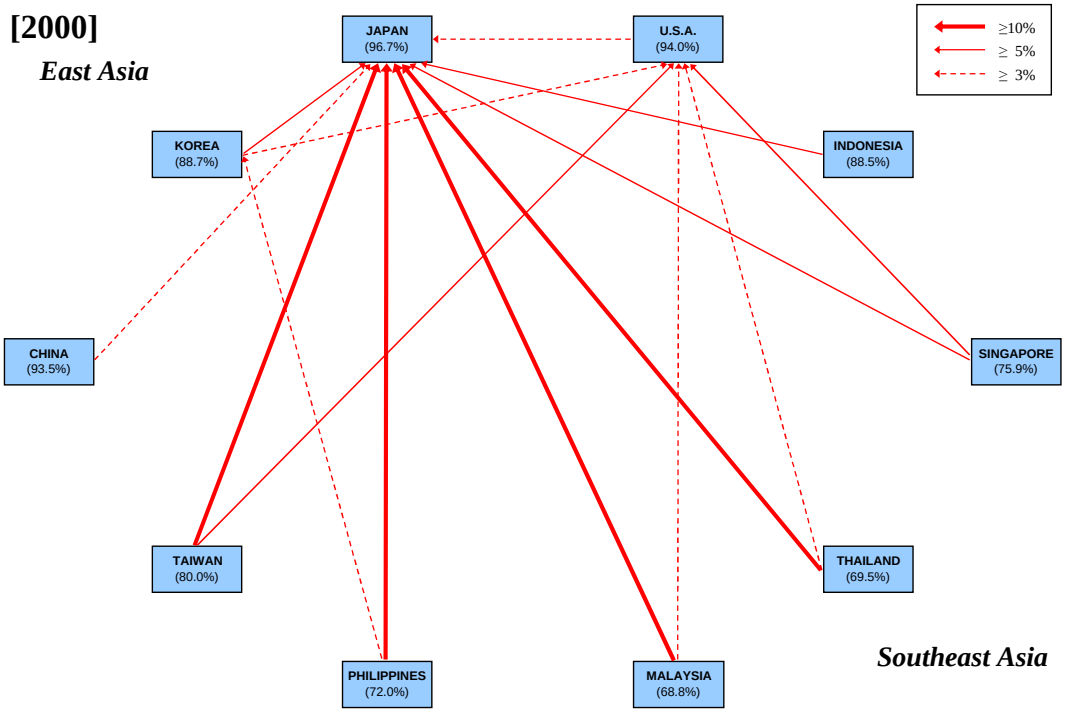




Source: Drawn by the authors.

Figure 5 Linkage structures of transport equipment industry





Source: Drawn by the authors.

Table 2 Number of Important Cells (by country)

1990	China	Indonesia	Japan	Korea	Malaysia	Taiwan	Philippines	Singapore	Thailand	U.S.A.	Total	Outgoing	Out./Intra.
China	133		9								**142**	9	6%
Indonesia		64	22								**86**	22	26%
Japan			78								**78**		0%
Korea				76							**76**		0%
Malaysia			21	6	77			9	5	16	**134**	57	43%
Taiwan			4			65				5	**74**	9	12%
Philippines			10				67	2		6	**85**	18	21%
Singapore		6	8		6			51	4	12	**87**	36	41%
Thailand			5					1	67	5	**78**	11	14%
U.S.A.										72	**72**		0%
Total	**133**	**70**	**157**	**82**	**83**	**65**	**67**	**63**	**76**	**116**	**912**	**162**	**18%**
Incoming		6	79	6	6			12	9	44	**162**		
In./Intra.	0%	9%	50%	7%	7%	0%	0%	19%	12%	38%	**18%**		

2000	China	Indonesia	Japan	Korea	Malaysia	Taiwan	Philippines	Singapore	Thailand	U.S.A.	Total	Outgoing	Out./Intra.
China	135										**135**		0%
Indonesia	8	63	21	6	1			1		1	**101**	38	38%
Japan			81								**81**		0%
Korea				77						5	**82**	5	6%
Malaysia			13	5	60			7		10	**95**	35	37%
Taiwan	4		9			64				9	**86**	22	26%
Philippines			8		2	2	54	1		6	**73**	19	26%
Singapore					9			54		8	**71**	17	24%
Thailand					2			1	61	3	**67**	6	9%
U.S.A.										63	**63**		0%
Total	**147**	**63**	**132**	**88**	**74**	**66**	**54**	**64**	**61**	**105**	**854**	**142**	**17%**
Incoming	12		51	11	14	2		10		42	**142**		
In./Intra.	8%	0%	39%	13%	19%	3%	0%	16%	0%	40%	**17%**		

Source: Authors' calculation from the Asian international input-output Tables for 1990 and 2000.

Table 3 Number of Important Cells (by industry)

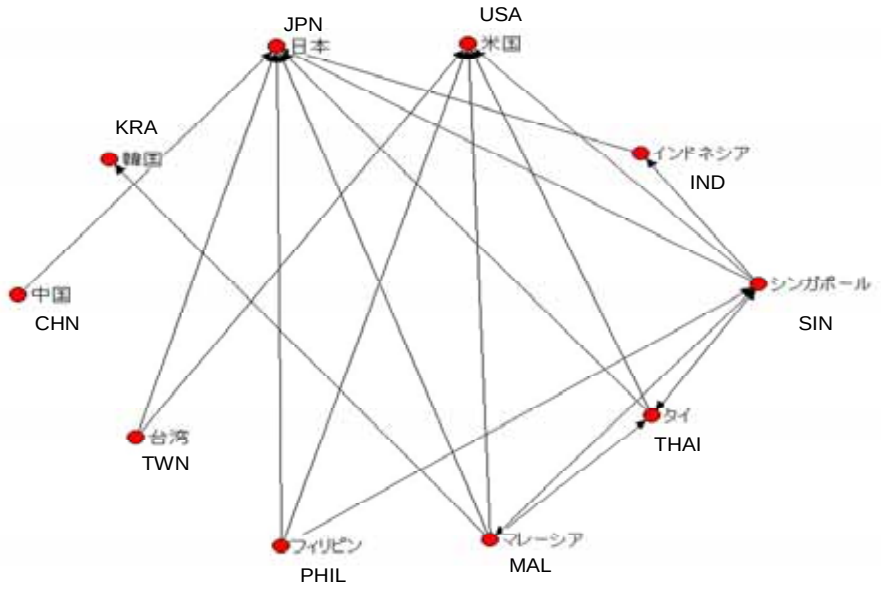
1990	Manufacturing	Agriculture & Services
Manufacturing	53	31
Agriculture & Services	44	34

2000	Manufacturing	Agriculture & Services
Manufacturing	73	22
Agriculture & Services	33	14

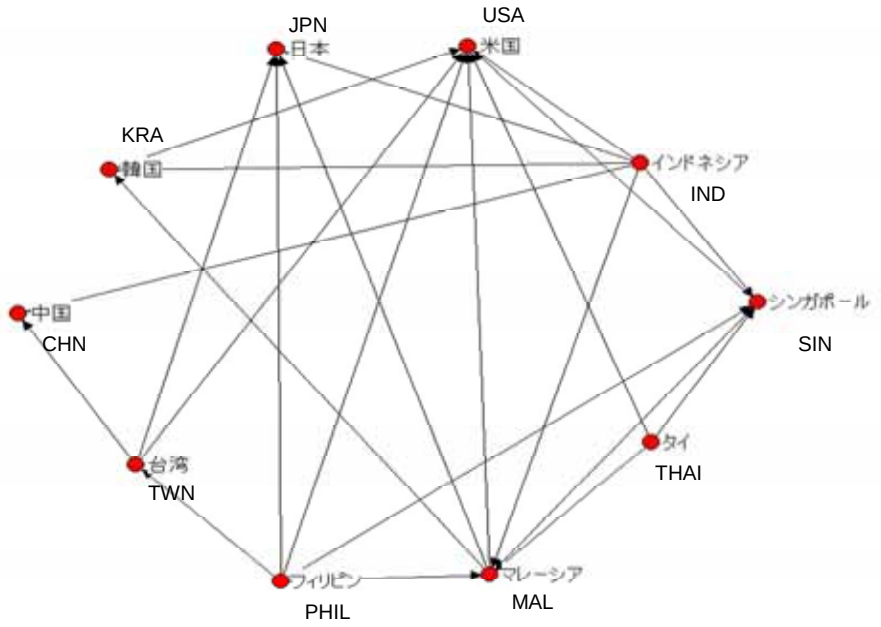
Source: Authors' calculation from the Asian international input-output tables for 1990 and 2000.

Figure 6 Networks among Countries

1990

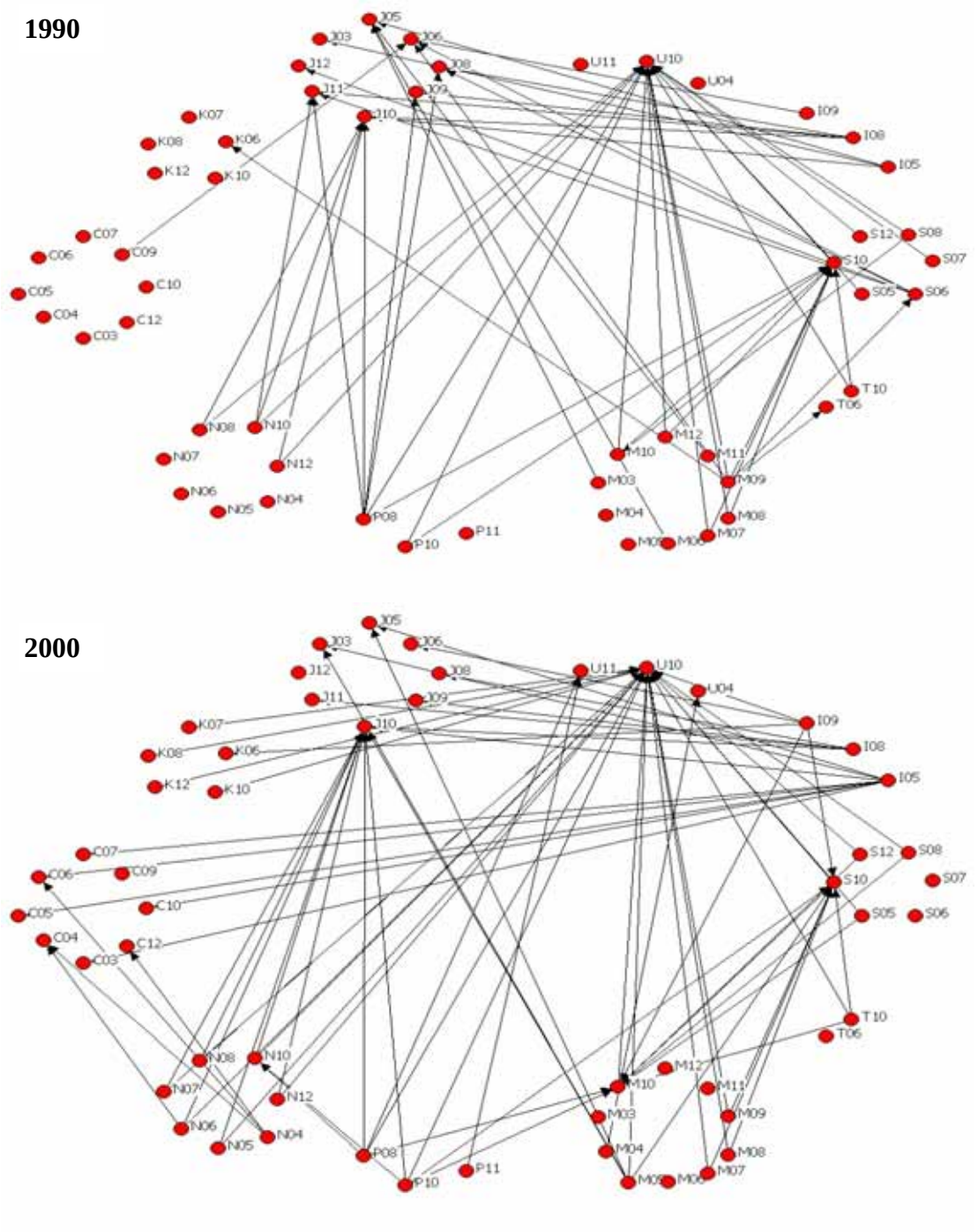


2000



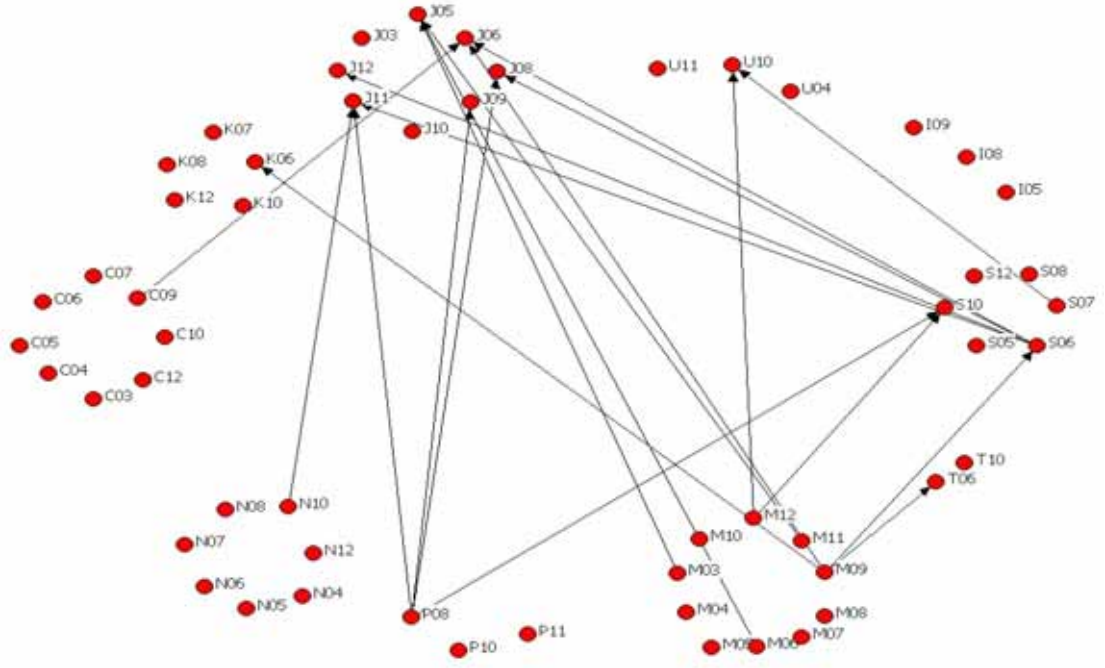
Source: Drawn by the authors.

Figure 7 The Networks of Manufacturing Sectors



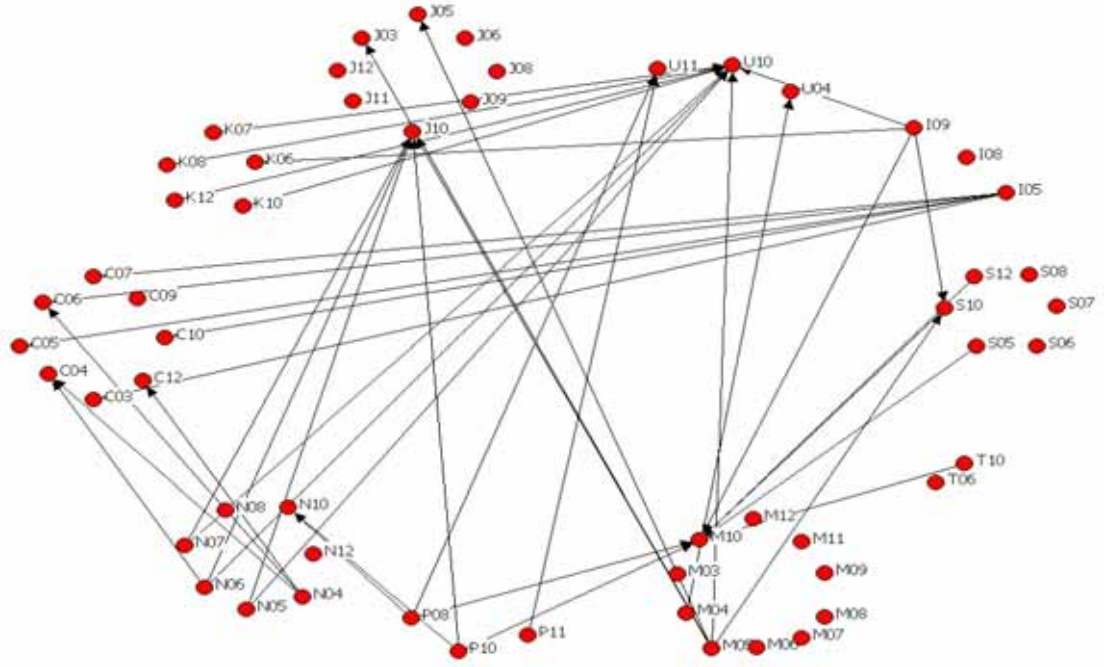
Source: Drawn by the authors.

Figure 8 Disappeared Networks



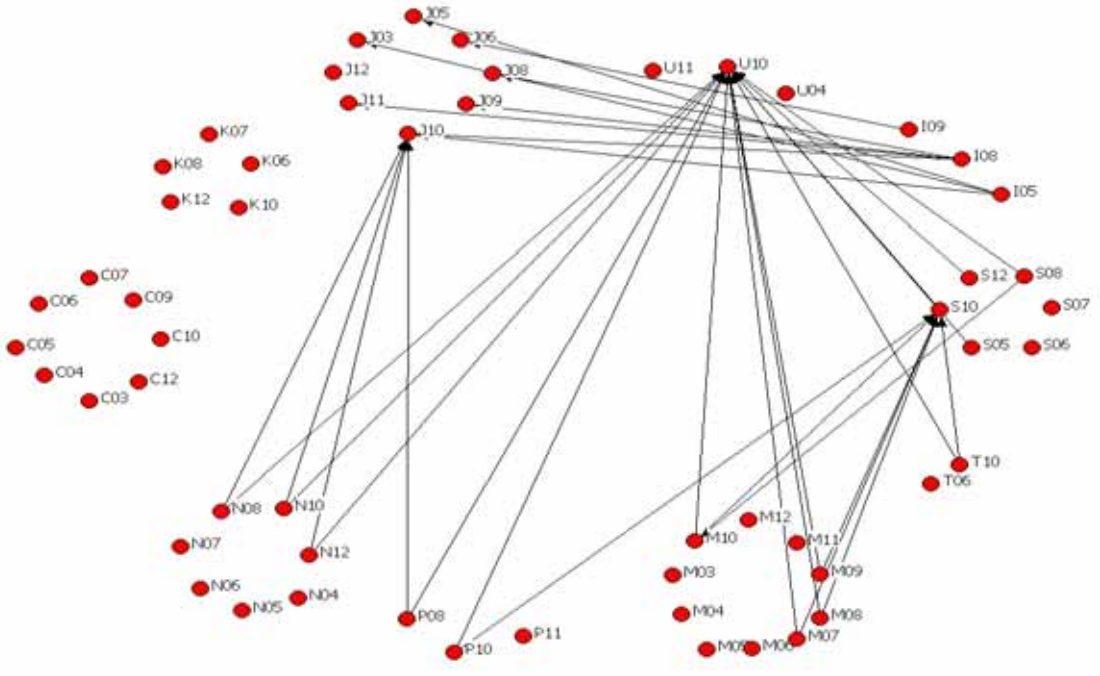
Source: Drawn by the authors.

Figure 9 Newly Created Networks



Source: Drawn by the authors.

Figure 10 Stable Networks



Source: Drawn by the authors.

Appendix 1 Layout of the Asian International Input-Output Table

			Intermediate Demand (A)										Final Demand (F)										Export (L)				
		code	Indonesia (AI)	Malaysia (AM)	Philippines (AP)	Singapore (AS)	Thailand (AT)	China (AC)	Taiwan (AN)	Korea (AK)	Japan (AJ)	U.S.A. (AU)	Indonesia (FI)	Malaysia (FM)	Philippines (FP)	Singapore (FS)	Thailand (FT)	China (FC)	Taiwan (FN)	Korea (FK)	Japan (FJ)	U.S.A. (FU)	Export to H.Kong (LH)	Export to EU (LO)	Export to R.O.W. (LW)	Discrepancy (QX)	Total Outputs (XX)
	Indonesia	(AI)	A^{II}	A^{IM}	A^{IP}	A^{IS}	A^{IT}	A^{IC}	A^{IN}	A^{IK}	A^{IJ}	A^{IU}	F^{II}	F^{IM}	F^{IP}	F^{IS}	F^{IT}	F^{IC}	F^{IN}	F^{IK}	F^{IJ}	F^{IU}	L^{IH}	L^{IO}	L^{IW}	Q^{I}	X^{I}
	Malaysia	(AM)	A^{MI}	A^{MM}	A^{MP}	A^{MS}	A^{MT}	A^{MC}	A^{MN}	A^{MK}	A^{MJ}	A^{MU}	F^{MI}	F^{MM}	F^{MP}	F^{MS}	F^{MT}	F^{MC}	F^{MN}	F^{MK}	F^{MJ}	F^{MU}	L^{MH}	L^{MO}	L^{MW}	Q^{M}	X^{M}
	Philippines	(AP)	A^{PI}	A^{PM}	A^{PP}	A^{PS}	A^{PT}	A^{PC}	A^{PN}	A^{PK}	A^{PJ}	A^{PU}	F^{PI}	F^{PM}	F^{PP}	F^{PS}	F^{PT}	F^{PC}	F^{PN}	F^{PK}	F^{PJ}	F^{PU}	L^{PH}	L^{PO}	L^{PW}	Q^{P}	X^{P}
	Singapore	(AS)	A^{SI}	A^{SM}	A^{SP}	A^{SS}	A^{ST}	A^{SC}	A^{SN}	A^{SK}	A^{SJ}	A^{SU}	F^{SI}	F^{SM}	F^{SP}	F^{SS}	F^{ST}	F^{SC}	F^{SN}	F^{SK}	F^{SJ}	F^{SU}	L^{SH}	L^{SO}	L^{SW}	Q^{S}	X^{S}
	Thailand	(AT)	A^{TI}	A^{TM}	A^{TP}	A^{TS}	A^{TT}	A^{TC}	A^{TN}	A^{TK}	A^{TJ}	A^{TU}	F^{TI}	F^{TM}	F^{TP}	F^{TS}	F^{TT}	F^{TC}	F^{TN}	F^{TK}	F^{TJ}	F^{TU}	L^{TH}	L^{TO}	L^{TW}	Q^{T}	X^{T}
	China	(AC)	A^{CI}	A^{CM}	A^{CP}	A^{CS}	A^{CT}	A^{CC}	A^{CN}	A^{CK}	A^{CJ}	A^{CU}	F^{CI}	F^{CM}	F^{CP}	F^{CS}	F^{CT}	F^{CC}	F^{CN}	F^{CK}	F^{CJ}	F^{CU}	L^{CH}	L^{CO}	L^{CW}	Q^{C}	X^{C}
	Taiwan	(AN)	A^{NI}	A^{NM}	A^{NP}	A^{NS}	A^{NT}	A^{NC}	A^{NN}	A^{NK}	A^{NJ}	A^{NU}	F^{NI}	F^{NM}	F^{NP}	F^{NS}	F^{NT}	F^{NC}	F^{NN}	F^{NK}	F^{NJ}	F^{NU}	L^{NH}	L^{NO}	L^{NW}	Q^{N}	X^{N}
	Korea	(AK)	A^{KI}	A^{KM}	A^{KP}	A^{KS}	A^{KT}	A^{KC}	A^{KN}	A^{KK}	A^{KJ}	A^{KU}	F^{KI}	F^{KM}	F^{KP}	F^{KS}	F^{KT}	F^{KC}	F^{KN}	F^{KK}	F^{KJ}	F^{KU}	L^{KH}	L^{KO}	L^{KW}	Q^{K}	X^{K}
	Japan	(AJ)	A^{JI}	A^{JM}	A^{JP}	A^{JS}	A^{JT}	A^{JC}	A^{JN}	A^{JK}	A^{JJ}	A^{JU}	F^{JI}	F^{JM}	F^{JP}	F^{JS}	F^{JT}	F^{JC}	F^{JN}	F^{JK}	F^{JJ}	F^{JU}	L^{JH}	L^{JO}	L^{JW}	Q^{J}	X^{J}
	U.S.A.	(AU)	A^{UI}	A^{UM}	A^{UP}	A^{US}	A^{UT}	A^{UC}	A^{UN}	A^{UK}	A^{UJ}	A^{UU}	F^{UI}	F^{UM}	F^{UP}	F^{US}	F^{UT}	F^{UC}	F^{UN}	F^{UK}	F^{UJ}	F^{UU}	L^{UH}	L^{UO}	L^{UW}	Q^{U}	X^{U}
Freight and Insurance		(BF)	BA^{I}	BA^{M}	BA^{P}	BA^{S}	BA^{T}	BA^{C}	BA^{N}	BA^{K}	BA^{J}	BA^{U}	BF^{I}	BF^{M}	BF^{P}	BF^{S}	BF^{T}	BF^{C}	BF^{N}	BF^{K}	BF^{J}	BF^{U}					
Import from H. Kong		(CH)	A^{HI}	A^{HM}	A^{HP}	A^{HS}	A^{HT}	A^{HC}	A^{HN}	A^{HK}	A^{HJ}	A^{HU}	F^{HI}	F^{HM}	F^{HP}	F^{HS}	F^{HT}	F^{HC}	F^{HN}	F^{HK}	F^{HJ}	F^{HU}					
Import from EU		(CO)	A^{OI}	A^{OM}	A^{OP}	A^{OS}	A^{OT}	A^{OC}	A^{ON}	A^{OK}	A^{OJ}	A^{OU}	F^{OI}	F^{OM}	F^{OP}	F^{OS}	F^{OT}	F^{OC}	F^{ON}	F^{OK}	F^{OJ}	F^{OU}					
Import from the R.O.W.		(CW)	A^{WI}	A^{WM}	A^{WP}	A^{WS}	A^{WT}	A^{WC}	A^{WN}	A^{WK}	A^{WJ}	A^{WU}	F^{WI}	F^{WM}	F^{WP}	F^{WS}	F^{WT}	F^{WC}	F^{WN}	F^{WK}	F^{WJ}	F^{WU}					
Duties & Import Taxes		(DT)	DA^{I}	DA^{M}	DA^{P}	DA^{S}	DA^{T}	DA^{C}	DA^{N}	DA^{K}	DA^{J}	DA^{U}	DF^{I}	DF^{M}	DF^{P}	DF^{S}	DF^{T}	DF^{C}	DF^{N}	DF^{K}	DF^{J}	DF^{U}					
Value Added		(VV)	V^{I}	V^{M}	V^{P}	V^{S}	V^{T}	V^{C}	V^{N}	V^{K}	V^{J}	V^{U}															
Total Inputs		(XX)	X^{I}	X^{M}	X^{P}	X^{S}	X^{T}	X^{C}	X^{N}	X^{K}	X^{J}	X^{U}															

Source: IDE (2006), p.12.

Appendix 2 Sector classification

Code	Description
001	Agriculture, forestry, fishery
002	Mining and quarrying
003	Food processing
004	Textiles
005	Other light manufacturing
006	Chemicals
007	Non-metallic mineral products
008	Metal products
009	Machinery
010	Electrical goods and electronics
011	Transport equipment
012	Other manufacturing
013	Electricity, gas and water
014	Construction
015	Trade and transport
016	Services

Appendix 3 Backward linkage effects (in percentage share)

[1990]

	China	Indonesia	Japan	Korea	Malaysia	Taiwan	Philippines	Singapore	Thailand	U.S.A.
[All industries]										
China	96.637%	0.633%	0.452%	0.047%	1.016%	0.074%	0.495%	2.349%	1.299%	0.137%
Indonesia	0.170%	90.400%	0.430%	0.609%	0.398%	0.475%	0.360%	1.004%	0.224%	0.051%
Japan	1.366%	4.560%	96.818%	4.644%	7.825%	5.962%	7.030%	11.740%	7.555%	0.982%
Korea	0.150%	0.847%	0.290%	89.209%	0.792%	0.548%	1.397%	1.055%	0.898%	0.190%
Malaysia	0.182%	0.304%	0.195%	0.523%	83.130%	0.424%	0.658%	3.424%	1.085%	0.064%
Taiwan	0.379%	0.867%	0.206%	0.404%	1.515%	87.371%	1.806%	1.834%	1.092%	0.239%
Philippines	0.016%	0.044%	0.049%	0.054%	0.073%	0.087%	83.355%	0.136%	0.075%	0.027%
Singapore	0.105%	0.610%	0.076%	0.150%	2.531%	0.397%	0.927%	71.921%	1.259%	0.078%
Thailand	0.057%	0.100%	0.081%	0.097%	0.337%	0.132%	0.130%	0.616%	83.939%	0.039%
U.S.A.	0.938%	1.636%	1.403%	4.264%	2.384%	4.529%	3.841%	5.921%	2.573%	98.193%
Total	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**
[Textiles]										
China	96.320%	1.498%	0.440%	0.074%	2.814%	0.082%	1.046%	3.631%	2.058%	0.379%
Indonesia	0.068%	85.277%	0.216%	0.390%	1.117%	0.415%	0.628%	2.731%	0.330%	0.138%
Japan	1.075%	3.175%	95.529%	4.919%	6.943%	4.497%	5.012%	10.028%	4.308%	0.761%
Korea	0.294%	1.899%	0.282%	88.216%	1.972%	1.016%	2.852%	1.202%	1.802%	0.653%
Malaysia	0.104%	0.436%	0.118%	0.331%	73.668%	0.208%	0.467%	3.123%	0.457%	0.091%
Taiwan	0.819%	2.730%	0.322%	1.309%	7.896%	90.048%	9.075%	9.537%	2.662%	0.569%
Philippines	0.007%	0.028%	0.087%	0.033%	0.059%	0.032%	72.048%	0.052%	0.022%	0.072%
Singapore	0.060%	0.685%	0.058%	0.088%	2.273%	0.223%	0.646%	65.379%	0.787%	0.067%
Thailand	0.056%	0.259%	0.191%	0.098%	0.843%	0.127%	0.359%	1.175%	84.447%	0.116%
U.S.A.	1.195%	4.013%	2.757%	4.544%	2.415%	3.352%	7.866%	3.144%	3.128%	97.154%
Total	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**
[Electrical goods and electronics]										
China	94.632%	0.620%	0.266%	0.072%	0.744%	0.098%	0.213%	0.767%	0.723%	0.178%
Indonesia	0.102%	81.329%	0.193%	0.218%	0.349%	0.216%	0.143%	0.431%	0.242%	0.034%
Japan	3.193%	8.475%	96.648%	14.224%	13.151%	16.372%	18.508%	21.077%	17.904%	3.290%
Korea	0.403%	1.461%	0.421%	77.880%	1.392%	1.184%	1.844%	2.230%	1.646%	0.536%
Malaysia	0.133%	0.416%	0.137%	0.489%	69.030%	0.781%	0.654%	3.786%	1.237%	0.271%
Taiwan	0.549%	2.236%	0.443%	0.873%	2.247%	72.477%	2.161%	2.723%	2.562%	0.760%
Philippines	0.016%	0.082%	0.053%	0.107%	0.270%	0.240%	63.449%	0.517%	0.193%	0.077%
Singapore	0.103%	1.855%	0.115%	0.446%	5.719%	1.000%	3.306%	56.821%	5.491%	0.525%
Thailand	0.036%	0.259%	0.084%	0.114%	0.460%	0.215%	0.237%	1.214%	57.842%	0.108%
U.S.A.	0.833%	3.267%	1.640%	5.577%	6.639%	7.416%	9.486%	10.435%	12.160%	94.221%
Total	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**
[Transport equipment]										
China	93.741%	0.419%	0.203%	0.044%	0.385%	0.062%	0.158%	1.285%	1.402%	0.157%
Indonesia	0.086%	79.166%	0.174%	0.218%	0.272%	0.223%	0.124%	0.656%	0.221%	0.034%
Japan	3.749%	16.884%	97.802%	8.024%	27.604%	12.614%	24.999%	16.942%	26.146%	2.898%
Korea	0.185%	0.616%	0.203%	87.430%	0.367%	0.626%	2.046%	1.057%	0.827%	0.285%
Malaysia	0.115%	0.214%	0.078%	0.213%	67.666%	0.203%	0.317%	1.544%	0.648%	0.091%
Taiwan	0.348%	0.509%	0.165%	0.351%	0.655%	81.611%	0.838%	1.160%	0.967%	0.388%
Philippines	0.016%	0.035%	0.041%	0.044%	0.026%	0.069%	69.370%	0.095%	0.098%	0.028%
Singapore	0.095%	0.479%	0.046%	0.136%	0.935%	0.306%	0.367%	66.256%	0.890%	0.099%
Thailand	0.049%	0.092%	0.042%	0.046%	0.155%	0.055%	0.179%	0.354%	66.198%	0.040%
U.S.A.	1.616%	1.585%	1.246%	3.494%	1.934%	4.230%	1.602%	10.653%	2.604%	95.981%
Total	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**

Source: Authors' calculation from the Asian international input-output table 1990.

[2000]

	China	Indonesia	Japan	Korea	Malaysia	Taiwan	Philippines	Singapore	Thailand	U.S.A.
[All industries]										
China	94.022%	1.295%	0.742%	1.817%	1.893%	1.576%	1.678%	2.413%	1.812%	0.551%
Indonesia	0.239%	90.151%	0.385%	0.701%	1.052%	0.746%	1.263%	0.884%	0.644%	0.091%
Japan	1.957%	3.320%	96.464%	3.402%	7.747%	5.925%	5.744%	7.019%	6.970%	1.119%
Korea	1.180%	1.099%	0.399%	89.883%	1.583%	1.324%	2.419%	1.213%	1.027%	0.356%
Malaysia	0.212%	0.678%	0.250%	0.413%	77.222%	0.662%	1.463%	3.744%	1.048%	0.163%
Taiwan	1.043%	0.652%	0.269%	0.407%	1.874%	84.861%	1.910%	1.030%	1.099%	0.362%
Philippines	0.046%	0.039%	0.062%	0.082%	0.243%	0.194%	79.796%	0.154%	0.178%	0.081%
Singapore	0.184%	0.489%	0.073%	0.242%	3.245%	0.533%	1.491%	77.562%	0.907%	0.126%
Thailand	0.139%	0.385%	0.135%	0.164%	1.157%	0.370%	0.774%	1.106%	83.718%	0.118%
U.S.A.	0.978%	1.891%	1.221%	2.890%	3.984%	3.808%	3.462%	4.875%	2.598%	97.035%
Total	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**
[Textiles]										
China	93.804%	2.347%	2.017%	5.008%	4.594%	1.286%	4.336%	5.257%	3.448%	1.196%
Indonesia	0.208%	85.956%	0.594%	1.056%	2.728%	1.111%	1.639%	0.582%	0.699%	0.445%
Japan	2.066%	2.592%	94.397%	2.579%	7.102%	4.703%	3.992%	3.666%	2.826%	0.879%
Korea	1.475%	2.309%	0.602%	87.259%	2.075%	1.707%	4.852%	2.276%	1.650%	0.753%
Malaysia	0.128%	0.742%	0.204%	0.300%	68.976%	0.592%	0.591%	4.754%	0.562%	0.274%
Taiwan	1.501%	1.683%	0.500%	0.995%	5.747%	86.153%	9.076%	1.890%	2.330%	1.025%
Philippines	0.020%	0.036%	0.033%	0.030%	0.173%	0.111%	68.659%	0.220%	0.085%	0.125%
Singapore	0.087%	0.427%	0.042%	0.120%	3.329%	0.333%	0.621%	76.495%	1.027%	0.100%
Thailand	0.113%	0.584%	0.289%	0.401%	1.582%	0.589%	1.812%	1.606%	85.763%	0.475%
U.S.A.	0.598%	3.325%	1.323%	2.252%	3.695%	3.417%	4.421%	3.253%	1.611%	94.729%
Total	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**
[Electrical goods and electronics]										
China	88.232%	1.683%	0.952%	2.272%	3.045%	2.354%	1.528%	3.665%	5.076%	1.130%
Indonesia	0.201%	86.701%	0.241%	0.307%	0.926%	0.526%	0.437%	0.858%	0.931%	0.106%
Japan	3.554%	4.450%	93.251%	9.710%	13.642%	13.678%	18.248%	14.464%	14.540%	3.607%
Korea	2.116%	1.562%	0.987%	74.022%	3.245%	3.996%	4.837%	2.501%	3.358%	1.453%
Malaysia	0.625%	0.866%	0.528%	1.400%	53.463%	2.063%	1.840%	5.851%	3.332%	0.810%
Taiwan	2.214%	0.819%	1.191%	2.069%	3.785%	67.037%	2.834%	2.267%	2.686%	1.328%
Philippines	0.209%	0.064%	0.260%	0.570%	1.293%	1.126%	53.727%	0.319%	0.707%	0.410%
Singapore	0.572%	1.022%	0.329%	1.228%	7.449%	1.961%	3.585%	60.860%	3.586%	0.855%
Thailand	0.318%	0.545%	0.218%	0.466%	2.332%	0.859%	1.337%	1.351%	57.665%	0.328%
U.S.A.	1.959%	2.289%	2.044%	7.955%	10.821%	6.399%	11.629%	7.864%	8.119%	89.972%
Total	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**
[Transport equipment]										
China	93.542%	1.781%	0.565%	1.475%	1.819%	1.731%	2.380%	2.135%	1.674%	0.873%
Indonesia	0.121%	88.541%	0.181%	0.355%	0.788%	0.358%	2.061%	1.166%	0.525%	0.076%
Japan	2.960%	6.204%	96.672%	5.249%	18.391%	10.054%	11.456%	8.897%	20.635%	3.250%
Korea	1.040%	0.623%	0.311%	88.702%	1.678%	1.423%	3.483%	1.262%	1.209%	0.560%
Malaysia	0.147%	0.394%	0.147%	0.263%	68.845%	0.473%	1.574%	2.184%	0.884%	0.224%
Taiwan	0.956%	0.447%	0.263%	0.353%	1.713%	80.041%	2.165%	0.754%	1.084%	0.533%
Philippines	0.033%	0.057%	0.070%	0.061%	0.150%	0.130%	72.018%	0.107%	0.636%	0.146%
Singapore	0.147%	0.311%	0.057%	0.220%	2.133%	0.352%	1.247%	75.937%	0.646%	0.168%
Thailand	0.109%	0.379%	0.271%	0.118%	0.959%	0.218%	0.971%	0.660%	69.532%	0.142%
U.S.A.	0.945%	1.263%	1.464%	3.203%	3.524%	5.221%	2.645%	6.899%	3.176%	94.028%
Total	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**	**100.000%**

Source: Authors' calculation from the Asian international input-output table 2000.