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Interdependence of Production and Income in Asia-Pacific Economies: An International Input-Output Approach

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Abstract

In this paper, we investigate interdependencies between Asia–Pacific economies by using the Asian International Input–Output Table. The results of production inducement analysis show that the production inducement coefficients of many Asia–Pacific countries have recently increased, and in particular production inducements to East Asian countries, especially China, have increased. Thus, interdependencies between Asia–Pacific economies in terms of global production networks deepened further from 2000 onwards through increases in trade in intermediate products. In particular, China plays a more important role than ever as the main production center in the Asia–Pacific region. Moreover, the degrees of income dependence between these countries are examined. It is found that East Asian economies have not necessarily become more autonomous than before in terms of their income dependence. Rather, their economic structure still tends to be affected by economic developments outside the region.

Keywords: Asian International Input–Output Table, production inducement coefficient, degree of income dependence.

JEL Classification Number: C67, F15

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1. INTRODUCTION

Many multinational companies in developed countries have been in pursuit of favorable production locations to secure advantages in the context of severe global competition since the early 1990s. Within the East Asian region, they actively trade raw materials and intermediate products, which are then given final processing, and typically export goods elsewhere, such as to the US, Europe, and Japan. With development, a global production network has been established in the region, and there has been progress in the international division of labor. In this sense, Asia–Pacific economies, which mainly comprise East Asian countries,[1] the US, and Japan, have developed and deepened their interdependence in terms of international input–output linkages. Furthermore, China has recently become more integrated into the world economy, which may have significantly changed the economic landscape in the East Asian region, and may have affected both the structure and the development of the global production network. In addition, China has also increased its importance as a destination for the final products of its trading partners. Considering these recent developments, it is suggested that interdependence between Asia–Pacific economies has entered a new phase, which needs to be scrutinized further.

For examining whether the interdependencies between Asia–Pacific economies have recently deepened, the Asian International Input–Output Table (hereafter, the AIO Table) compiled by the Institute of Developing Economies, Japan External Trade Organization is extremely useful; it provides systematic descriptions of the international input–output structures of intermediate and final goods and multilateral trade flows in a table that can be used to quantitatively analyze the structure of industry and trade and the interdependence of Asia–Pacific economies.[2] The AIO Table covers 10 countries of interest: China; South Korea, Taiwan, and Singapore (the NIEs3); Thailand, Indonesia, Malaysia, and the Philippines (the ASEAN4); Japan; and the US. To date, the AIO Table has been compiled for five years, which allows us to analyze intertemporal changes in the interdependence of the Asia–Pacific economies.

In spite of these advantages of the AIO Table, it also has limitations; because it

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[1] In this paper, "East Asian countries" refers to the following eight countries unless otherwise stated: China, South Korea, Taiwan, Singapore, Thailand, Indonesia, Malaysia, and the Philippines. Taiwan is counted as a *country* for simplicity.

[2] In related studies, Hasebe and Shrestha (2006) examine the degree of recent economic integration in East Asia by using the AIO Table, and Kamada *et al*. (2002) analyze interdependence in the Asia–Pacific area by developing a macroeconometric model of the area, i.e., the "*Asian Economy Model*." The model of Kamada *et al*. (2005) makes it possible to quantify how deepening interdependence affects economic activities in the area and quantify the effects of changes in a county's adopted policy rule on other countries and on itself. See also Kamada and Takagawa (2005) for an extended version of the Asian Economy Model, which incorporates the Taiwanese economy as a new component of "East Asia."

generally takes a large amount of labor and time to complete the table, its publication is seriously delayed. For example, the most recent currently available AIO Table is for the year 2000, which was published in 2006. As already mentioned, it is likely that interdependencies between Asia–Pacific economies have recently entered a new phase given the increasing presence of China as both a major production center and a destination for the final products of its trading partners. Hence, it may be inappropriate to use the AIO Table for 2000 to analyze recent changes in the interdependence of the Asia–Pacific economies.

In this paper, we attempt to tackle the above problem. To analyze the recent state of interdependence between Asia–Pacific economies by using the AIO Table, we derive an input coefficient matrix from the table, in which the elements represent the inputs needed to produce one unit of output, which plays a significant role. In this respect, we try to estimate the input coefficient matrix of the AIO Table for 2005 by applying the "RAS" method to the published AIO Table for 2000. In this context, Okada and Takagawa (2004) developed the "*Trade*-RAS" method, which improves the predictive accuracy of the "RAS" method by incorporating updated information on multilateral trade.[3] We follow their procedure to estimate the input coefficient matrix of the AIO Table for 2005. This allows us to investigate recent developments and the degrees of interdependence between Asia–Pacific economies.

In this paper, deepening interdependence is evaluated at the country level both in terms of the global production network, which has accompanied the development of the international division of labor, and in terms of the income dependence of Asia–Pacific economies.[4] The remainder of the paper is organized as follows. In Section 2, we give a full account of the procedure used to estimate the AIO Table for 2005, including its input coefficient matrix. We also report the estimation results for total outputs, intermediate demands, and final demands of the 10 Asia–Pacific countries. In Section 3, we examine whether interdependence between Asia–Pacific economies has deepened in terms of the global production network by focusing on the production inducement coefficient derived from the AIO Tables for different periods. The production inducement coefficients are useful indicators of the degrees of interdependence among Asia–Pacific economies based on trade in intermediate products across countries. In Section 4, we consider the degrees of income dependence of Asia–Pacific economies. For each country, income dependence

[3] The "RAS" method is a conventional method of estimating the input coefficient matrix of the Input–Output table developed by Stone (1963). It is an algorithm used to scale the matrix, conditional on the sums of rows and columns. See the Appendix for an outline of the "Trade-RAS" method; see also Okada and Takagawa (2004) for a detailed explanation.

[4] We do not implement the AIO analysis at the industry level. This is because the "Trade-RAS" method is known to achieve predictive accuracy only at the *macro* level, and because complete industry data for the period 2000–2005 is not available for the East Asian countries.

relates to the extent to which its income depends on the final demand of other countries. In Section 5, we present our conclusions.

2. ESTIMATION OF THE AIO TABLE

In this section, we estimate an AIO Table for 2005. In Section 2.1, we explain in detail a practical procedure for estimating the table. This method begins with the calculation of total outputs and value added. Then, after demonstrating the use of an estimation procedure for intermediate demands, we explain the estimation of final demands. In Section 2.2, we report countries' estimated total outputs, intermediate demands, and final demands.

2.1. *Estimation Procedure*

(1) Gross Output, Value Added

First, the growth rates of total outputs and value added in 2000–2005 are calculated from statistics on the 10 Asia–Pacific countries listed in the AIO Table. The growth rates are multiplied by the values of total outputs and value added in the AIO Table 2000 to yield the 2005 estimated values for these countries. Details follow.

- For Japan and the US, we calculate the values of total outputs and value added in 2005 from the currently published 2005 input–output (I–O) tables of both countries.
- For other countries, the corresponding values are estimated for manufacturing and nonmanufacturing separately. Value added in manufacturing and nonmanufacturing for these countries is obtained from the country-by-country GDP statistics. Total manufacturing outputs are based on manufacturing production statistics from the *CEIC* database.[5] However, because it is difficult to find data on total nonmanufacturing outputs by country, the growth rates of value added in nonmanufacturing from the country-by-country GDP statistics are used to estimate the 2005 values.
- For each country, inputs for intermediate demands (i.e., (C) in Figure 1) are calculated by subtracting value added (B) from the total outputs, which are equivalent to total inputs (A).

(2) Intermediate Demand

We explain the procedure used to estimate intermediate demands of the 10 countries for 2005 by implementing the "Trade-RAS" method. Data on international trade for 2005 are needed to apply this method; the method uses data on the aggregate exports and

[5] However, because data on the total outputs of Malaysia, Indonesia, Taiwan, and South Korea are not available, they are calculated by multiplying the manufacturing industrial production indices by their corresponding domestic producer price indices.

imports of the 10 listed countries for 2005. These values are calculated as their total exports and imports minus their exports to, and imports from, the countries outside the Asia-Pacific regions, which represent the rest of world (ROW). Corresponding data on total final goods exports and imports are also needed. Details follow.

- Data on goods exports and imports by country are from the *Direction of Trade Statistics* (DOTS) compiled by the International Monetary Fund. Because data on trade in services are not available by country, services exports and imports by country are calculated by weighting services exports and imports on a balance of payments (BOP) basis by using the country-by-country ratios for goods exports and imports implied by the DOTS.
- For each listed country, import values are calculated as the value of imports minus the total cost of "freight, insurance, and tariffs (i.e., the sum of (E) and (K) in Figure 1).[6] Total export (or import) values of final goods for the listed countries in 2005 are obtained by multiplying export (or import) ratios of final goods for that country from the AIO Table for 2000 by its total export (or import) values in 2005.
- Foreign intermediate demands (i.e., (N) in Figure 1) are estimated by applying the "Trade-RAS" method on the basis of the multilateral trade matrix of the AIO Table for 2000 and by using the figures for international trade for 2005 calculated as described above.
- Imports of intermediate and final goods from the ROW in 2005 (i.e., (D) and (J) in Figure 1, respectively) are calculated from the ratio of imports of intermediate goods to imports of final goods from the ROW in the AIO Table for 2000 and from total import values from the ROW in 2005. Net inputs for intermediate demands (F) are calculated as (C) minus the sum of (D) and (E). Domestic intermediate demand (G) is obtained by subtracting (N) from (F) for each country. Hence, we obtain all elements of the intermediate demand matrix, which yield the total intermediate demands of the 10 countries (H).[7]

(3) Final Demand

We estimate the final demands of the 10 countries by using data on their demand components of GDP.

- For each country, the value of total inputs for final demands (i.e., (I) in Figure 1) is defined as the sum of private consumption expenditure, government expenditure, gross fixed capital formation, and inventory investment. The 2005 value of total inputs for the final demand of

[6] Because imports are based on CIF values, which include the costs of "freight, insurance, and tariffs," these costs must be subtracted from import values to match the export and import values implied by bilateral trade. The costs of the 10 listed countries in 2005 are calculated by multiplying their ratios of costs to import values in the AIO Table for 2000 by their corresponding import values in 2005. Then, they are multiplied by the ratios of intermediate to final import values from the AIO Table for 2000 to obtain the costs of "freight, insurance, and tariffs" for the intermediate and final goods of the respective countries in 2005 (represented by (E) and (K) in Figure 1, respectively).

[7] For a robustness check, we used the RAS method to obtain the revised values of the intermediate demand matrix for 2005 on the basis of (F) and (H) calculated in the paper and the initial values of the intermediate demand matrix for 2000. The estimation results are similar to those presented in the paper.

each country is calculated by multiplying the value in the AIO Table for 2000 by its growth rate in 2000–2005, which is calculated from the country-by-country GDP statistics.

- The value of net inputs for final demand of each country (i.e., (L) in Figure 1) is derived by subtracting the sum of (K) and (J) from (I). Domestic final demand (M) is calculated by subtracting the import value of final goods calculated in above (2) from (L). Total final demand (P) is obtained by adding (M) to the obtained export value of final goods for each country.
- The final demand matrix in the AIO Table for 2005 is completed by implementing the "RAS" method based on (L), (P), and the final demand matrix of the AIO Table for 2000.

2.2. *Overview of the Total Outputs, Intermediate Demands, and Final Demands of Asia–Pacific Countries*

Figure 2(1) illustrates the total outputs of the 10 Asia–Pacific countries in billions of US dollars for 1990, 1995, 2000, and 2005.[8] In conjunction with Figure 2(1), Table 1(1) reports the annual growth rates of the total outputs of those countries in three different periods.

According to Table 1(1), the total outputs of the NIEs3 and the ASEAN4 countries recorded double-digit annual growth rates in 1990–1995. However, their growth rates declined drastically in 1995–2000; in particular, the total outputs of Indonesia and Thailand, both of which were seriously affected by the 1997–1998 Asian financial crises, actually fell during this period. Nonetheless, the growth rates of total output in the East Asian countries have improved since 2000, albeit to varying degrees. The total output of the US, which is the world's largest (at 23 trillion dollars in 2005), has increased consistently since the 1990s. Japan's total output increased during 1990–1995 but declined in 1995–2000 as its domestic economy stagnated and as the transfer of domestic production to foreign countries, especially in Asia, accelerated. The most prominent feature is the dramatic increase in China's total output. Although China's total output was valued at only 875 billion dollars in 1990, it has increased dramatically over the last 15 years to reach, by 2005, 7 trillion dollars, which is about 90 percent of Japan's total output value for 2005 (see Table 1(2)). In addition, China's total output grew by about 20 percent per year on average during the period 2000–2005; this means that China outgrew other Asia–Pacific countries.

To explore the changes in the total outputs of the Asia–Pacific countries, Figures 2(2) and 2(3) illustrate intermediate and final demands from 1990–2005. Except in 1995–2000, intermediate and final demands have increased. Table 1(3) shows that the growth

[8] The values of total outputs, intermediate and final demands of those countries are all represented in US dollar terms. Therefore, for countries that experienced home currency appreciations (depreciations) against the US dollar, values are larger (smaller) than those measured in domestic currencies.

rates of intermediate demand have exceeded those of final demand in most East Asian countries, which have experienced increases in their ratios of intermediate demand to final demand over the last 15 years. All but a few of these ratios have tended to exceed unity. The ratios exceed those of the US and Japan, which averaged 0.8 to 0.9 during the period. These results suggest that intermediate goods have become more actively traded between East Asian countries year by year. This suggests that these countries have recently become more interdependent in terms of the global production network.

Returning our attention to China, as Figure 2(2) shows, its intermediate demand has consistently increased since the 1990s. By 2005, it exceeded 5 trillion dollars, which matches Japan's level. According to Figure 2(3), China's final demand has also increased recently. However, its value is almost half that of Japan's, and was less than one-sixth of the US level in 2005. This implies that China's total output increased mainly because of a rise in its intermediate demand, which suggests that China has been integrated into the world economy as a large production base; it imports materials, parts, and components, and then assembles them into final products, which are ultimately exported to countries such as the US. Nonetheless, in terms of the scale of final demand, even though China's final demand has grown rapidly (by averaging double-digit growth rates over the last 15 years), final demand in the US far exceeds the levels in the Asia–Pacific countries, including China. Therefore, the US economy is even now the main export destination of their final products.

In the next section, we use the AIO Table to estimate production inducement coefficients to analyze the deepening interdependence of the Asia–Pacific economies.

3. PRODUCTION INDUCEMENT ANALYSIS

In this section, we formally investigate interdependence among Asia–Pacific economies in terms of the global production network by focusing on production inducement coefficient derived from the AIO Table. This coefficient is a useful indicator of the degree to which Asia–Pacific countries are interdependent through their trade of intermediate products. In Section 3.1, we explain how the coefficient is obtained from the AIO Table. In Section 3.2, we report the estimation results. In Section 3.3, we explain China's increasing presence in the global production base.

3.1. *Derivation of the Production Inducement Coefficient*

The production inducement coefficient represents the quantitative magnitude of production induced to home and foreign countries when one unit of final demand takes place in the home country. When final products comprise a number of intermediate products, an initial increase in demand for final products consequently induces manifold production to both home and foreign countries through the trading of those intermediate

products, which are necessary to produce those final products.

We first describe the derivation of the production inducement coefficient from the AIO Table. We define a (10×1) vector of the total outputs of the 10 Asia–Pacific countries as X; we define a (10×1) vector in which each element is unity as ι; and we define two (10×10) matrices of intermediate and final demands as z and f, respectively. In addition, we define a (10×1) vector of exports to the ROW as L. Given these definitions, the system represented by the AIO Table described in Figure 1 can be expressed by the following equation:

$$X = z\iota + f\iota + L$$

$$\Leftrightarrow \begin{bmatrix} X^I \\ X^M \\ \vdots \\ X^U \end{bmatrix} = \begin{bmatrix} z^{II} & z^{IM} & \cdots & z^{IU} \\ z^{MI} & z^{MM} & \cdots & z^{MU} \\ \vdots & \vdots & \cdots & \vdots \\ z^{UI} & z^{UM} & \cdots & z^{UU} \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{bmatrix} + \begin{bmatrix} f^{II} & f^{IM} & \cdots & f^{IU} \\ f^{MI} & f^{MM} & \cdots & f^{MU} \\ \vdots & \vdots & \cdots & \vdots \\ f^{UI} & f^{UM} & \cdots & f^{UU} \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{bmatrix} + \begin{bmatrix} L^I \\ L^M \\ \vdots \\ L^U \end{bmatrix}, \quad \text{(3-1)}$$

where the upper-right subscript of each element in each matrix indicates a country's code.[9]

Let A be the following (10×10) matrix of intermediate inputs:

$$\underset{(10\times10)}{A} = \begin{bmatrix} \alpha^{II} & \alpha^{IM} & \cdots & \alpha^{IU} \\ \alpha^{MI} & \alpha^{MM} & \cdots & \alpha^{MU} \\ \vdots & \vdots & \cdots & \vdots \\ \alpha^{UI} & \alpha^{UM} & \cdots & \alpha^{UU} \end{bmatrix},$$

where input coefficient α^{ij} is defined as $\alpha^{ij} \equiv \dfrac{z^{ij}}{X^j}$ for $i, j = I, M, P, \cdots, U$.

We rewrite the final-demand term $f\iota$ in (3-1) as the product of a (10×10) matrix B and a (10×1) vector S, which are defined as:

$$\underset{(10\times10)}{B} = \begin{bmatrix} \beta^{II} & \beta^{IM} & \cdots & \beta^{IU} \\ \beta^{MI} & \beta^{MM} & \cdots & \beta^{MU} \\ \vdots & \vdots & \cdots & \vdots \\ \beta^{UI} & \beta^{UM} & \cdots & \beta^{UU} \end{bmatrix} \text{ and } \underset{(10\times1)}{S} = \begin{bmatrix} S^I \\ S^M \\ \vdots \\ S^U \end{bmatrix},$$

[9] The country subscripts are as follows: *I*, Indonesia; *M*, Malaysia; *P*, the Philippines; *S*, Singapore; *T*, Thailand; *C*, China; *N*, Taiwan; *K*, South Korea; *J*, Japan; *U*, the US.

where $\beta^{ij} \equiv \frac{f^{ij}}{S^j}$ and $S^j \equiv \sum_{i=I}^{U} f^{ij}$ for $i, j = I, M, P, \cdots, U$.

When the (10×10) matrix Π is defined as $\Pi \equiv [I - A]^{-1} B$, (3-1) can be expressed as:

$$X = \Pi S + [I - A]^{-1} L, \tag{3-2}$$

where $\underset{(10\times10)}{\Pi} = \begin{bmatrix} \pi^{II} & \pi^{IM} & \cdots & \pi^{IU} \\ \pi^{MI} & \pi^{MM} & \cdots & \pi^{MU} \\ \vdots & \vdots & \cdots & \vdots \\ \pi^{UI} & \pi^{UM} & \cdots & \pi^{UU} \end{bmatrix}$.

Each π^{ij}, which is an element of the matrix Π, is a production inducement coefficient, which represents the increase in country *i*'s production induced by a unit increase in the final demand of country j. In addition, the sum of each column, $\sum_{i=I}^{U} \pi^{ij}$, represents the total increase in the production of the 10 Asia–Pacific countries that is induced by a unit increase in the final demand of country j.

3.2. *Deepening Interdependence in terms of the Global Production Network*

Figure 3 shows the production inducement coefficients in chronological order for 1990, 1995, 2000, and 2005 implied by a unit increase in final demand that arises in each Asia–Pacific country. While the coefficients for 1990, 1995, and 2000 are calculated from the published AIO Table, those for 2005 are obtained from the estimated AIO Table for 2005 described in Section 2.

Figure 3(1) indicates that both the magnitudes of the production inducement coefficients and the relative production inducements to home and foreign countries differ between countries. For example, when final demand increases by one unit in the NIEs3 or ASEAN4 countries, production is induced to both home and foreign countries. This suggests that the economic structure of these countries depends, to some extent, on their overseas economies. By contrast, when final demand increases by one unit in Japan or the US, production is mainly induced to the home countries. This is because both the Japanese and the US economies have self-contained industrial structures. In addition, the figure also shows that the production inducement coefficients of China, which have increased from 2.2 to 2.5 over the last 15 years, generally exceed those of the other countries. This may be because of the unique industrial structure of China, where industry is dominated by a large secondary sector,[10] with assembly, processing, and other

[10] According to the *World Economic Indicators* of the World Bank, the share of the secondary sector in all industry in China was 51 percent in 2003, which is much higher than those of low- and middle-income

labor-intensive stages of global production chains having been highly developed.

According to Figure 3(1), the production inducement coefficients of many East Asian countries have increased recently, because of the rises in production inducement coefficients to both home and foreign countries. In this context, Figure 3(2) breaks down production inducements to foreign countries into countries and regions. It is clear that the recent increases are mainly led by those in production inducements to East Asian countries, particularly China.

Regarding the production inducement coefficients to foreign countries, for each country, Table 2 shows successive five-year changes in the relative shares of countries to which production is induced following a unit increase in final demand. According to Table 2(1), for the period 1995–2000, while relative production induced to the US and Japan declined, production induced to East Asian countries, including China, showed relative increases during the period. The pattern is the same for 2000–2005: Table 2(2) shows that while relative production induced to the US and Japan continued to fall, production induced to China rose substantially. Among the NIEs3 and ASEAN4 countries, production inducements to Singapore, South Korea, and Thailand increased during the period, whereas production inducements to Indonesia, Malaysia, and the Philippines declined slightly.

In summary, the Asia–Pacific economies became more interdependent in terms of the global production network from 2000 onwards, despite the 2001–2002 global slowdown. In particular, production induced to China increased, which suggests that China's role in the world production base in the activities of processing and assembly has become more important. To a lesser extent, production induced to the NIEs3 and ASEAN4 countries increased during the period, although inducements varied between countries.

3.3. *Increasing Presence of China as a Major Production Center in the Asia–Pacific Region*

Below, we offer some explanation for the recent increase in China's presence as a major production center in Asia–Pacific region.

First, as shown in Table 3, China has consistently succeeded in attracting inflows of foreign direct investment (FDI) since the early 1990s; as a result, Chinese companies have been integrated into the global supply chain, and a significant portion of the final assembly of Asian-made products, which used to be assembled and finished in other Asian countries, now occurs in China. This development has been supported by the

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countries on average, which were 27 and 36 percent, respectively.

Chinese government's policy shift to reform and liberalization.[11] Furthermore, China's large domestic market and its accession to the World Trade Organization in 2001 led foreign companies to further advance and conduct their business in China. In contrast, the inflows of FDI to countries such as Indonesia, Malaysia, and the Philippines peaked in the latter half of the 1990s. This appears to be associated not only with the greater prominence of China as a relatively more attractive FDI destination but also with their lack of conditions that attract foreign investors. These conditions include relatively slower economic growth rates, especially following the 1997–1998 Asian financial crises, wage increases, insufficient social infrastructure, undeveloped domestic legislation, and political and social instability.[12]

Second, China's products have become more competitive. This could be the effect of the active FDI inflows to China, which include transfers of technology from developed countries and capital accumulation. This has probably strengthened China's production capacity and its international competitiveness recently. Because China has recently moved up the value chain, particularly in the electronics sector, patterns of production in other Asian countries have also probably shifted to enable China to dominate low-tech and mid-tech industries in the region.[13]

In this context, consider the global export shares of East Asian countries. There is prima facie evidence in Table 4(1) that the exports of East Asian countries to the ROW have increased since 1995. The export shares of East Asian countries rose from 15 percent in 1995 to 22 percent in 2005, and these rises occurred in almost all industrial sectors; they are particularly apparent in, for example, the electrical machinery industry (e.g., office appliances, automated data processing machines, telecommunications equipment, and electrical parts and products) and light manufacturing industry (e.g., clothing and footwear, furniture and parts, and miscellaneous manufactured products). By association, Table 4(2) compares the relative export shares of China and the NIEs3 and ASEAN4 countries to their total exports in 1995, 2000, and 2005. The relative share of China's exports has been rising since 1995, and particularly in 2000–2005. This was a

[11] This policy includes, for instance, preferential treatment of foreign capital, allowing local governments and exporting enterprises to retain a proportion of foreign exchange receipts, eliminating mandatory export and import planning, and opening domestic markets to the outside world.

[12] See Urata (2006) for a detailed discussion of the relationship between the greater prominence of China, ASEAN trade, and FDI. China's success in attracting FDI has raised concerns, especially for other East Asian counties. For instance, Eichengreen and Tong (2007) and Mercereau (2005) investigate the impacts of China's FDI on other East Asian countries. They report that China's rapid growth and its increasing role as a destination for FDI have not occurred at the expense of other East Asian countries; rather, these developments have encouraged FDI inflows to those countries, because producers in the region belong to a common supply chain.

[13] Regarding China's recent export performance, there is also discussion of the perceived artificially low renminbi exchange rate and the existence of underemployed rural Chinese who are to be integrated into the modern manufacturing sector.

feature of almost all industrial sectors, particularly in the electrical machinery and light manufacturing industries. With competition in export products defined as "shifts in market shares" in the world market, the recent increase in China's export share suggests that its products have become more competitive.[14]

4. DEGREES OF INCOME DEPENDENCE

In this section, we consider interdependences among Asia–Pacific economies in terms of their degrees of income dependence. The degree to which the income of the home country depends on other countries is measured as the ratio of the value-added inducement of the home country caused by an increase in the final demands of other countries to its total value-added inducement. This shows the extent to which each country's income depends on the final demands of other countries. In Section 4.1, we explain how to use the AIO Table to measure the degrees of income dependence of the 10 Asia–Pacific countries. In Section 4.2, we discuss the estimation results.

4.1. *Measuring the Degree of Income Dependence*

In general, the income of a country is induced through two channels: one operates through final demand in the home country, with products being produced and supplied domestically; the other operates through final demand from foreign countries, with domestically produced products being exported from the home country to foreign countries. In this context, we attempt to quantify the degree of income dependence, which indicates the extent to which each country's income depends on the final demands of other countries.

In the Asia–Pacific region, whereas the US and Japanese economies have large domestic demands, the East Asian economies tend to depend on demand from outside the region. However, the East Asian economies have recorded high growth rates since the 1990s, except during the Asian financial crises of 1997–1998 and during the global economic slowdown of 2001–2002, and have also experienced rapid growth in domestic demand. Hence, the autonomy of East Asian economies may have recently increased. Measuring the recent degrees of income dependence of these economies is important for evaluating their autonomy: the greater the extent to which the incomes of East Asian countries depend on their own final demands (i.e., the less dependent are East Asian

[14] In this respect, Ahearne *et al.* (2003, 2006) examine the export shares of Asian economies to the US market at both aggregate and sectoral levels. They report that there is little evidence that increases in China's exports reduce exports of other Asian economies; however, China is displacing other Asian economies in particular products. Eichengreen *et al.* (2004) argue that there is a tendency for China's exports to third markets to crowd out the exports of other Asian countries, although this effect is observed only in markets for consumers goods.

economies on demand from outside the region), the more autonomous are those economies.

We now explain how to measure the degrees of income dependence of the 10 Asia–Pacific countries. We define the (10×1) vector F of the 10 countries as:

$$F = \begin{bmatrix} F^{I} \\ F^{M} \\ \vdots \\ F^{U} \end{bmatrix} = \begin{bmatrix} f^{II} + f^{IM} \cdots + f^{IU} + L^{I} \\ f^{MI} + f^{MM} \cdots + f^{MU} + L^{M} \\ \vdots \quad \vdots \quad \cdots \quad \vdots \\ f^{UI} + f^{UM} \cdots + f^{UU} + L^{U} \end{bmatrix}.$$

Equation (3-2) can be modified by replacing F with the term $f\iota + L$ in (3-1):

$$X = [I - A]^{-1} F \ , \tag{4-1}$$

where $\underset{(10\times10)}{[I - A]^{-1}} = \begin{bmatrix} \Gamma^{II} & \Gamma^{IM} & \cdots & \Gamma^{IU} \\ \Gamma^{MI} & \Gamma^{MM} & \cdots & \Gamma^{MU} \\ \vdots & \vdots & \cdots & \vdots \\ \Gamma^{UI} & \Gamma^{UM} & \cdots & \Gamma^{UU} \end{bmatrix}$ is the "Leontief inverse matrix."

Multiplying both sides of (4-1) by a (10×10) diagonal matrix V, which is made up of diagonal elements of value-added ratios, i.e., the ratios of value added to total output, of the 10 Asia–Pacific countries, yields:

$$VX = V[I - A]^{-1} F \ ,$$

$$\Leftrightarrow \begin{bmatrix} Y^{I} \\ Y^{M} \\ \vdots \\ Y^{U} \end{bmatrix} = \begin{bmatrix} v^{I} \ X^{I} \\ v^{M} \ X^{M} \\ \vdots \\ v^{U} \ X^{U} \end{bmatrix} = \begin{bmatrix} v^{I} \ \sum_{j=I}^{U} \Gamma^{Ij} \ F^{j} \\ v^{M} \ \sum_{j=I}^{U} \Gamma^{Mj} F^{j} \\ \vdots \\ v^{U} \ \sum_{j=I}^{U} \Gamma^{Uj} F^{j} \end{bmatrix}, \tag{4-2}$$

where v^{i} is country i's value-added ratio; Y^{i} represents the value-added inducement of country i (i.e., country i's income) caused by an increase in its own final demand and the final demands of other countries.

In (4-2), for example, China's income, Y^{C}, can be written as follows:

$$Y^{C} = v^{C} \sum_{j=I}^{U} \Gamma^{Cj} F^{j}$$

$$\vdots$$

$$= v^C [\sum_{j=I}^{U} \Gamma^{Cj} f^{jI} + \sum_{j=I}^{U} \Gamma^{Cj} f^{jM} + \cdots + \sum_{j=I}^{U} \Gamma^{Cj} f^{jU} + \sum_{j=I}^{U} \Gamma^{Cj} L^j].$$

The degree of China's income dependence on country i (i.e., Y_i^C) is thus calculated as the ratio of China's value-added inducement caused by an increase in country i's final demand to its total value-added inducement; i.e.:

$$Y_i^C = \frac{\sum_{j=I}^{U} \Gamma^{Cj} f^{ji}}{\sum_{j=I}^{U} \Gamma^{Cj} F^j} \text{ for } i = \{I, M, \cdots, U\}.$$

Similarly, the degree of China's income dependence on the ROW (Y_R^C) is:

$$Y_R^C = \frac{\sum_{j=I}^{U} \Gamma^{Cj} L^j}{\sum_{j=I}^{U} \Gamma^{Cj} F^j}.$$

In this way, we measure the respective degrees of income dependence of the 10 Asia–Pacific countries.

4.2. *Have the Degrees of Income Dependence of the Asia–Pacific Economies Changed Recently?*

Figure 4 illustrates the degrees of income dependence of the Asia–Pacific countries in 1990, 1995, 2000, and 2005.

First, Figure 4(1) shows that the degrees of income dependence of the NIEs3 and ASEAN4 countries on the out-of-region demands, i.e., the sum of the US, Japan, and the ROW's final demands, were fairly stable during 1990–1995; they then increased modestly from 1995–2000 and remained fairly constant in 2000–2005.[15] In other words, in recent years, the incomes of these countries have become more dependent on foreign final demand, including demand from the US. Figure 4(2) shows that the degree of China's income dependence on out-of-region demand has increased since the 1990s; in particular, its income has become more dependent on US final demand. Hence, it is unclear whether East Asian economies have become more autonomous. Rather, we conclude, a fortiori, that the structure of East Asian countries remains dependent on economic developments outside the region.

Second, in the context of Figures 4(5) and 4(6), which illustrate the income

[15] The degrees of income dependence of the NIEs3 and ASEAN4 countries on their domestic demand were 72.9, 71.8, 64.1, and 66.9 percent in 1990, 1995, 2000, and 2005, respectively. The large declines in their degrees of income dependence on domestic demand in 1995–2000 partly reflect the effects of exchange rate changes; i.e., the NIEs3 and ASEAN4 countries experienced currency depreciations following the 1997–1998 Asian financial crises, and the values of their incomes declined in US dollar terms.

dependence of the NIEs3 and ASEAN4 countries, we emphasize the increasing importance of China as a consumer market, particularly for the NIEs3 countries.[16] Their degrees of income dependence on China have increased notably since 2000; i.e., whereas their degrees of income dependence on China were less than 1 percent in 1990, they have significantly increased over the last 15 years to reach, by 2005, 5.5 percent, 6.3 percent, and 3.6 percent for Singapore, Taiwan, and South Korea, respectively. For these countries, their dependence on China is second only to their dependence on the US and is similar to their dependence on Japan. This evidence indicates that China has recently become more important as a final export destination for its trading partners, and suggests that China will become one of the world main consumer's markets in the future.

Third, Figures 4(3) and 4(4) show that the income dependence of both Japan and the US differ from those of East Asian countries in the sense that the former have traditionally depended on domestic demand. For example, in 2005, the degree of Japan's income dependence on its domestic demand was over 85 percent; its dependence on foreign demand was divided as follows: 3.8 percent on the US, 2.3 percent on the NIEs3 and ASEAN4 countries, 1.1 percent on China, and 6.0 percent on the ROW. In 2005, the US's degree of income dependence on its domestic demand was almost 90 percent, and its dependence on domestic demand has been similar to, or has exceeded, that of Japan in recent years. However, US income depends more on demand from the ROW than from the Asia–Pacific; income dependence on Japan, China, the NIEs3, and the ASEAN4 countries in 2005 was less than 1 percent, compared to 7.7 for the ROW. In this respect, Japan differs because its foreign demand comes mainly from Asia–Pacific countries.

5. CONCLUDING REMARKS

In this paper, we have investigated interdependence among Asia–Pacific economies by using the "Asian International Input–Output Table." Although the most recently available AIO Table is based on 2000 data, we estimated an AIO Table for 2005 by applying the "Trade-RAS" method. This enabled us to analyze the recent state of interdependence among Asia–Pacific economies.

Our analysis indicates that the production inducement coefficients of many Asia–Pacific countries have increased recently. In particular, production inducement to East Asian countries, and especially China, increased. Thus, interdependence among Asia–Pacific economies in terms of the global production network strengthened from 2000 onwards. In particular, the degree of production induced to China has increased in recent years. This suggests that China has played a more important as a primary production

[16] Figure 4(1) also shows that the income dependence of the NIEs3 and ASEAN4 countries on China's final demand increased, particularly after 2000.

center in the Asia–Pacific region.

We also examined degrees of income dependence among 10 Asia–Pacific countries. Our estimates show that while the incomes of Japan and the US depend largely on domestic demand, those of East Asian economies are dependent on final demand from outside the region, i.e., on demand from the US, Japan, and the rest of the world. In addition, because the degrees of income dependence of the East Asian economies on out-of-region demand have remained fairly stable or have increased slightly since the 1990s, it is difficult to judge whether East Asian economies have become more autonomous. Currently, their economic structures still tend to be affected by the economic developments outside the region.

Our analysis represents a first step in verifying deepening interdependence among Asia–Pacific economies since 2000 in line with ongoing economic globalization. This is probably closely related to recent changes in intraregional patterns of trade and industrial structure, and to the liberalization of international capital flows, which have not been sufficiently dealt with in this paper.[17] Detailed analysis of these aspects may improve our understanding of recent developments in, and interdependence among, Asia–Pacific economies; we leave these issues for future research.

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[17] In one of the recent studies, Haltmaier *et al.* (2007) examine recent increasing effects of China on other Asian countries from both a micro and a macro perspective. Their results are: (1) external demand remains an important source of economic growth for the region; (2) the macro and micro evidences suggest that China has become a more independent source of demand in recent years, although it is still more of a conduit, importing intermediate products from other Asian countries, and assembling them in final products. Both results are nearly consistent with our findings in this paper.

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Appendix: Outline of "Trade-RAS" Method: A Case for Two Countries

Input-Output table for two countries at period *t*

	Intermediate Demand		Total Intermediate Demands	Final Demand		Total Outputs
	Country A	Country B		Country A	Country B	
Country A	$W_{11}(t)$	$W_{12}(t)$	$M_1(t)$	$F_1^A(t)$	$F_1^B(t)$	$X_1(t)$
Country B	$W_{21}(t)$	$W_{22}(t)$	$M_2(t)$	$F_2^A(t)$	$F_2^B(t)$	$X_2(t)$
Input for Intermediate Demands	$Z_1(t)$	$Z_2(t)$				
Total Inputs	$X_1(t)$	$X_2(t)$				

Bilateral Trade extracted from IO table at period *t*

	Country A	Country B	Final Goods	Total	
Country A	0	$W_{12}(t)$	$F_1^B(t)$	$W_{12}(t)+F_1^B(t)$	← Total Exports of Country A
Country B	$W_{21}(t)$	0	$F_2^A(t)$	$W_{21}(t)+F_2^A(t)$	← Total Exports of Country B
Final Goods	$F_2^A(t)$	$F_1^B(t)$	0	$F_2^A(t)+F_1^B(t)$	← Final Goods Exports of Both Countries
Total	$W_{21}(t)+F_2^A(t)$	$W_{12}(t)+F_1^B(t)$	$F_2^A(t)+F_1^B(t)$		
	↑ Total Imports of Country A	↑ Total Imports of Country B	↑ Final Goods Imports of Both countries		

Bilateral Trade at period *t+1* estimated by applying RAS-method

Estimated by applying RAS-method

	Intermediate Goods		Final Goods	Total	
	Country A	Country B			
Country A	0	$\hat{W}_{12}(t+1)$	$\hat{F}_1^B(t+1)$	$W_{12}(t+1)+F_1^B(t+1)$	Actual Exports of Each Country at period *t+1*
Country B	$\hat{W}_{21}(t+1)$	0	$\hat{F}_2^A(t+1)$	$W_{21}(t+1)+F_2^A(t+1)$	
Final Goods	$\hat{F}_2^A(t+1)$	$\hat{F}_1^B(t+1)$	0	$F_2^A(t+1)+F_1^B(t+1)$	
Total	$W_{21}(t+1)+F_2^A(t+1)$	$W_{12}(t+1)+F_1^B(t+1)$	$F_2^A(t+1)+F_1^B(t+1)$		

Actual Imports of Each Country at period *t+1*

Estimated Final Goods Exports (or Imports) of Both Countries at period *t+1* *

$$*F_2^A(t+1)+F_1^B(t+1)=(W_{12}(t+1)+F_1^B(t+1)+W_{21}(t+1)+F_2^A(t+1))\times\frac{(F_2^A(t)+F_1^B(t))}{(W_{12}(t)+F_1^B(t)+W_{21}(t)+F_2^A(t))}$$

Estimated Input-Output table for two countries at period *t+1*

	Intermediate Demand		Total Intermediate Demands
	Country A	Country B	
Country A	$\hat{W}_{11}(t+1)$	$\hat{W}_{12}(t+1)$	$\hat{M}_1(t+1)$
Country B	$\hat{W}_{21}(t+1)$	$\hat{W}_{22}(t+1)$	$\hat{M}_2(t+1)$
Input for Intermediate Demands	$Z_1(t+1)$	$Z_2(t+1)$	

$$\hat{W}_{11}(t+1)=Z_1(t+1)-\hat{W}_{21}(t+1)$$
$$\hat{W}_{22}(t+1)=Z_2(t+1)-\hat{W}_{12}(t+1)$$
$$\hat{M}_1(t+1)=\hat{W}_{11}(t+1)+\hat{W}_{12}(t+1)$$
$$\hat{M}_2(t+1)=\hat{W}_{21}(t+1)+\hat{W}_{22}(t+1)$$

Actual Inputs for Intermediate Demand at period *t+1*

Table 1 : Total Outputs of Asia-Pacific Countries

(1) Annual Growth Rates of the Total Outputs

(%, period average)

	90-95	95-00	00-05
Indonesia	17.0	-6.2	10.7
Malaysia	17.1	3.3	9.2
the Philippines	10.6	1.5	7.7
Singapore	18.4	2.6	5.3
Thailand	14.7	-3.3	8.2
China	16.3	10.7	19.3
Taiwan	9.3	3.1	3.5
Korea	12.9	2.5	9.7
Japan	10.6	-2.3	-0.8
US	6.3	5.9	4.7

(2) International Comparison of the Total Outputs

＜Japan=1＞

	1990	1995	2000	2005
Indonesia	0.03	0.05	0.04	0.06
Malaysia	0.02	0.02	0.03	0.05
the Philippines	0.01	0.01	0.02	0.03
Singapore	0.02	0.02	0.03	0.04
Thailand	0.03	0.04	0.03	0.05
China	0.15	0.19	0.36	0.90
Taiwan	0.06	0.06	0.08	0.09
Korea	0.10	0.11	0.14	0.23
Japan	1.00	1.00	1.00	1.00
US	1.68	1.38	2.07	2.71

(3) Intermediate Demand to Final Demand Ratios

	ID	MY	PH	SG	TH	CH	TW	KR	JP	US
1990	0.8	1.2	0.9	1.7	1.0	1.5	1.4	1.3	1.0	0.8
1995	0.8	1.3	0.9	2.0	1.0	1.6	1.2	1.1	0.9	0.9
2000	1.0	2.0	1.1	2.3	1.4	1.8	1.2	1.3	0.9	0.8
2005	0.9	2.3	1.2	3.0	1.3	2.5	1.4	1.3	0.9	0.8

Table 2 : Changes in the Relative Shares of Production Inducement

(1) 1995-2000

	ID	MY	PH	SG	TH	CH	TW	KR	JP	US
ID		2.2	▲ 1.1	▲ 0.5	1.9	0.3	0.1	1.5	▲ 0.3	▲ 0.2
MY	2.8		0.8	6.2	1.2	0.7	0.5	1.3	1.1	▲ 0.7
PH	0.3	1.2		▲ 0.3	0.5	0.6	0.8	0.6	0.6	0.3
SG	▲ 2.2	1.6	4.4		0.7	0.1	0.6	1.1	▲ 0.7	▲ 1.8
TH	2.3	2.2	1.4	▲ 1.7		0.5	0.3	0.7	0.0	▲ 0.2
CH	6.4	4.7	▲ 0.2	4.0	6.6		2.9	4.8	6.6	12.9
TW	▲ 0.8	1.0	▲ 3.2	▲ 0.8	0.0	9.7		1.7	0.9	0.1
KR	1.3	▲ 0.0	3.4	▲ 2.1	0.3	4.7	2.6		0.1	1.0
JP	▲ 7.7	▲ 7.7	▲ 2.3	▲ 4.1	▲ 9.4	▲ 11.5	▲ 6.6	▲ 7.3		▲ 11.4
US	▲ 2.4	▲ 5.1	▲ 3.3	▲ 0.7	▲ 1.9	▲ 5.1	▲ 1.2	▲ 4.4	▲ 8.3	

(2) 2000-2005

	ID	MY	PH	SG	TH	CH	TW	KR	JP	US
ID		▲ 0.3	▲ 0.1	▲ 0.4	▲ 0.1	0.5	▲ 0.1	▲ 0.2	▲ 0.7	▲ 0.4
MY	▲ 0.8		▲ 0.7	▲ 2.6	▲ 1.1	▲ 0.3	▲ 0.7	▲ 0.9	▲ 1.6	▲ 1.2
PH	▲ 0.2	▲ 0.5		▲ 0.1	▲ 0.3	▲ 0.1	▲ 0.4	▲ 0.3	▲ 0.7	▲ 0.7
SG	1.3	2.1	1.9		1.5	1.7	0.9	0.6	0.1	0.4
TH	0.4	0.5	0.6	0.6		0.7	0.3	0.2	▲ 0.1	0.1
CH	8.0	6.0	4.4	7.6	8.5		6.1	10.1	12.0	12.6
TW	▲ 1.3	▲ 1.9	▲ 1.7	▲ 0.8	▲ 1.6	▲ 2.8		▲ 1.1	▲ 2.3	▲ 2.6
KR	1.2	0.1	0.3	0.4	0.3	2.7	0.3		▲ 0.7	▲ 0.5
JP	▲ 7.3	▲ 4.2	▲ 3.4	▲ 3.4	▲ 5.5	▲ 1.8	▲ 4.6	▲ 5.3		▲ 7.8
US	▲ 1.3	▲ 1.9	▲ 1.3	▲ 1.4	▲ 1.6	▲ 0.5	▲ 1.9	▲ 3.2	▲ 6.0	

Note.

The tables show successive five-year changes in the relative share of countries to which production is induced following a unit increase in final demand of one country.

For example, in the case of a unit increase in the final demand of Japan, the share of production induced to China to total production inducement increased by 12 percentage points from 2000 to 2005.

Shadow parts denote the shares increased during the respective periods.

Table 3 : Foreign Direct Investments toward East Asian Countries

（US billion dollars, period average）

	90-95	95-00	00-05
TOTAL	**37.0**	**71.5**	**80.8**
China	**19.4**	**40.2**	**52.2**
NIEs3	**8.4**	**20.0**	**21.9**
Korea	1.0	5.2	5.4
Taiwan	1.2	2.3	2.4
Singapore	6.2	12.5	14.1
ASEAN4	**9.2**	**11.3**	**6.7**
Thailand	2.0	4.2	2.7
Malaysia	4.2	4.0	3.1
Indonesia	2.1	1.4	-0.1
the Philippines	0.9	1.7	1.0

Sources.
IFS and CEIC.

Table 4 : Global Export Shares of East Asian Countries

(1) Global Export Shares of East Asian Countries

	1995		2000		2005	
	US, $ billions	% of the world	US, $ billions	% of the world	US, $ billions	% of the world
Total	719.2	15.4	1135.8	18.3	2083.4	22.1
Chemical products	78.9	18.9	59.6	10.2	126.2	12.3
Metals and non-ferrous metals	20.8	8.5	24.7	10.8	56.7	14.5
General industrial machines	33.9	7.2	50.7	8.9	105.2	12.7
Office appliances	80.6	32.9	164.8	43.4	275.0	57.9
Telecommunications equipment	56.9	33.4	88.8	30.7	230.5	51.6
Electrical parts and products	104.1	26.3	210.4	32.9	392.7	46.1
Transport equipment	16.9	3.5	32.5	5.1	66.0	7.1
Furniture and parts	8.3	20.8	17.4	28.3	36.7	37.3
Clothing and footwear	80.4	38.7	103.7	40.6	150.6	44.7
Precision machines	16.1	11.7	26.4	13.8	74.0	25.1
Miscellaneous manufactured products	51.5	27.7	76.8	32.4	120.7	35.5
Miscellaneous	170.9	10.3	279.9	13.3	449.1	13.2

(2) Relative Export Shares of China and NIEs/ASEAN

(%)

	1995		2000		2005	
	China	NIEs/ASEAN	China	NIEs/ASEAN	China	NIEs/ASEAN
Total	30.7	69.3	35.1	64.9	47.3	52.7
Chemical products	11.1	88.9	21.1	78.9	27.4	72.6
Metals and non-ferrous metals	33.4	66.6	28.6	71.4	43.8	56.2
General industrial machines	21.5	78.5	29.5	70.5	45.5	54.5
Office appliances	11.6	88.4	21.1	78.9	53.8	46.2
Telecommunication equipments	31.5	68.5	40.4	59.6	56.8	43.2
Electrical parts and products	13.8	86.2	19.5	80.5	30.8	69.2
Transport equipment	12.0	88.0	18.0	82.0	22.1	77.9
Furniture and parts	34.8	65.2	54.9	45.1	76.6	23.4
Clothing and footwear	65.5	34.5	72.1	27.9	83.8	16.2
Precision machines	43.3	56.7	52.4	47.6	43.3	56.7
Miscellaneous manufactured products	60.4	39.6	71.0	29.0	75.3	24.7
Miscellaneous	35.3	64.7	33.5	66.5	41.6	58.4

Source.
United Nations Statistics Division, PC-TAS.

Figure 1 : Outline of Asian International Input-Output Table

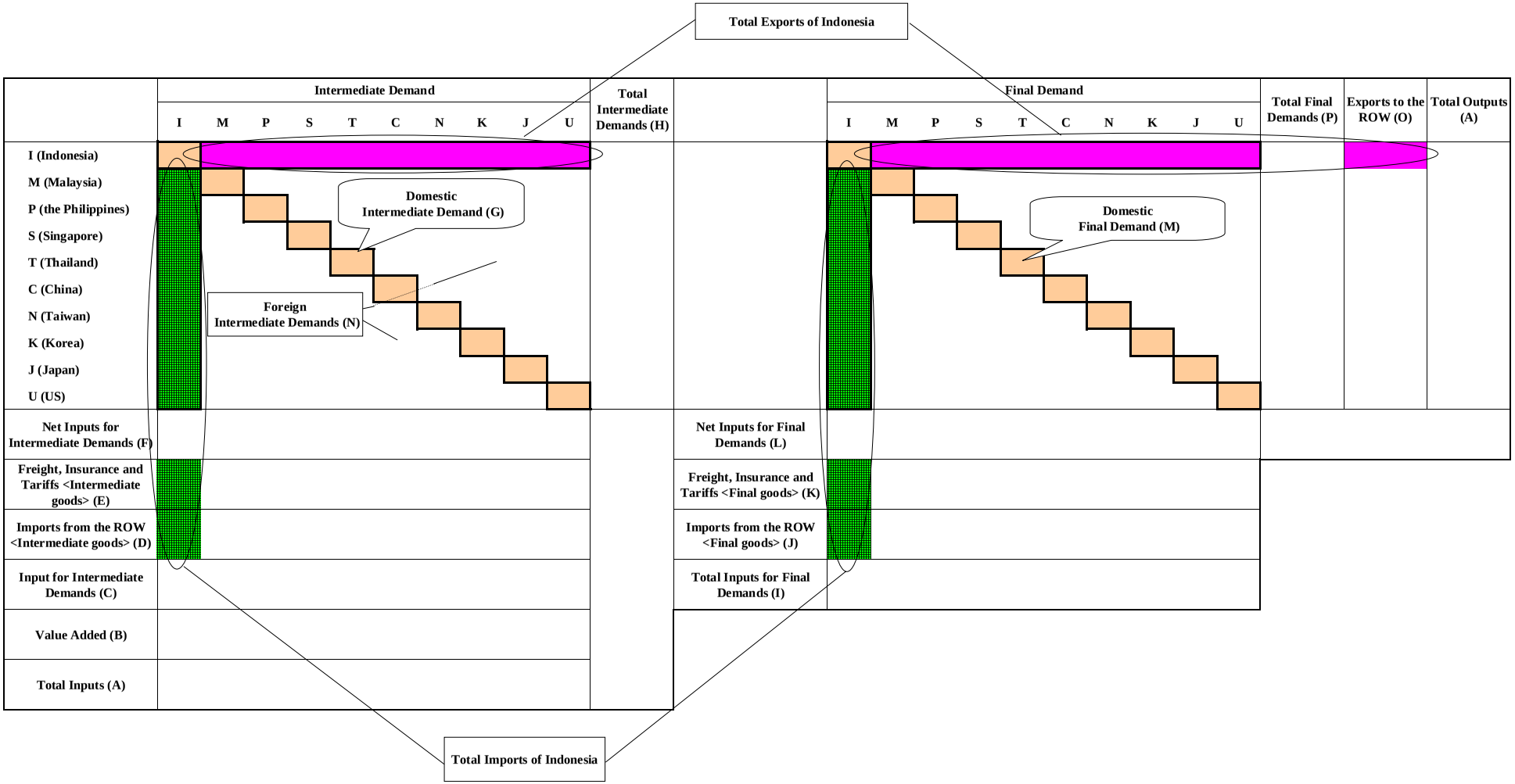
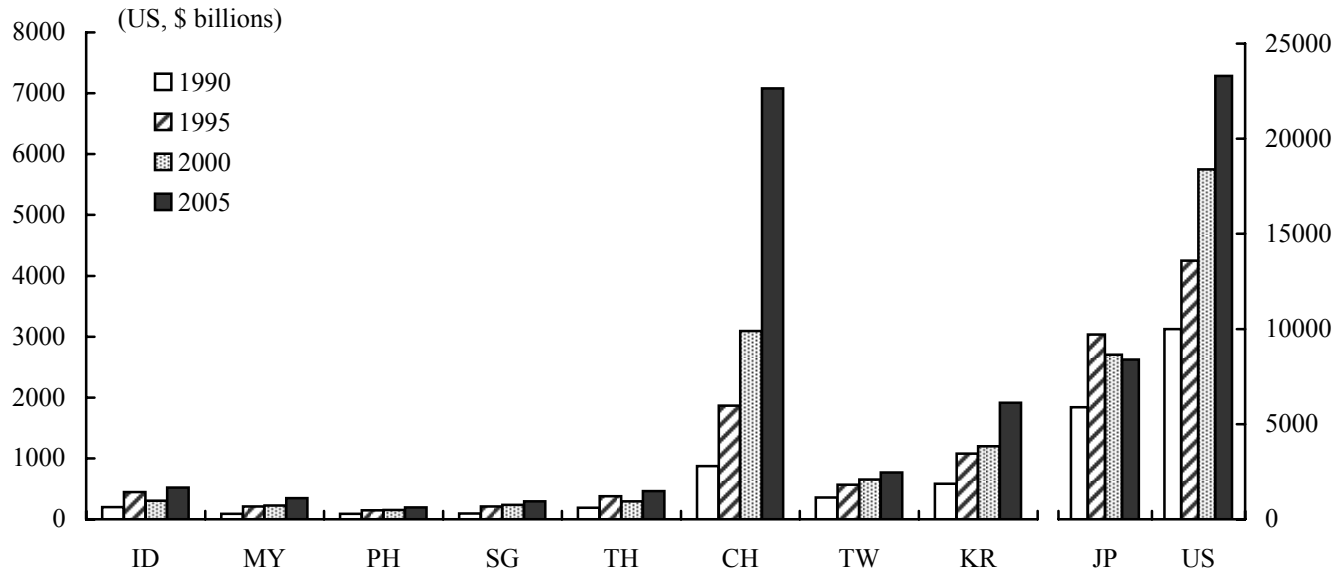
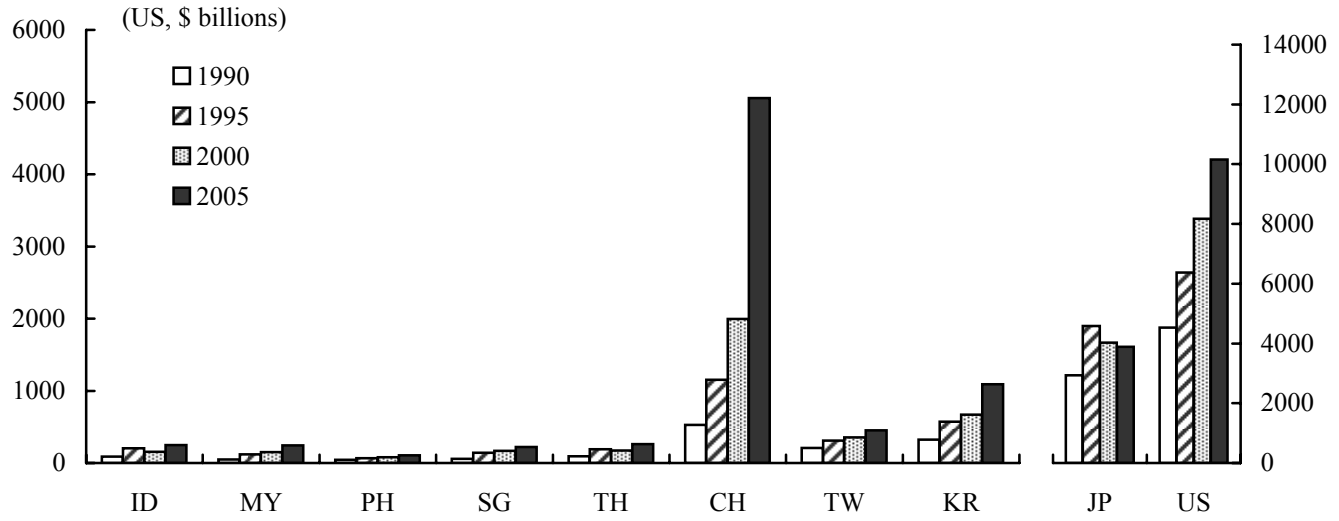


Figure 2 : Total Outputs, Intermediate and Final Demands of Asia-Pacific Countries

(1) Total Outputs



(2) Intermediate Demands



(3) Final Demands

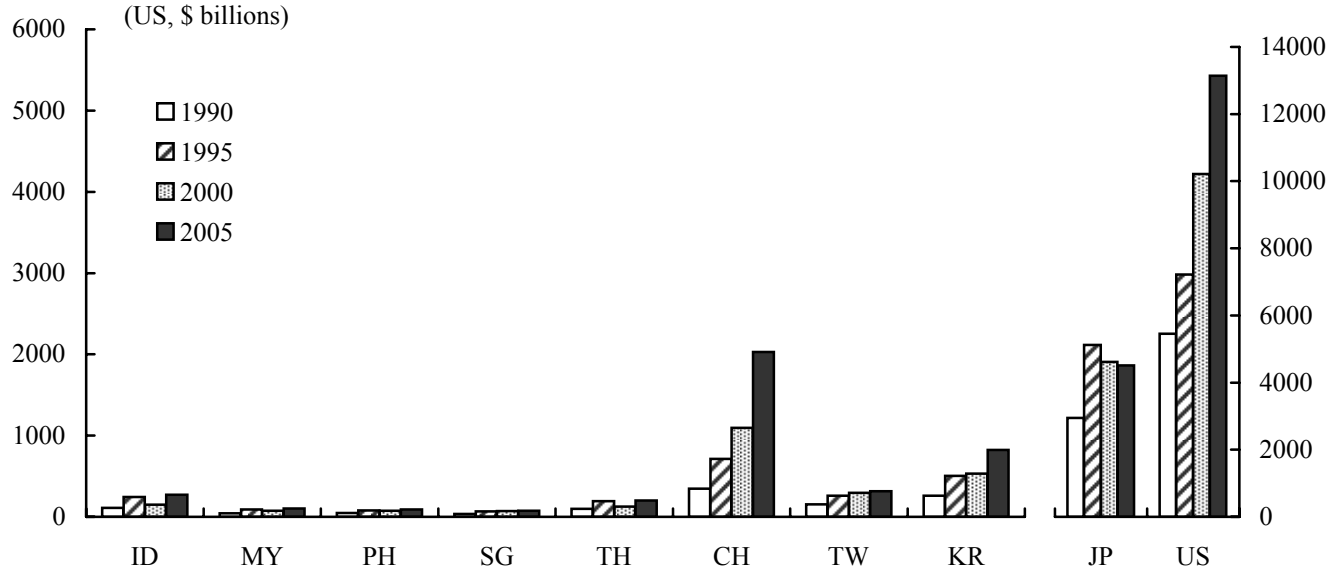
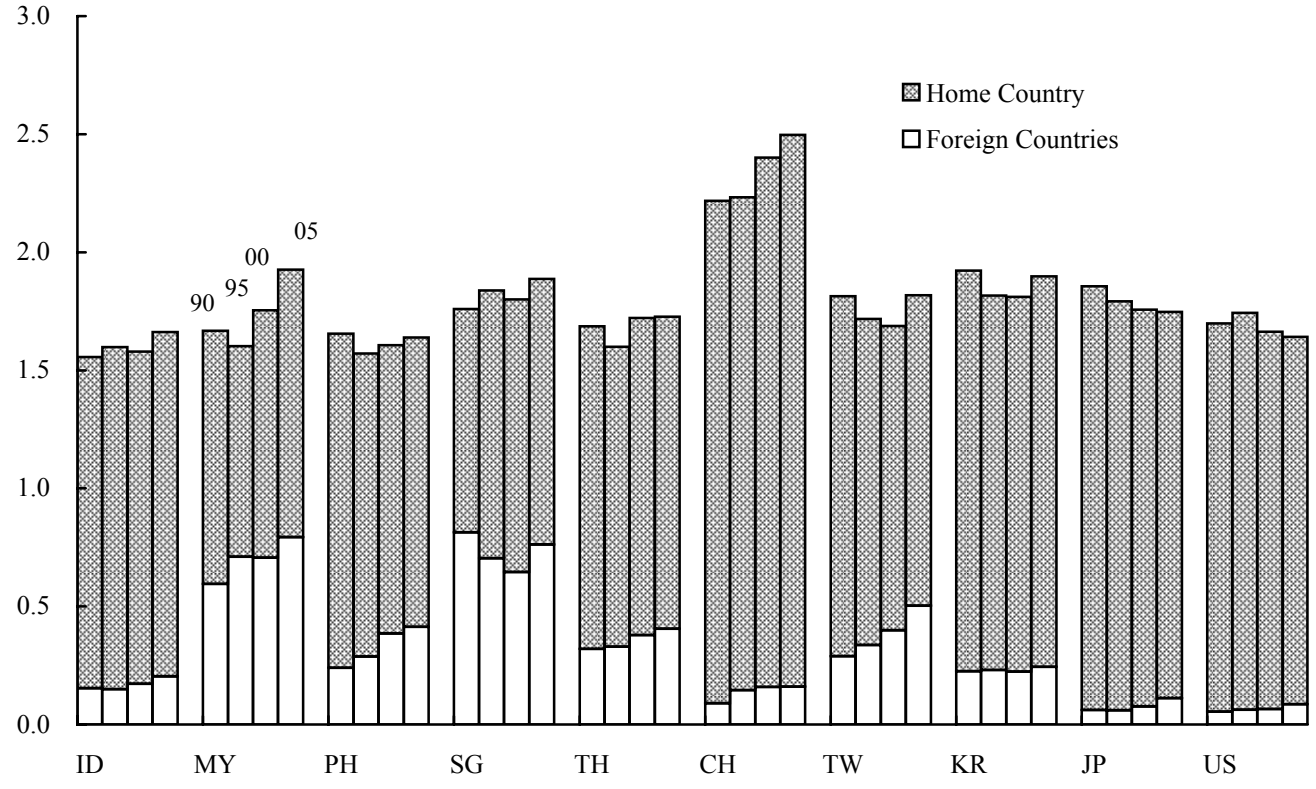
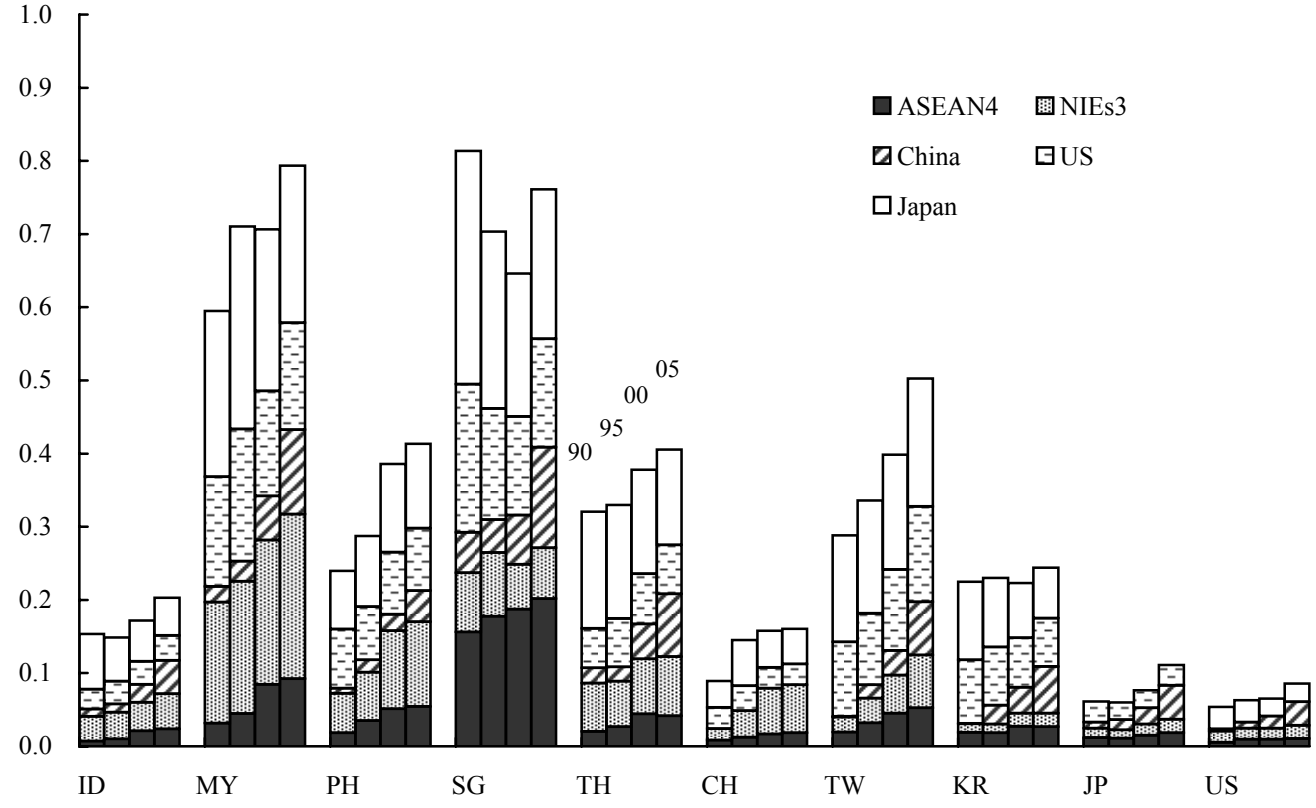


Figure 3 : Production Inducement Coefficients

(1) Production Inducement Coefficents to Home Country and Foreign Countries



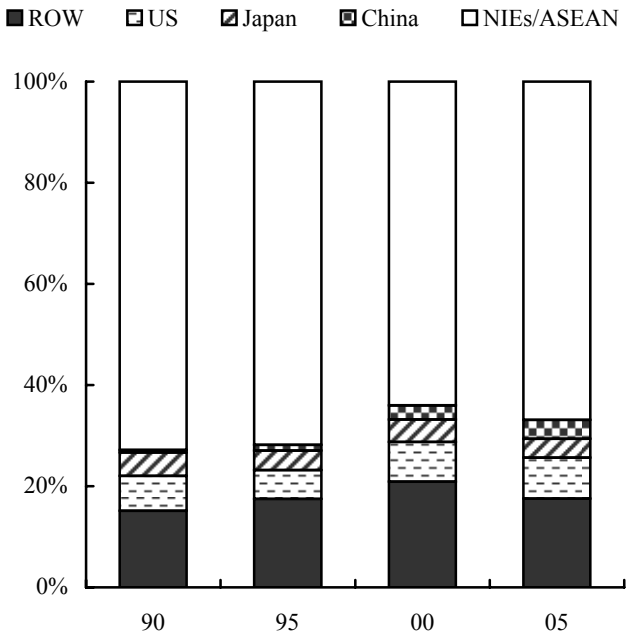
(2) Breakdowns of Production Inducement Coefficients to Foreign Countries



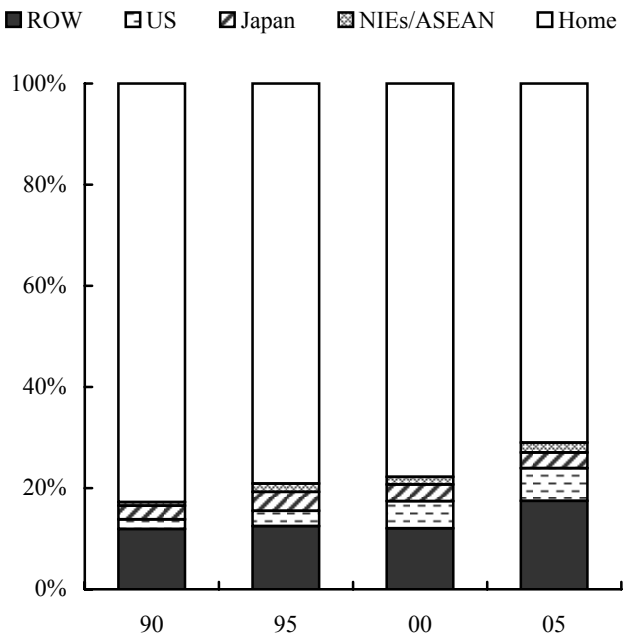
Note.
The coefficients to NIEs3 and ASEAN4 are calculated by excluding those to their home countries.

Figure 4 : Degrees of Income Dependence

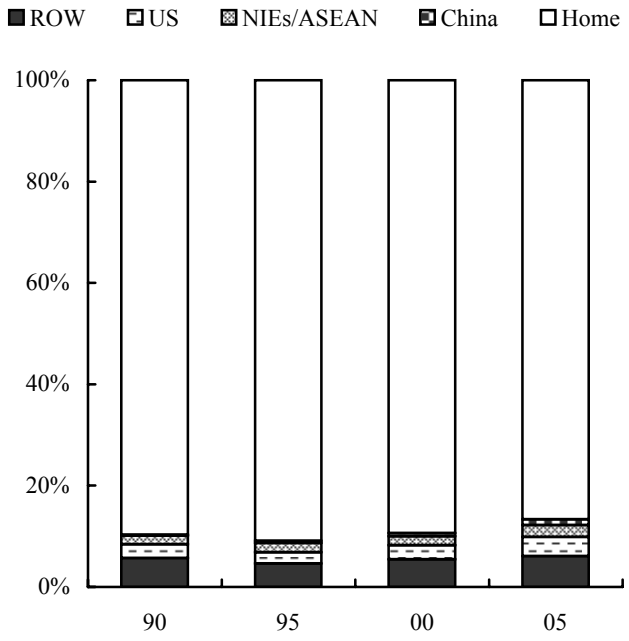
(1) NIEs3 and ASEAN4



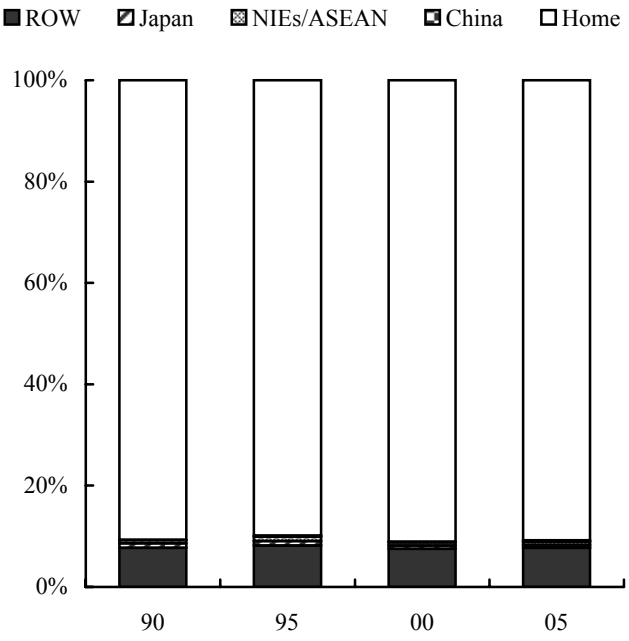
(2) China



(3) Japan



(4) US



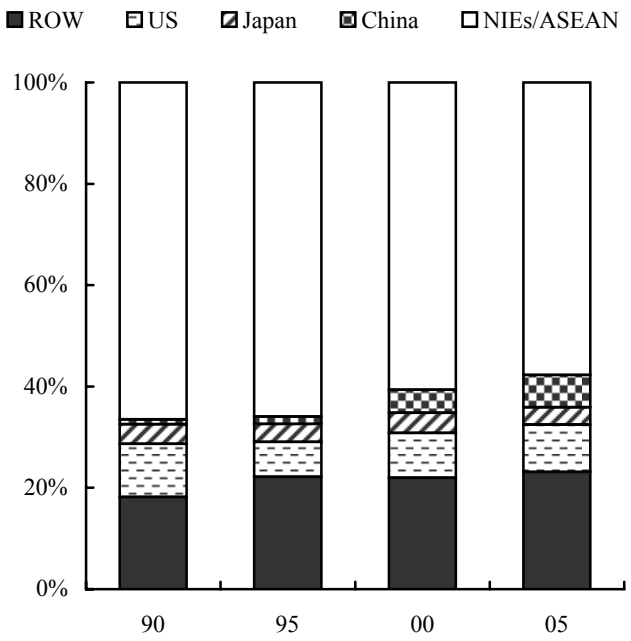
Note.

1. "ROW" denotes the rest of world.
2. "NIEs/ASEAN" of NIEs3 and ASEAN4 countries are calculated by including their income dependences on their home countries.

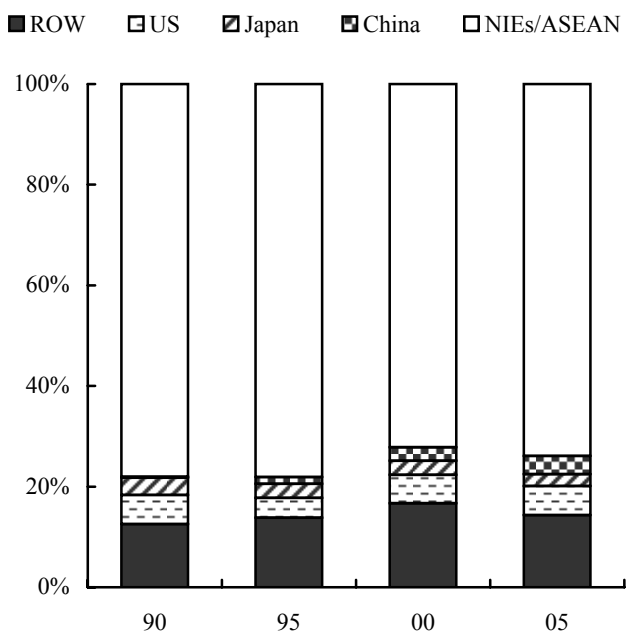
Figure 4 : continued

(5) NIEs3 by Country

Taiwan



South Korea



Singapore

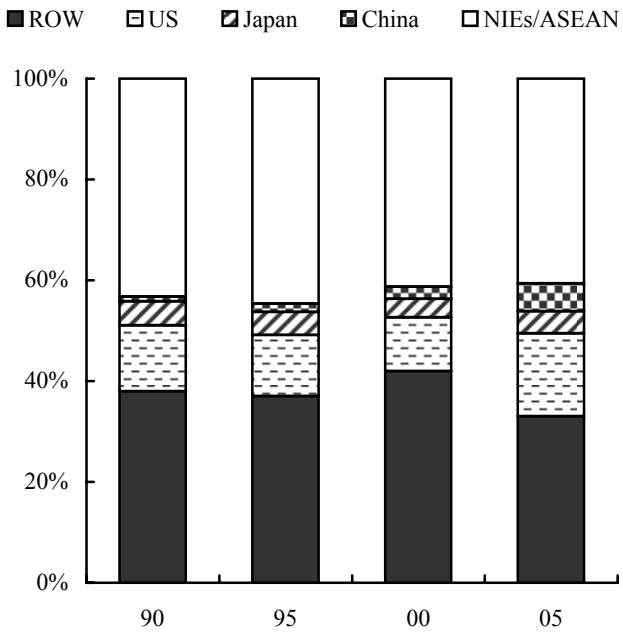
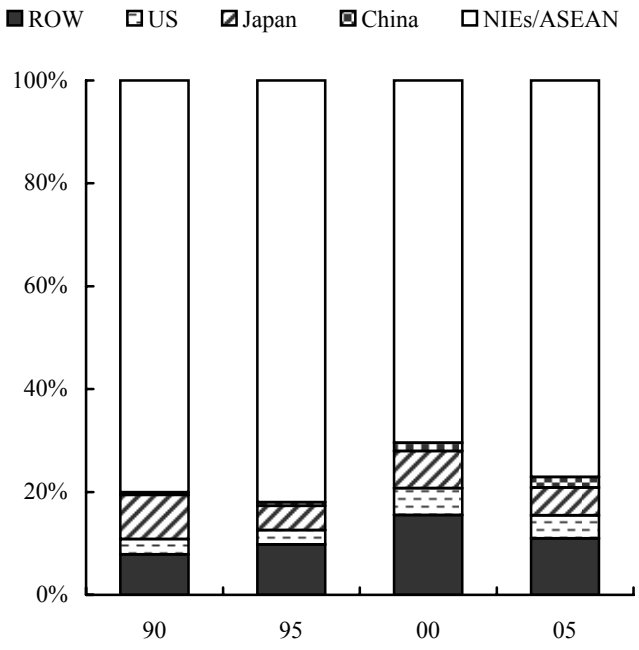


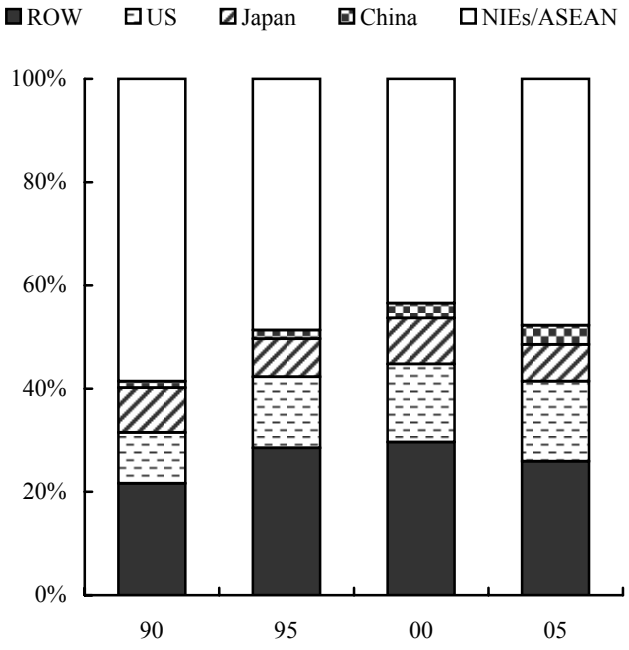
Figure 4 : continued

(6) ASEAN4 by Country

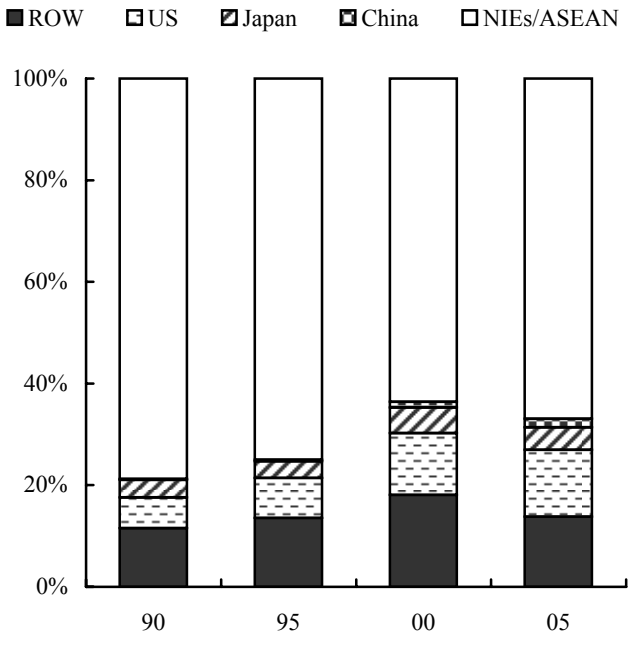
Indonesia



Malaysia



the Philippines



Thailand