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Value Chain in East Asia Production Network

-An International Input-output Model Based Analysis

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Abstract

This paper extends quantitative measures of vertical specialization (VS and VS1) proposed by Hummels, Ishii, and Yi (2001) into a framework that includes many countries based on an international input-output model. It not only distribute foreign value-added in a country's exports to its original sources, but also further decompose domestic value-added in a country's exports into direct exports and indirect intermediate exports via third countries, thus completely "slice of the value-chain". This extended measure of vertical specialization allows us to estimate each country's net contribution of value-added in the East Asia production network at industry level thus provide systematic quantitative evidence for the nature and growth of value chain in the East Asia production network during the 1990s. Our main data source is the Asian international Input-Output tables (AIO) compiled by the Institute of Development Economies (IDE). It includes 9 major economies in East Asia (Japan, China, Korea, Taiwan, Singapore, Thailand, Malaysia, Indonesia, and Philippine) plus the United States. Our results show that East Asia developing economies (China and ASEAN-4) are more deeply integrated into the value-chain of East Asia manufacturing production network in the 90's, indicated by the dramatic increase of their share of value-added contained in final goods that East Asia supplied to the U.S. markets and their increased indirect value-added exports via other neighboring countries, despite the continuing dominance of Japan and NIE-3. We also report interesting heterogeneity of value chain across sectors: the electronic industry is most dynamic and well integrated global production network, and the value share become relative evenly distributed among East Asian economies in 2000 than that in 1990, while automobile production still mainly involve Japan and Korea by 2000 with developing Asia just start to show up in the chain. Value chain of wearing apparel is more concentrated in Asia developing countries with the value-added production shift from Asian NIE and Japan and rest of the world during the studied period.

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[1] The views in the paper are those of the authors and are not the official views of the USITC, or of any other organization that the authors are or have been affiliated with.

I. Introduction

World production has become increasingly fragmented. For many products, their global supply chains have stretched across many countries, with each country specializing in a particular stage of a good's vertically integrated production sequence. While the formation of such production networks is observed in Europe and North America (such as between Germany and Hungary/Czech and between the U.S. and Mexico), the one in East Asia has be more dynamic and become a substantial component of each economy in the region. Fragmented trade along vertical integrated production network has been at the heart of the growth in trade among East Asian countries in recent decades. One will be not able to really understand manufacturing activities and international trade patterns in East Asia without understanding these production networks.

There is a sizable literature demonstrated the growing importance of fragmentation based specialization for economic growth and structure transformation in East Asia economies. For example, by decomposing East Asian countries' machinery trade statistics at six-digit HS level for 1990, 1996 and 2000 into one-way trade, horizontal and vertical intra-industry trade, Ando(2006) found that the explosive increase in both imports and exports of machinery parts and components is largely due to the expansion of back-and-forth transactions in vertically fragmented cross-border production process and shown that vertical international production sharing did become an essential part of each East Asian economy in the 1990s. Also using parts and components trade as a proxy measure of fragmentation, Athukorala and Yamashita (2006) also found that the dependence on this new form of international specialization is proportionally large in East Asia than that in North America and Europe. However, growth dynamism based on vertical specialization in the region has depended heavily on exports of final goods in extra-regional markets.

There are three major shortcomings in exiting analyses of production network in East Asia based only on trade data. First, in the presence of production fragmentation, trade data are repeatedly-counted because goods in a vertical integrated production chain need cross multiple nation borders before getting embodied in the final products, thus the total amount of recorded trade statistics could be multiple of the value of final goods.

Therefore, export structure or technological sophistication of exports calculated from readily available gross trade statistics can lead to wrong inference as to the relative importance of each trading regions and is likely to come up with an exaggerated picture of the technological sophistication of a country's exports (Athukorala,2003). Second, as noted by Hummels, Ishii, and Yi (2001), analyses based on intermediate goods or parts and components trade has to rely on rather arbitrary classifications of goods into final and intermediates. Finally and most importantly, none of these existing trade statistics based analyses is able to capture the source of value-added and to quantify the contribution of each country to the total product value created in the production network, thus fail to provide systematic evidence quantifying the nature and growth of the value chain in East Asia production network.

This paper extends quantitative measures of vertical specialization (both VS and VS1) proposed by Hummels, Ishii, and Yi (2001) (HIY for short in subsequent discussion) into a framework that includes many countries based on an international input-output model. This extended measure allows us to estimate each country's net contribution of *value-added* in the East Asia production network at industry level thus provide systematic quantitative evidence for the nature and growth of value chain in the East Asia production network during the 1990s. Our main data source is the Asian international Input-Output tables (AIO) compiled by the Institute of Development Economies (IDE), a public research institute affiliated with Ministry of Economics, Trade and Industry of Japan jointly with statistical institutions in each of the covered countries. It includes 9 major economies in East Asia (Japan, China, Korea, Taiwan, Singapore, Thailand, Malaysia, Indonesia, and Philippine) plus the United States, not only provides the origin and destination of all transaction flows at industry level, but also specifies every intermediate and/or final use for all such flows and external trade flows with Hong Kong and Rest of the World. Our estimates show that East Asia developing economies (China and ASEAN-4) are more deeply integrated into the value-chain of East Asia production network, indicated by the dramatic increase of their share of value-added contained in final goods that East Asia shipped to major world markets, despite the continuing dominance of Japan and NIE-3 in the value chain. At sector level, top five product categories of East Asia exports with highest foreign content (lowest domestic

value-added) in 1990 was Refined petroleum and its products, Non-ferrous metal, Spinning, Wearing apparel, and leather products, dominated by natural resource and labor intensive products, while in 2000, although the domestic content for these natural resource based sectors still remain low because of the scarcity of natural resources in major East Asia economies, Electronics and Shipbuilding replaced the two labor intensive industries became the second and fourth sectors with highest foreign value-added embodies in East Asia exports to the U.S. market.

The international IO model and the method to estimate the impact of final demand change on value-added exist for a long time in Input-output literature. However, it is relative rare to use an international IO table to evaluate the growth of vertical specialization and to slice up value-added along an industrial supply chain across countries. The only related paper that we are aware of is by Pula and Peltonen (2009), entitled "Has Emerging Asia Decoupled? An analysis of Production and Trade Linkage Using the Asian International Input-Output Table." They estimate the dependence of each country's value-added (GDP) on domestic, intra-East Asia and extra-regional demand based on an updated aggregate AIO table, and conclude there is no support for the "decoupling" view, although emerging Asia is less "coupled" with the rest of the world than what suggested by gross trade statistics. However, these authors did not connect their exercise with HIY's measure of vertical specialization and do not conduct any analysis at the industry level.

Another related line of work focus on measure international trade in value-added (Johnson and Noguera, 2008; Dauding,Rifflart and Schweisguth, 2008), which nets of double-counted vertical trade and tracks the value-added produced in each country to the final destination where that value-added is consumed. Using combined data from input-output tables and data on bilateral trade in version 6 Global Trade Analysis Project (GTAP) database, these authors calculate measures of economic openness based on exported value-added content, refine HIY measure on domestic content of exports, and examining the difference between gross and value-added trade flows to study patterns of production sharing across countries. They find production sharing and trade in intermediate goods significantly distort both bilateral trade imbalance and sector-level measures of exports. Countries and sectors that appear to exports a small amount of their

production may be in fact significantly exposed to international markets because their exports is embodied in goods that are directly exported. However, most of their analyses are devoted to aggregate and bilateral trade patterns and do not address the issue how value-chain in a global production network should be quantified. Moreover, their IO and bilateral trade data are organized according to a multi-region input-output table (MRIO) in GTAP database, which is simplified from an inter-regional input-output table (IRIO) (Canning and Wang, 2005). Methodology developed in this paper is based on an IRIO accounting framework, which includes detailed information on the use of all domestically and internationally traded goods and services, explicitly distinguish intermediate and final products by sources and destinations, thus permit us not only to compute value-added trade, but also to completely slice the value chain along global production net work
.

Rest of the paper is organized as follows. In section 2, we start from HIY's measure of vertical specialization and discuss its shortcomings when used to estimate value chain in a production network across many countries, then specify underpinning international IO model and derive our total value-chain measures. In section 3 we describe our major data sources and present our estimations of the total value chain in East Asia production network at 1990 and 2000, and discuss the characters and growth trends in these value chains by major markets and major industries. Section 4 concludes the paper with a brief discussion of its caveats and directions for future improvements.

II. Value Chain in Production Network: Concepts and Measurement

2.1 Concepts

In their nominal paper, HIY (2001) discussed two ways in which a country can participate in vertical specialization: one is when the country uses imported intermediate inputs to produce exports, another is when the country exports intermediate goods that are used as inputs into another country's production of goods for exports. Based on single country non-competitive type input-output models(implicit in their paper), HIY derived VS as measure of the value of imports embodied in the country's exports, and VS1 as measure of the value of exports embodied in all other country's exports. A complete picture of vertical specialization or a county's position in a vertical integrated production

network involves both measures. However, VS1 is more difficult to measure than VS in the framework proposed by HIY, because it requires matching bilateral trade flow data to all destination country's input-output tables the country under consideration exports to.

Two key (implicit) assumptions are needed for the HIY's measure to work. First, the intensity in the use of imported inputs is the same between production for exports and production for domestic final demand. Second, the foreign value added in all imported intermediate inputs is 100%[2]. That is, there is no indirect domestic content in a country's imports. The first assumption is violated when processing exports are pervasive such as the case of China and Mexico due to policy incentives. The second assumption generally does not hold because the essence of production fragmentation is any given country's exports could contain inputs coming from many other countries, including its own. By this logic, imported inputs (e.g., imported computer parts by China) could very well contain domestic value added that is embedded in the country's intermediate goods exports used by other countries producing goods sold back to the exporting country. In fact, the key phenomenon behind fragmentation is that countries increasingly link sequentially to produce final goods. Such a multiple- border-crossing, back-and-forth aspect of trade is what HIY intend use their proposed VS and VS1 to measure. Obviously, a measure which combines VS and VS1 and also capture any domestically sourced content embodied in a country's imported intermediate inputs will be more consistent with the multiple- border-crossing, back-and-forth aspect of trade that much of the anecdotal and case study evidence suggested has rise dramatically in recent decades.

When data on processing trade is utilized, one can relax the first assumption. Koopman, Wang and Wei (2008) provide a methodology to re-compute domestic and foreign value added in such cases. Data from an international input-output (IRIO) table permits the relaxation of the second assumption. In our view, an international production or supply chain can be seen as distribution of value-added share among countries (regions) in a particular global industry. Within the supply chain or production network, each producer purchases inputs and then adds value, which then becomes part of the cost of the next stage of production. The sum of the value added by every stage in the chain

[2] This is equivalent to the assumption that the first exporting country's exports have to be 100% domestic sourced when compute VS1 in HIY framework.

equals the value of final goods produced by the network. To precisely define such chains across many countries one need able to quantify the contribution of each country (region) to the total value-added generated in the process of production (supply) of final products. In this regard, an international input-output table provided the best available information to allow us to complete slice the value chain across all related countries at industry average level.[3] In particular, such a table would have information on (a) transaction flows of intermediate products and final goods within and between each country in the world at industry level, (b) the direct value-added of each industry in all countries, and (c) the gross output for each industry in all countries. In other words, the IRIO table not only provides the origin and destination of all transaction flows in its covered industries, but also specifies every intermediate and/or final use for all such flows. For example, based on information in the Asia IO table, we will not only know how many electronics produced in China was shipped into the United States, but also can distinguish how many of them used as intermediate inputs in which particular U.S. sector and how many of them used for U.S. private household consumption and capital formation (across the row). Similarly, the tables not only provide the information on how many steel used as intermediate inputs in Japan's motor vehicle industry, but also have the information on which part of the world these steels come from (down the column). Since this type IO table matches bilateral trade flow data to input-output relations and includes more detailed source/destination, supply/use information than single country IO table, they are more suitable to be used to compute measures of production fragmentation and vertical specialization.

In the next two sub-sections, we will use an international input-output model to illustrate how value added along a multi-country production chain can be decomposed into the sum of each participating country's net contributions. We will combine the VS and VS1 share concepts proposed by HIY(2001) and extends them into a framework that includes many countries, thus providing a better measure to systemically quantifying the nature and growth of value chain (vertical specialization) in a world production network.

[3] There are product-level approaches to estimate the financial value embedded in an product and quantify how it is distributed across the many participants in the supply chain from design and branding to component manufacturing to assembly to distribution and sales**. (**Jason Dedrick, Kenneth L. Kraemer, Greg Linden, 2008)

2.2 When a World Input-Output Table (That Covers All Countries) Is Available

Assuming there are G countries, with N sectors in each country. The production in each sector in any country can potentially use intermediate inputs from any sector (including its own) in any country. Assuming a predetermined location of production that defines the structure of the global economy, the deliveries of goods and services between countries are determined by imbalances between supply and demand inside the different countries. A world IO table is a comprehensive account of annual product and payment flows within and between countries. We use the following notations to describe the elements of the world IO table (expressed in annual values): x_i^r = Gross output of industry 'i' in country 'r'; v_i^r = Direct value added by production of industry 'i' in country 'r'; z_{ij}^{sr} = Delivery of good 'i' produced by country 's' and used as an intermediate by sector 'j' in country 'r'; and y_{ik}^{sr} = Delivery of good 'i' produced in country 's' for final use in final demand type 'k' in country 'r' the total number of final demand type is H). Then the following two accounting identities describe the relationship among elements of each row (i,r) and column (j,s) of the international IO table:

$$\sum_{s=1}^{G}\sum_{j=1}^{N} z_{ij}^{sr} + \sum_{s=1}^{G}\sum_{k=1}^{H} y_{ik}^{sr} = x_i^r \qquad (1)$$

$$\sum_{r=1}^{G}\sum_{i=1}^{N} z_{ij}^{rs} + v_j^s = x_j^s \qquad (2)$$

The economic meanings of the two equations are straightforward. A typical row in Equation (1) states that total gross output of commodity "i" in country "r" is equal to the sum of all deliveries to intermediate and final users in all countries (including itself) in the world. Equation (2) defines the value of gross output for commodity "j" in production country "s" as the sum of the values from all of its (domestic plus imported) intermediate and primary factor inputs. Equations (1) and (2) must hold for all i,j $\in$ N, k $\in$ H and s,r $\in$ G in each year. In addition, this World IO account has to be consistent with each country's national IO account and official trade statistics, which requires the following accounting identities to be satisfied each year:

$$\sum_{k=1}^{H}\sum_{s=1}^{G} y_{ik}^{sr} = y_i^{\bullet r} \tag{3}$$

$$\sum_{s=1}^{G} z_{ij}^{sr} = z_{ij}^{\bullet r} \tag{4}$$

$$\sum_{s\neq r}^{G}\sum_{j=1}^{N} z_{ij}^{sr} + \sum_{s\neq r}^{G}\sum_{k=1}^{H} y_{ik}^{sr} = e_i^{s} \tag{5}$$

$$\sum_{s\neq r}^{G}\sum_{j=1}^{N} z_{ij}^{sr} + \sum_{s\neq r}^{G}\sum_{k=1}^{H} y_{kj}^{sr} = m_j^{r} \tag{6}$$

Where $y_i^{\bullet r}$ = total final domestic demand of product 'i' of destination country 'r';

$z_{ij}^{\bullet r.}$ = total intermediate demand of product 'i' by sector 'j' in destination country 'r';

e_i^s = exports of sector 'i' of production country 's' ;

and m_j^r = imports of product 'j' of destination country 'r'.

Equation (3) indicates that each country's total final demand for commodity "i" must be met by final goods and services shipped from all nations, including its own. While Equation (4) states each country's total intermediate use of product 'i' in sector 'j' must equal to total input-output flow from sector 'i' to sector 'j' in IO table of the destination country 'r'. Equations (5) and (6) are simply the facts that all intermediate and final goods and services export to and import from all foreign countries have to equal the country's total exports to and imports from the world markets.

Define $a_{ij}^{rr} = {}^{z_{ij}^{rr}}\!/_{x_j^{rr}}$ as the direct input coefficients of domestic products of country 'r', $a_{ij}^{sr} = {}^{z_{ij}^{sr}}\!/_{x_j^{rr}}$ s≠r as intermediate input/output coefficients of good 'i' produced in source country 's' for use in sector 'j' by destination country 'r'; and $av_j^s = {}^{v_j^s}\!/_{x_j^s}$ as each sector 'j's ratio of direct value added to gross output for each producing country 's'; then using matrix notation, equations (1) and (2) could be re-written as:

$$AX + Y = X \tag{7}$$

$$A^T X + \hat{A}_v X = X \tag{8}$$

where A is a NG by NG square matrix with G^2 number of N by N block sub matrixes. It shows inter-industry input/output coefficients not only within each country, but also across all of the countries.

$$A = \begin{bmatrix} A^{11} & \cdots & A^{1G} \\ \vdots & \ddots & \vdots \\ A^{G1} & \cdots & A^{GG} \end{bmatrix}$$

$A^{rr} = [a^{rr}_{ij}]$ is a $n_x n$ matrixes at the diagonal, $A^{sr} = [a^{sr}_{ij}]$ s≠r is also $n_x n$ matrix but at off-diagonal. $\hat{A}_v$ is a diagonal block matrix of NG by NG whose diagonal elements are row vectors of corresponding country's ratio of direct value added to gross output (value-added coefficients).

$$\hat{A}_v = \begin{bmatrix} AV^1 & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & AV^G \end{bmatrix}$$

where $AV^r = [av^s_j]$ is a n by n diagonal block matrix and X is a RG by 1 output vector

$$X = \begin{bmatrix} x_1^1 & \cdots & x_n^1 & \cdots & x_1^r \cdots & x_n^r & \cdots & x_1^G \cdots & x_n^G \end{bmatrix}^T$$

The adding up condition on the input-output coefficients in equations (7) and (8) can be written as

$$uA + A_v = u \qquad (9)$$

where u and A_v are a 1 by NG unit vector and direct value-added coefficient vector respectively. It implies that direct value added coefficients and intermediate inputs-output coefficients from all domestically produced and imported products in any sector j and country s has to sum to unity.

From equation (7) we have

$$X = (I - A)^{-1} Y \qquad (10)$$

$B = (I - A)^{-1} = [b^{sr}_{ij}]$ is the Leontief inverse. Its jth column in the r-th block gives how much the production of each industry in all countries is induced when the final demand for jth industry in country 'r' increases by one unit (total requirement coefficient). Y is a NG by H final demand matrix, usually including private and government consumptions, capital formation and inventory changes.

Based on the definition of value-added coefficient, the incremental increase in value-added induced by one unit increase in final demand is given by

$$\Delta V = \hat{A}_v \, \Delta X = \hat{A}_v (I - A)^{-1} \Delta Y = \hat{A}_v (I - A)^{-1} \tag{11}$$

Define a G by NG matrix VAS as value added share distribution in a unit of final products. Each row 'r' represents the value-added share contributed to an industry 'i' by corresponding country 'r'. It can be computed by correctly sum across row (along the column) of the NG by NG matrix ΔV

$$VAS = V_0 (I - A)^{-1} = V_0 B \qquad V_0 = S \cdot \hat{A}_v \tag{12}$$

Where S is a G by NG block diagonal summation matrix with G 1 by N unit vectors as its diagonal block. Its elements is the column sum of product between value-added coefficient and total requirement coefficient

$$vas_i^{sr} = \sum_{j=1}^{N} av_j^s b_{ji}^{sr} \tag{13}$$

Where industry "i" in destination country "r" represents the using industry, while industry "j" in source country "s" represent the supply industry. The direct value-added coefficient is from the producing industry "j" at source country "s". Intuitionally, this equals pre-multiplying the Leontief inverse by the direct value-added ratio and sum them over the column (industries) for each bilateral transaction in every country and industry, so we obtained the amount of value-added generated directly and indirectly in one unit of final products for each industry in each country. The contributed value-share from all countries for a particular industry equals unit.

The VAS matrix can be write as G block G by N matrix as follows,

$$VAS = \left[VAS_1^1 \quad \cdots \quad VAS_i^r \quad \cdots \quad VAS_N^G \right] \tag{14}$$

Where $VASi^r = [vas^{sr}{}_i]$ is a G by G matrix . For each VAS_j^s, the off-diagonal elements in a row (for all s≠r, hold production country "s" constant) is the term captures allowing exported intermediate inputs from source country 's' in output of destination country 'r' at the 2^{nd},3^{rd},4^{th}, … stages before it becomes embodied in final goods delivered to other countries, therefore the sum over destination country 'r' weighted by corresponding final goods from all G countries consumed in country r is similar to the VS1 measure proposed by HIY without the assumption that the exported intermediates is 100% domestically sourced. This

revised VS1 measures how much the production country" s" domestic value-added is embodied in its indirect intermediate exports to other third countries that exports the final goods consumed in a destination countries and can be computed at each sector "i"as

$$vs1_i^s = \sum_{r \neq s}^{G} vas_i^{sr} y_i^{sr} \tag{15}$$

The off-diagonal elements in a column (for all r ≠ s, hold the destination country "r" constant) in the VAS matrix is the term captures allowing imported intermediate inputs from source country 's' in output of destination country 'r' at the 2^{nd},3^{rd},4^{th}, … stages before it becomes embodied in final goods imported by destination country "r". Therefore, the sum over source country's' is similar to the VS measure proposed by HIY without the assumption that the imported intermediates is 100% foreign sourced. This revised VS measure decomposes the foreign value-added embodied in direct exports of the exporting country "s" to its destination country "r" into its original value-added sources and can be computed at sector level as

$$vs_i^r = \sum_{s \neq r}^{G} vas_i^{sr} y_i^{sr} \tag{16}$$

For the destination country "r", vs^{sr}_i is the domestic content of its imports, the domestic content come back to the home country through home country's imports. The diagonal elements of each VAS_i^s matrix is the term that captures allowing domestic intermediate inputs in domestic output of country 'r' at the 2^{nd},3^{rd},4^{th}, … stages before it becomes embodied in final goods delivered to other countries plus the revised VS1, the domestic value added embodied in its exports used by any third country to produce exports to a destination for final consumption. Therefore, the domestic value-added share derived from HIY VS share measure (one minus HIY VS share) will under estimate domestic value-added by neglect both the domestic value-added embodied the imports of home country and indirect exports to the destination country via indirect intermediate exports to a third countries. It can be computed at sector "i" for each country as follows:

$$dv_i^s = \sum_{r \neq s}^{G} vas_i^{ss} y_i^{sr} \tag{17}$$

The aggregate measure of revised VS, VS1 and domestic value-added share DV at each country or each sector level for a particular destination market can be obtained by sum over sector (country) weighted by final demand. For example

$$VS^r = \sum_{s \neq r}^{G} \sum_{i}^{N} vas_i^{sr} y_i^{sr} \tag{18}$$

$$VS_i = \sum_{s \neq r}^{G} \sum_{r \neq s}^{G} vas_i^{sr} y_i^{sr} \tag{19}$$

Just as our revised VS measure provides a way to further decompose VS into all its original source countries, our revised VS1 measure provides a way to farther decompose domestic value-added into domestic value-added embodied in a country's direct exports to its consumption destination and domestic value-added embodied in its indirect intermediate exports via any third countries to its final destination.

Obviously, our total value chain measure, VAS, is an extension of the vertical specialization measure (VS and VS1) proposal by HIY into as many as G countries. It includes both domestic value-added share (in the diagonal) and foreign value-added share from all other countries, and a country's exports of intermediates embodied in all other countries' exports, thus combines VS and VS1 in a consistent framework. The detailed distribution of foreign value added in both a production country's direct and indirect exports to destination country revealed by this systematic measure will enable us to quantify the length and thick of the production Chain. In addition, it relaxes the unrealistic assumption that a country's imported intermediate inputs have to be 100% foreign contents and the first country's exports have to be 100% domestic content which is necessary for empirically estimate HIY measures. It really takes all the back-and forth trade of intermediates across the border many times into account, which HIY measure is not able to capture because of the single country IO model it based on.

2.3 Working with an Inter-regional Input-Output Table (for a Subet of Countries)

World IO tables that include all countries are rare because the tremendous data requirement in its compilation and the difference of statistical classification among different countries. Many developing countries even do not have national IO table. Available tables such the Asian international IO table usually covers only a select set of economies and treats

other countries in rest of the world (without IO account) as exogenous regions. To estimate total value chain based on such table, model specified in previous section has to be modified.

Dividing the G countries into a set of M endogenous and another set of G-M exogenous countries, the model specified by equations (1) and (2) becomes:

$$\sum_{s=1}^{M}\sum_{j=1}^{N} z_{ij}^{sr} + \sum_{s=1}^{M}\sum_{k=1}^{H} y_{ik}^{sr} + \sum_{s=G-M}^{G} e_{i}^{sr} = x_{i}^{r} \tag{20}$$

$$\sum_{s=1}^{M}\sum_{i=1}^{N} z_{ij}^{sr} + \sum_{s=G-M}^{G}\sum_{i=1}^{N} m_{ij}^{sr} + v_{j}^{r} = x_{j}^{r} \tag{21}$$

where e_i^{sr} = Exports of product 'i' from endogenous country 's' to exogenous country 'r' in rest of the world.; m_{ij}^{sr} = Imports of product 'i' used in sector 'j' in an endogenous country 'r' from an exogenous country 's' in rest of the world.

This modified international IO model sometimes refers to as "Inter-Regional IO model" (IRIO) in the Input-output literature. The computation of VAS in such model is similar to equations (12) and (13) with a different dimension of related matrixes. (Matrix A reduces to NM with M^2 number of N by N blocks. $\hat{A}_V$ reduces to a diagonal block matrix of NM by NM, and block diagonal summation matrix S reduces to M by NM).

To estimate the value-added contribution from exogenous countries in the rest of the world (which does not have input-output account), we need to assume imported intermediate inputs from the G-M exogenous countries are 100% foreign sourced similar to HIY. Then the contribution of value added share from the G-M exogenous countries in each of the N industry is computed as follows:

$$VSS = M_0 (I - A)^{-1} \tag{22}$$

where *VSS* is a G-M by N(G-M) matrix, with each row i giveing the contribution of value-added share from a corresponding exogenous country to each of the N industries.

$$M_0 = \begin{bmatrix} M_0^{M+1} & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & M_0^{G} \end{bmatrix}$$

M_o is also a diagonal block matrix of G-M by N(G-M) whose diagonal block are $1xn$ row vector $M_o^r = [m_{oj}^r]$, each elements m_{oj}^r is the column sum of the direct import coefficients for

the corresponding exogenous country. In other words, $M^r_0 = uM^r$ where $M^r = [m^{sr}_{ij}]$ is an n by n import coefficient matrix and u is a $1xn$ vector of one. Intuitionally, the amount of imports from rest of the world required directly and indirectly by one unit of final demand (including exports to rest of the world) can be obtained by pre-multiplying Leontief inverse by the imported intermediate IO coefficient matrix.

The column sum of VAS and VSS always equal to one by using the adding up condition of the international IO model, which says the column sum of domestic input/output coefficients, import input/output coefficients, and direct value-added ratio for each industry in each endogenous country has to equal to unity.

When all the block matrix except the first diagonal block in this modified A matrix equals to zero and the M_0 matrix consolidated into a $1xn$ row vector, each of its elements is the column sum of the direct import coefficients for rest of the world as a whole, our VAS matrix reduces to HIY's VS measure computed from each country's non-competitive IO tables individually and additional assumption on foreign content of each country's imports have to be imposed to make the computation feasible.

III Characters and Changing Patterns of Value-Chain in East Asia Production Network

3.1 Data Source

The primary data source is the Asian international Input-Output tables (AIO) compiled by the Institute of Development Economies (IDE) affiliated with Japan's Ministry of Economics, Trade and Industry in collaboration with national statistical institutions in eight other economies in Asia (China, Korea, Taiwan, Singapore, Thailand, Malaysia, Indonesia, and Philippine) plus the United States. It provides the origin and destination of all transaction flows within and across these ten economies at the industry level, and reports trade flows with Hong Kong and Rest of the World. It specifies intermediate and/or final use for all such flows. The table is available for 1990 and 2000. The 2000 table separates the EU15 from the rest of the world.

64 sectors, including 36 non-food-processing manufactures sectors, are common between the 1990 and 2000 tables after carefully concordance. Final demand in the AIO has four components (4 types, i.e H=4): private consumption, government consumption, gross domestic fixed capital formation, and changes in inventories. Direct value-added in the AIO

includes wages and salary, operating surplus, gross fixed capital formation, and indirect tax less subsidies.

3.2 East Asia Manufactured Final Products sold at U.S. Markets

3.2.1 Domestic and foreign contents

To illustrate how the value-chain along a global production network can be empirically estimate using the measures developed in previous section based on international IO model and how these measures can be used to systematically quantify the nature and growth of a global production network, we compute these measures for final manufacturing products made by the nine East Asia countries that exported and sold in the U.S. market from the AIO. Table 1a reports major results of 1990 and 2000 for aggregated manufacturing products except food. Columns (2) and (3) report the current dollar value of final and intermediate goods exports by each of the nine East Asian economies in 1990 and 2000, respectively. Column (4) gives the share of intermediate exports in total manufacturing exports [(4) = (3)/[(2)+(3)]. In 2000, the median value of this share is 52.9% (Malaysia). Four countries that exported a greater portion of goods that year are Korea (63.55), Philippines (61%), Singapore (60%), and Taiwan (62%). It is noteworthy that China's share is the lowest in Asia. Indeed, comparing 2000 with 1990, China stands out as the only country that experienced a decline in the share of intermediate in exports. All other countries experienced an increase, with the increment exceeding 10 percentage points for five of them. By this metric, it seems that China's participation in the global production chain declined, but it may actually indicate China is likely located in the end of the production chain with significant portion of its exports to the U.S. market are final products.

However, the share of intermediate goods in a country's total exports is a misleading yardstick to judge international integration. A more informative statistic is the shares of domestic and foreign content in a country's exports; these are reported in Columns (5) and (8) in Table 1a. The foreign content share exceeds 40% for Malaysia, Philippines, Singapore, Thailand and Taiwan in 2000. This suggests that these economies are heavy users of imported intermediates in the production of their exports. On the other end of the spectrum is Japan, whose foreign content is less than 10% of its exports. This indicates that Japan primarily specializes in producing intermediate inputs for other countries' exports, but uses

relatively few foreign-sourced inputs in its own final goods exports. In comparison, the foreign content share for China's exports is estimated to be 23.5% in 2000, which is on the low end of the spectrum when compared with most other East Asian economies. Indirect (via other East Asia countries) domestic value-added (extended VS1 measure) for each East Asia economy is listed in columns (6), while foreign value-added from other East Asia countries contributed to each economy's direct final exports to U.S. market is reported in column (7). These two measures quantify how intensive each East Asia country engages in the Asia production network from its imports and exports perspective respectively. Compare these indexes for 1990 and 2000, three characters of the nature and growth of East Asia manufacturing production net work become apparent. First, between 1990 and 2000, domestic value-added share are declined for most East Asia countries during the decade except Philippines and Singapore, the domestic content for all East Asia exports to the U.S. market in average at 79 percent in 1990 and lower to 74.5 percent in 2000. Second, only about 8.9 percent (7/79) of these domestic value-added exports in 1990 was indirectly through exports of intermediates to other countries in East Asia then finally end up in U.S. market, while this number increased to 13 percent (10/74.5) in 2000. The increase of both VS and VS1 measures indicate the degree of vertical specialization in East Asia manufacturing production was increased during the 10 year period and the emerging East Asia (China and ASEAN4) became major players in East Asia manufacturing net work as a results of Japan and NIE3 increasingly outsourcing their production to these emerging East Asia countries. Finally, intermediate manufacture exports as a share of gross manufacture exports dramatically increased for most East Asia countries except China, which moderately declined about 4 percent, indicating China exports to the U.S. market became proportionally more finished products than all other East Asia countries during this period.

(**Insert Table 1a here**)

It is important to note that the estimation reported in Table 1a does not distinguish between processing and normal exports, it underestimates the true extent of foreign content in exports. For China, as shown by Koopman Wang and Wei (2008), the foreign content share is on the order of 50% once the higher reliance on imported inputs by processing exports is taken into account. As the use of processing exports is more intensive in China than many other economies, it is likely that the adjustment needed is smaller for other

economies. For example, for both Japan and Singapore, since their tariff rates on manufactured inputs are low anyway, the estimation errors are likely to be small, and the estimated foreign content shares reported in Table 1a are likely to be reliable.

Last column in Table 1a (9) reports the share of U.S. domestic value-added embodied in its manufacturing imports from East Asia countries (which is part of foreign content in East Asia exports). At aggregate, the role of U.S. as an intermediate inputs supplier in East Asia manufacturing goods produced for U.S. market seems unchanged during the 10 year period. For imports from Asian NIE and ASEAN (except Indonesia), U.S. domestic content was quite significant.

3.2.2 Slicing up the value chains across countries

As a major advantage of the international I/O table, it allows for further decomposition of foreign content in a country's exports along the origins of the supplying countries of intermediate goods. This is done, with the help of formula in equation (18) and (22)[4], and reported in Table 1b.

(**Insert Table 1b here**)

Each row represents a breakdown of the supply chain, for a given county's exports to the United States, of all foreign countries that contribute value added to its production. For example, the first row shows that Indonesia contributed 1.1% to the foreign content in the Chinese exports to the United States in 1990. Hong Kong, Japan, and the United States are the most significant supply of intermediate inputs for the Chinese exports to the United States, accounting for 51.3%, 13.0% and 6.8% of the foreign content. Comparing 2000 with 1990, we can see the share of Hong Kong in the foreign content of Chinese exports has declined substantially (to 10.5% in 2000). On the other hand, the shares by Japan, Korea, Taiwan and the United States in the foreign content of Chinese exports have each increased by more than 2 percentage points during the same period. The biggest increase in the contribution to the foreign content comes from the rest of the world, which is dominated by Europe. In other words, sourcing of inputs to be used in the production of exports by companies located in China has become more dispersed geographically. It implies other

[4] The columns 2-11, share of the 10 endogenous countries is computed according to equation (18), while columns 12 and 13, the share for Hong Kong and rest of the world is computed according to equation (22) and they are treated equally when conduct unitization (make their sum to 100).

countries increasingly using China as an export platform to export value added to the United States indirectly during this period.

Across the rows in Table 1b, we can compare the geographic sourcing patterns in exports for nine major economies in East Asia. A number of interesting patterns emerge. First, Japan is the dominant supply of inputs used in the production of other Asian economies' exports to the U.S. market, accounting for 20% of foreign content in nearly all other Asian exporters. This role by Japan has declined only moderately over time. Second, the United States itself is often a major input supplier to Asian countries' exports to the U.S. market. Its role is relatively stable over time, though with some fluctuations for individual exporters. Third, Korea and Taiwan are the next two most significant Asian suppliers of inputs in other Asian economies' exports. Finally, the last row of each year in Table 1b shows that there was a dramatic increase in China's value-added contribution to total East Asia manufacturing exports to the U.S. market in contract with the dramatic decrease of value-added contribution from Japan. Similar pattern also exist for ASEAN4 (increase their value-added share) and NIE3 (their value-added contribution were decline, especially for Taiwan), but in a less extent. These quantitative measures all indicate the degree of vertical specialization in East Asia manufacturing production was increased during the 10 year period and the emerging East Asia (China and ASEAN4) became major players in East Asia manufacturing net work as a results of Japan and NIE3 increasingly outsourcing their production to these emerging East Asia countries.

3.2.3 Decomposing gross and value-added manufacturing trade flows

Table 1c reports the decomposition of East Asian manufacture exports to and import from the United States and their balance of trade in both gross and value-added terms. Columns (2) and (3) are gross exports to and imports from the U.S., including both intermediate and final goods; columns (4)–(6) are value-added imports, decomposing into value-added embodied in direct imports from the U.S. and indirect via U.S. intermediate exports via third countries; columns (7) – (9) are value-added exports, decomposing into value-added in direct exports to U.S. and indirect intermediate exports via third countries are reported in; column (10) and (11) are U.S. balance of trade with each of East Asian economy in gross and value-added term respectively; last four column [(12)-(15)] are composition of each country's exports and imports in gross and value-added terms.

(**Insert Table 1c here**)

It is interesting to note from these bilateral trade flow decomposition that most East Asian economies, except Japan, Korea and Taiwan, value-added imports from the U.S. exceeds their direct gross imports, indicating that United States exports a large portion of its value-added to East Asian through third countries and this almost doubled between 1990 and 2000. In contract, most East Asian economies, except Japan and Indonesia, their value-added exports to the U.S. are significantly smaller than their gross exports. As a result, U.S. deficit of manufacture trade with East Asia is much smaller measured in value-added term than that measured in gross term for most East Asian economies, except Japan and Indonesia, which U.S. run larger deficit if trade is measured in value-added term. However, for Malaysia and Singapore, U.S. actually run surplus if trade was measured in value-added term instead in gross term.

3.3 East Asia Manufacturing Exports to the U.S. Market by Sectors

Table 2a reports our value chain measures for final products made in East Asia sold in U.S. market by major manufacturing sectors, similar to Table 1a. Sectors are ranked based on its share in total gross manufacturing exports from the nine East Asia countries to the United States in 2000. Electronics, Motor vehicles, and Machinery are consistently the top three major manufacturing product categories that East Asia exports to the U.S. market in both 1990 and 2000, and constitute more than 60% East Asia's total gross manufacturing exports. However, only the share of electronics increased dramatically (from 32.2 to 40.8), while the share of both motor vehicles and machinery are declined by 5.2% and 0.6% respectively. Interestingly, the average foreign content share also dramatically increased for electronics (from 28.1% to 40.6%), but slightly declined for machinery. However, the vertical integration among East Asia economies seems intensified in all these top exporting industries, indicated by the increase of the average indirect domestic value-added exports via other East Asia countries (column 7) and the share of East Asia's indirect value-added exports as a share of its total value-added exports to the U.S. market (column 10).

(**Insert table 2a here**)

Top five product categories of East Asia exports with highest foreign content (lowest domestic value-added) in 1990 was Refined petroleum and its products, Non-ferrous metal,

Spinning, Wearing apparel, and leather products, dominated by natural resource and labor intensive products, while in 2000, although the domestic content for those natural resource based sectors still remain low because of the scarcity of natural resources in major East Asia economies, Electronics and Ship building replaced the two labor intensive industries became the second and fourth sectors with highest foreign value-added embodies in East Asia exports to the U.S. market.

If we ranking the industries based on how intensively East Asia country conduct indirect value-added exports or contribute to other neighboring countries' exports to the U.S. market (by domestic value-added via other 8 Asian countries (revised VS1) or foreign value-added from other 8 Asian countries (revised VS), the two are equal each other when we aggregate East Asia economy together using their exports to U.S. as weights), electronics, ship building and wearing apparel were in the top in both 1990 and 2000 based on such measures, confirmed that these sectors are the most vertical integrated sector in East Asia. However it is very interesting to note that if we ranking the industry based domestic content of the destination countries imports (USA in our case) the results are very different. In 1990, the top five product categories are: Other made-up textile products, Plastic products, Pulp and paper, Spinning, Leather and leather products (ranking low to high), all are resource intensive sectors; While in 2000, the top sector became: Shipbuilding, Other transport equipment, Spinning, Precision machines, Electronics and electronic products, indicate more U.S. domestic content embodied in its imports from East Asia become skill intensive products (the high value-added portion such as product design is originated from the U.S.).

(**Insert table 2b here**)

Table 2b decomposes value-added in East Asia manufacturing exports to the U.S. market into their original contributing sources by major industries, and ranked them the same way as that in table 2a. The results clearly demonstrate the production network in many manufacturing industries had experienced dramatic expansion in East Asia last decades. Emerging East Asia (ASEAN4 plus China), especially China became more integrated into the value-added production processing as Japan and Asian NIEs source their manufacture production to ASEAN4 and China. The net value-added contribution from Japan and Asia NIE declined in most sectors and replaced by China and ASEAN 4. The most visible case is Japan and China. In 1990, Japan's value-added share in what East Asia sold at U.S, market

were more that 40% in 18 out of the 35 industries reported in Table 2b, while only 9 sectors still remain such dominate position in the production chain at 2000. In contrast, there is only one industry (Weaving and dyeing), China's value-added contribution exceeded 40 percent in 1990 (less than 10% for 23 out of the 35 industry), while at 2000, China's net value-added contribution were more than 40% in 10 industries, with less than 10% net value-added contribution in only 7 industries. The changing role of NIE3 and ASEAN4 in the production chain was very similar: the net value-added contribution from Korea, Taiwan and Singapore to manufacturing goods that East Asian exported to the U.S. market was more than 20% in 21 out of the 35 sectors at 1990, while the number of such sectors declined to 10 at 2000. However, there were only 4 of the 35 industries with a value share contribute by Indonesia, Malaysia, Philippines and Thailand was more than 20% at 1990, while the number of such industries expanded to 9 in 2000. This means the production of final manufacturing products that supply the U.S. market are more dispersed geographically among East Asia economies, the supply chain for U.S. market not only became longer but also grew relative evenly thicker in East Asia during this period. It also very interesting to note that contrast with the dramatic redistribution of value-added share among East Asia economies in the supply Chain, the net value-added contribution from the U.S. and the rest of the world are relatively stable in most industries, indicated the vertical production integration of manufacturing products occurred mainly within East Asian, although U.S. and rest of the world (mainly EU) still remain as the largest destination of final goods produced from East Asia production network.

(**Insert table 2c here**)

Table 2c decomposes bilateral trade flow in manufacture, computes balance of trade in both gross and value-added term between East Asia and the United States by sectors. The data show that except several resource based sectors such as refined petroleum and its products, Pulp and paper), U.S. trade deficit with East Asia is smaller in value-added term than that in gross term, for some skill and capital intensive sectors, such as electronics and electronic products, the difference between balance of trade measured in gross term and in value-added term increased between 1990 and 2000 (from 23% of gross BOT to 40%), while for some labor intensive sectors, such as Wearing apparel, this gap is diminish during the same period (from 25% o f gross BOT to 16%). To better understand what drive such trend

and the characters of the value chain at industry level, we will further analyze several selected industries based on more disaggregated results in next section.

3.4 East Asia manufacturing exports to the U.S. market in selected industries

3.4.1 Electronics industry

Tables 3a to 3c report the major characters of value-chain and decomposition of gross trade flows in East Asia electronics production network that supply U.S. market in a way similar to tables 1a to 1c. The value-added contributed from economies outside East Asia to East Asia exports to the U.S. market was 16.1% in 1990, but increased to 23% in 2000. The domestic value-added for each East Asia country (exclude value-added contribution from other 8 neighboring countries) in average was at 71.9% in 1990 (column (5) – column (6) in the row of Total) and lower to 59.4 % in 2000.There was a 5.6 percentage points (from 12% to 17.6%) increase of East Asia countries' indirect value-added contribution via exports of intermediates to other East Asia economies then embodied in the final electronic products East Asia supplied to the U.S market during the 10 year period.

(**Insert tables 3a to 3c here**)

Another feature of the East Asia electronics production network development during last decades is that Japan still remains the center of value-added creation in the production chain and the rapid emergence of China. Among the nine East Asia economies in the production chain, Japan is the only country had a significantly higher share in value-added exports than that of gross exports (65.3% via 50.6% in 1990, 45% via 29.3% in 2000, column (13) and (14) in Table 3c) in East Asia's electronic exports to the United States, indicating Japan supply higher value-added intermediate inputs to other East Asia economies thus indirectly exports its domestic value-added into U.S. electronic market through its neighboring East Asia economies. This mirrored by most other Asia countries, except China, all had much higher share in gross exports but lower share in value-added exports. In 1990, China only had 3% percent U.S. electronic market in both gross and value-added term, this share trebled in 10 years to about 12 %, catch up with the three newly industrialized economies.

It is also notable from table 3a that there was increased integration of electronic production between East Asia and the United States. This can be seen from the dramatic

increase of intermediate goods exported from East Asia to the United States. Most East Asia economies, except China and Indonesia, exported more intermediates than final goods to the U.S. market in 2000 (Column (4), Table 3a), and there are nearly 7% value of U.S. imported final electronics products for consumption from East Asia actually originated from U.S. domestic firms (Column (9), table 3a). This not only highlight that the two largest East Asia developing economies were positioned at the end of the East Asia electronic production chain supply the U.S. market, but also show how deeply U.S. electronic industry is vertically integrated with East Asia.

Table 3b further distributes the foreign content of East Asia electronic exports to the United States into each of its contributing economies. Two features are notable from the table. One is China's emergence as a major player in the production network and the relatively decline of Japan. China's value-added contribution in the final electronic products sold at U.S. market increased from 3.2% in 1990 to 13.5% in 2000, while Japan's share declined from 56.7% to 34.2%. In the meantime, all other East Asia countries, except Singapore also increased their value-added share in the production chain, indicating China's raise in the East Asia electronic production chain was not crowing out other East Asia developing neighbors, but actually enhance the competitiveness and efficiency of the production chain as a whole. The other is that there is no any sign of "decouple" of East Asia and rest of the world in the electronic industries. In contract, to produce the electronics for the U.S. market, the production chain extends beyond East Asia, the role of United States itself and rest of the world in the production process were actually increased, they contributed more than half of the total foreign contents and more than 20 % of the total value-added exports from East Asia to the U.S. Market (increased from 14.6% in 1990 to 22.3% in 2000, column (11) plus (13) in table 3b). It reveals East Asia not only heavily depend on rest of the world, especially the U.S. and E.U as final markets for its electronics exports, but also deeply integrated with the United States and rest of the world in the production process.

3.4.2 Machinery industry

The value chain for machineries made in East Asia supplied to U.S. market is an important part of Asian production network, but its nature and development pattern are somehow different with electronic industries. The major characters of this value-chain and

decomposition of gross trade flows between East Asia and the United States in machineries are reported in Tables 4a to 4c. Three special features are observed from the data:

First, Vertical specialization within East Asia increased very moderately comparing with electronics industry, indicted by the slightly increased value-added embodied in intermediate goods exported to other East Asia countries as input to produced final machinery products sold at U.S. Market (increased from 4.3% to 4.7%, Column (6) of Table 4a). However, the average domestic content of each East Asia economy actually slightly increased (from 84.9% to 85.7% Column (5)-(6) in the row of "Total", table 4a) and value-added contribution from economies outside Asian also slightly declined;

Second, the role of Japan in the production chain is similar to that in the electronics industry, but its dominate position did not change over the ten year period. For example, similar to electronic industry, Japan is the only country has a share in value-added exports to the United States significantly higher than its share in gross exports; but its share in both the gross and value-added exports basically stay the same in 1990 and 2000 (column (12) and (13) in table 4c); and

Finally, The emergence of China in the value chain is very significant, its net value-added contribution increased from 1.9% to 8.2%(column (2) in table 4b), but different with electronic industry, China was replacing Taiwan's position instead Japan's in the value chain (Japan's net value-added contribution actually increased from 65.5% to 68.5%, while Taiwan's declined from 17.9% to 6.2% column (4) and (7) in table 4c).

(**Insert tables 4a to 4c here**)

3.4.3 Wearing apparel industry

It is well known that there is a well developed production net work of wearing apparel in East Asia. However, a careful look the estimation results of total value chain measures developed in this paper reveals that the characters and development patterns of wearing apparel value chain in East Asia are very different with that of electronic industry in the 1990s. Tables 5a to 5c report our computation results. The most significant difference observed is that the valued –added of wearing apparel made in East Asia sold at U.S. market are increasingly sourced within East Asia economies. The contribution from economies outside East Asia declined from 19.9% in 1990 to 13.6% in 2000 (column (11) plus (13) in the row "Total" of Table 5b) , while the average domestic value-added share increased from

64.2% to 72.2% (Column (5)-(6) in the row of "Total", table 5a); Although the indirect value-added contribution to the value chain (supply U.S. market) via intermediate good exports as other East Asia countries' inputs to produce final wearing apparel sold at U.S. market is much higher than that in machinery industries, but lower than that in electronic industry and only marginally increased over the 10 year period (from 11.9% to 12.3%, column (6) in table 5b). The emergence of both China and ASEAN4 are significant, their net value-added contribution increased from 7.2% in 1990 to 26.8% in 2000 and 23% to 30.7% respectively (Table 5b). This mainly replaced the role of Taiwan and Singapore (their value-added share declined from 18% and 5.6% in 1990 to 6% and 1.8% in 2000 respectively), in a less extend of Japan (its share declined from 7.2% to 3.9%), but not Korea (its share stayed basically the same at about 15%) during that period.

(**Insert tables 5a to 5c here**)

3.4.4 Motor vehicle industry

The computation results of total value-chain measure and decomposition of trade flows between East Asia and the United States in motor vehicle industry are reported in Tables 6a to 6c. These results indicate that the auto production network is much less developed in East Asia compare with other industries analyzed in this section and basically concentrated in Japan and Korea with very limited involvement of Taiwan. This reflected by a very high average domestic content share (more than 90% in both 1990 and 2000) and a very low share of indirect value-added via other East Asia economies. Its integration with economies outside East Asia was also relatively low than other industries, reflected by the value-added contribution from U.S. and rest of the world (1.5% and 7% respectively, Table 6a). However, there was development during the 10 year period could be observed: First, Korea significantly increase its weight in the value chain, its share of value-added increased from 3.7% in 1990 to 9.5% in 2000; second, China, Indonesia, Philippines and Thailand start to show up in the value chain in 2000, with their contribution mainly indirectly through export intermediates to Japan and Korea as their inputs to produce automobile sold at the U.S. market.

(**Insert tables 6a to 6c here**)

V. Conclusion and Direction for Future Works

In this paper, we extend quantitative measures of vertical specialization (VS and VS1) proposed by Hummels, Ishii, and Yi into a consistent framework that includes many countries based on an international input-output model. The extended measure relaxed the unrealistic assumption of all imported intermediate inputs are 100% foreign sourced made by HIY in computing VS, and the unrealistic assumption of the first exporting country's intermediate exports are 100% domestically sourced made by HIY in computing VS1. It really takes all the back-and forth trade of intermediates across the border many times into account, which HIY measure is not able to because of the single country IO model it based on. We also developed computation method to decompose a country's exports and imports into value-added share and to compute bilateral balance of trade in both gross and value-added term based on this extended measure of vertical specialization. It not only distribute foreign value-added in a country's exports to its original sources, but also further decompose domestic value-added in a country's exports into direct value-added exports and indirect value-added exports via third countries, thus completely "slice of the value-chain". Using Asia international input-output table compiled by the Institute of Development Economies of Japan, we applied this extended measure to estimate each East Asia country's net contribution of value-added in East Asia manufacturing production chain that supply the U.S. market, providing systematic quantitative evidence for the nature and growth of value chain in the East Asia production network during the 1990s at industry average level. Our results show that East Asia developing economies (China and ASEAN-4) are more deeply integrated into the value-chain of East Asia manufacturing production network, indicated by the dramatic increase of their share of value-added contained in final goods that East Asia shipped to the U.S. markets and their increased indirect value-added exports via other neighboring countries, despite the continuing dominance of Japan and NIE-3 in the value chain. We also report interesting heterogeneity of value chain across sectors: the electronic industry is most dynamic and well integrated global production network with the dramatic emergence of China and ASEAN4, and the value-added share become relative evenly distributed among East Asian economies in 2000 than that in 1990; while automobile production still mainly involve Japan and Korea by 2000 with developing Asia just start to show up in the value chain. Value chain of wearing apparel is more concentrated in Asia

developing countries with the value-added production shift from Asian NIE, Japan and rest of the world during the studied period.

The total value chain measures computed in this paper and the decomposition of trade flows based on such measures provide useful insights for understanding the nature and growth of the value chain in a global production network. It demonstrates that international IO tables can be a valuable tool for "completely slice the value chain" and quantify the degree of vertical specialization along a global production network. However, there are several obvious limitations that should be mentioned. First, processing trade has not been included in the development of the total value chain measure because of limitations of the AIO. As shown by KWW, ignore the significant difference in the intensity of using imported intermediate inputs between processing and ordinary exports may result systematic aggregation bias and under estimate the foreign content share in gross exports, thus resulted inaccurate estimates of the distribution of value-added along the global production network; Second, the latest AIO table available is 2000, given the rapid changes of production and trade structure in East Asia , especially the dramatic impact of China joining the WTO at the end of 2001, the data in 2000 AIO table may be too old to describe the status of current Asia production network. Therefore, results reported in this paper only can be seen as a "snapshot" of the East Asian manufacturing production value chain in the 1990s at its best. Finally, the AIO tables only include ten endogenous countries, left out EU and other important market for final goods, which force us to stay with the HIY unrealistic assumptions in computing the VS and VS1 measure when rest of the world has to be involved. To overcome all these caveats, a time series world IO table, which include all major economies in the world and incorporate available processing trade information has to be developed and the total value chain measure defined in this paper also needs to be revised. This will be the next step of our research efforts in this area.

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Table 1a: Foreign vs. Domestic Value-added in East Asia Manufacturing Exports to the United States

Source Country (1)	*Final goods exports* (2)	*Interm e-diate goods exports* (3)	*Int. share in gross exports* (4)	*Total domestic Value-added* (5)	*Domestic value-added via others in East Asia* (6)	*Foreign value-added from others in East Asia* (7)	*Total foreign value-added* (8)	*U.S. Domestic Content* (9)
				1990				
China	3,870	2,672	40.8	81.2	6.3	4.1	18.8	1.3
Indonesia	886	538	37.8	76.9	40.5	7.8	23.1	2.6
Japan	53,446	28,473	34.8	91.6	7.6	1.4	8.4	1.6
Korea	11,298	5,450	32.5	68.3	3.7	11.0	31.7	6.6
Malaysia	2,051	2,091	50.5	52.8	23.0	19.5	47.2	5.8
Philippines	1,361	596	30.5	55.0	7.6	16.7	45.0	8.1
Singapore	5,306	3,599	40.4	39.9	4.3	30.4	60.1	11.8
Thailand	2,641	1,189	31.0	56.9	7.1	16.2	43.1	7.6
Taiwan	13,280	8,411	38.8	63.6	3.9	12.7	36.4	6.4
Total	94,139	53,019	36.0	86.0	7.0	0.0	14.0	3.8
				2000				
China	37,991	22,060	36.7	76.5	4.2	8.9	23.5	2.1
Indonesia	3,730	2,424	39.4	75.4	22.0	8.1	24.6	2.1
Japan	66,680	53,438	44.5	90.5	10.8	2.5	9.5	1.8
Korea	16,661	19,260	53.6	66.2	11.8	12.3	33.8	5.9
Malaysia	9,681	10,860	52.9	35.1	9.5	29.6	64.9	11.6
Philippines	3,674	5,785	61.2	55.4	10.2	20.7	44.6	6.0
Singapore	6,074	9,072	59.9	41.8	15.1	25.9	58.2	8.7
Thailand	5,909	5,912	50.0	54.9	11.1	20.8	45.1	5.9
Taiwan	12,300	19,761	61.6	54.5	14.8	19.9	45.5	6.3
Total	162,700	148,571	47.7	84.5	10.0	0.0	15.5	3.7

Data Source: Author computed from Asia Input-Output Table, compiled by the Institute of Development Economics, Ministry of Economics, Trade and Industry, Japan.

Note: a. in Millions of U.S. Dollars

Table 1b: Tracing Foreign Value Added in Manufacturing Products Made in East Asia Sold at the U.S. Market

Source country	China	Indo-nesia	Japan	Korea	Malay-sia	Taiwan	Philip-pines	Singa-pore	Thai-land	United States	Hong Kong	Rest of World	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
						1990, in percent							
China	-	1.1	13	1.4	1.7	3.5	0.1	0.4	0.9	6.7	51.3	20	100
Indonesia	3.2	-	12.2	8.2	1.6	5.9	0.3	1.7	0.7	11.3	3.3	51.6	100
Japan	2.6	3.7	-	2.9	1.7	2.6	0.8	0.7	1.5	18.6	1.2	63.6	100
Korea	0.2	1.5	26.5	-	2.8	2.2	0.3	0.5	0.6	20.7	1.5	43.2	100
Malaysia	2.1	1.3	21.1	2.3	-	5.8	0.5	7.2	1	12.3	3.8	42.5	100
Taiwan	0.2	1.2	28.2	2	1.4	-	0.4	1	0.5	17.7	3.3	44.1	100
Philippines	1.3	1.1	16.4	3.9	1.1	10.8	-	1.9	0.5	18.1	10.4	34.4	100
Singapore	1.6	1.3	32.8	2.7	5.6	4	0.9	-	1.6	19.6	4.4	25.4	100
Thailand	2.4	0.8	22.4	2.5	2	3.3	0.3	3.8	-	17.5	2.3	42.6	100
Total[a]	**3.6**	**1.1**	**56.3**	**8.6**	**1.7**	**9.5**	**0.9**	**2.5**	**1.8**	**3.8**	**1**	**9.2**	100
						2000, in percent							
China	-	1.6	15.5	8.4	1.6	7.9	0.5	1.2	1	8.9	10.5	42.9	100
Indonesia	5.4	-	11.5	6.3	2.3	4.2	0.2	1.4	1.6	8.4	2.3	56.4	100
Japan	6.1	3.6	-	4.6	2.5	4.5	1.3	1.1	2.7	18.4	2.3	52.8	100
Korea	6	1.7	21.5	-	1.7	2.7	0.7	1.3	0.8	17.5	3.2	42.9	100
Malaysia	3.4	1.8	21.1	3.8	-	4.6	1.5	6.8	2.6	17.9	5.1	31.3	100
Taiwan	3.8	1.7	26	5.3	2.4	-	1.4	1.9	1.2	13.8	3.2	39.3	100
Philippines	5	2.5	17	6.2	2	8.9	-	2	2.9	13.5	9.8	30.2	100
Singapore	4.3	1.4	23.6	3.3	7.1	2.8	0.5	-	1.7	15	2.9	37.6	100
Thailand	6.2	2.1	22.1	4.2	3.4	4	0.8	3.3	-	13.2	3.2	37.5	100
Total[a]	**18.8**	**2.2**	**41.5**	**8**	**2.7**	**5.2**	**1.5**	**2.1**	**2.4**	**3.7**	**1.3**	**10.5**	100

Data Source: Author computed from Asia Input-Output Table, compiled by the Institute of Development Economics, Ministry of Economics, Trade and Industry, Japan.

Note. a. The total also include each countries domestic value-added, it is the value-added structure of final goods made in East Asia sold at U.S. market

Table 1c Decomposition of Manufacture Trade Flow between East Asia and the United States by Countries, in Millions of U.S. Dollars

	Gross Trade		Value-added Imports from U.S			Value-added Exports to U.S.			U.S. Balance of trade		% of Each Country			
Source country (1)	Exports (2)	Imports (3)	Total (4)	Direct (5)	Indirect (6)	Total (7)	Direct (8)	Indirect (9)	Gross (10)	Value-added (11)	Gross exports (12)	VA exports (13)	Gross imports (14)	VA imports (15)
							1990							
China	6,542	4,500	4,431	4,056	374	5,837	5,432	405	-2,042	-1,407	4.4	4.6	6.8	7.0
Indonesia	1,424	1,328	1,446	1,204	242	1,727	1,128	599	-96	-280	1.0	1.4	2.0	2.3
Japan	81,919	28,690	26,950	25,559	1,391	81,113	74,401	6,712	-53,229	-54,163	55.7	64.6	43.5	42.4
Korea	16,748	10,312	9,680	9,190	490	11,924	11,260	664	-6,436	-2,244	11.4	9.5	15.7	15.2
Malaysia	4,142	3,372	3,584	3,006	578	2,998	2,236	762	-769	586	2.8	2.4	5.1	5.6
Philippines	1,957	1,778	1,773	1,611	162	1,251	1,070	180	-179	523	1.3	1.0	2.7	2.8
Singapore	8,905	5,645	5,677	5,055	622	3,954	3,550	404	-3,261	1,723	6.1	3.1	8.6	8.9
Thailand	3,829	2,475	2,674	2,210	464	2,433	2,149	284	-1,354	241	2.6	1.9	3.8	4.2
Taiwan	21,691	7,787	7,414	6,905	509	14,364	13,599	766	-13,904	-6,951	14.7	11.4	11.8	11.7
Total	147,158	65,887	63,629	58,797	4,833	125,601	114,824	10,777	-81,271	-61,972	100.0	100.0	100.0	100.0
							2000							
China	60,050	15,027	16,336	12,589	3,747	49,579	46,179	3,400	-45,024	-33,243	19.3	19.3	12.1	13.4
Indonesia	6,154	2,217	2,207	1,876	331	6,296	4,598	1,698	-3,937	-4,089	2.0	2.4	1.8	1.8
Japan	120,118	40,598	38,365	33,851	4,513	124,218	107,506	16,712	-79,520	-85,853	38.6	48.3	32.7	31.5
Korea	35,921	20,139	18,205	16,664	1,540	26,415	22,456	3,959	-15,783	-8,210	11.5	10.3	16.2	15.0
Malaysia	20,541	10,013	10,485	8,293	2,191	9,516	7,393	2,122	-10,527	969	6.6	3.7	8.1	8.6
Philippines	9,458	3,773	3,825	3,145	680	5,112	4,270	841	-5,685	-1,287	3.0	2.0	3.0	3.1
Singapore	15,146	8,438	8,848	7,059	1,789	8,131	6,060	2,071	-6,708	717	4.9	3.2	6.8	7.3
Thailand	11,821	5,217	5,375	4,331	1,044	7,471	6,121	1,350	-6,605	-2,096	3.8	2.9	4.2	4.4
Taiwan	32,061	18,770	17,966	15,628	2,337	20,628	17,198	3,430	-13,291	-2,662	10.3	8.0	15.1	14.8
Total	311,271	124,191	121,610	103,437	18,173	257,365	221,781	35,584	-187,080	-135,754	100.0	100.0	100.0	100.0

Data Source: Author computed from Asia Input-Output Table, compiled by the Institute of Development Economics, Ministry of Economics, Trade and Industry, Japan.

Table 2a Foreign vs. Domestic Value-added in East Asia Manufacturing Exports to the United States by Sector, 1990 and 2000

Sector	Year	Final goods exports	Int. goods exports	Int. share in gross exports	Share of domestic content	Indirect DVA via others in East Asia	Share of foreign content	Domestic content of U.S. imports	East Asia VS1/total DVA	Share of gross manufac. Exports
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Electronics and electronic products	1990	28,876	19,057	39.8	71.9	12.0	28.1	5.9	16.7	32.6
	2000	53,509	73,346	57.8	59.4	17.6	40.6	6.8	29.6	40.8
Motor vehicles	1990	25,834	4,416	14.6	91.6	1.5	8.4	1.3	1.7	20.6
	2000	35,259	12,645	26.4	89.7	2.9	10.3	1.5	3.2	15.4
Machinery	1990	6,809	3,877	36.3	84.9	4.3	15.1	2.1	5.1	7.3
	2000	13,137	7,821	37.3	85.7	4.7	14.3	1.9	5.5	6.7
Other manufacturing products	1990	6,714	1,067	13.7	76.9	5.8	23.1	3.1	7.6	5.3
	2000	11,442	2,082	15.4	79.4	7.1	20.6	1.8	8.9	4.3
Other electric machinery and appliance	1990	2,308	2,390	50.9	76.9	7.6	23.1	3.4	9.9	3.2
	2000	7,104	5,594	44.1	76.9	8.0	23.1	2.4	10.4	4.1
Wearing apparel	1990	4,960	963	16.3	64.3	11.9	35.7	3.9	18.6	4.0
	2000	9,750	805	7.6	72.2	12.3	27.8	2.0	17.0	3.4
Metal products	1990	1,267	3,842	75.2	76.0	7.4	24.0	2.4	9.7	3.5
	2000	3,451	5,498	61.4	77.4	7.9	22.6	1.4	10.2	2.9
Precision machines	1990	3,320	1,566	32.0	84.0	4.8	16.0	2.9	5.7	3.3
	2000	6,143	2,253	26.8	70.6	11.3	29.4	5.7	16.1	2.7
Leather and leather products	1990	2,154	92	4.1	65.5	7.2	34.5	8.7	11.0	1.5
	2000	5,475	317	5.5	77.4	8.1	22.6	2.5	10.5	1.9
Other transport equipment	1990	1,178	679	36.5	78.9	6.5	21.1	5.3	8.3	1.3
	2000	3,060	2,631	46.2	81.7	4.4	18.3	5.0	5.4	1.8
Plastic products	1990	1,023	1,847	64.3	69.8	7.8	30.2	6.8	11.1	2.0
	2000	380	4,129	91.6	75.5	9.3	24.5	2.7	12.3	1.4
Iron and steel	1990	14	2,886	99.5	78.4	3.8	21.6	2.1	4.8	2.0
	2000	153	4,304	96.6	75.3	8.0	24.7	1.2	10.6	1.4
Heavy Electrical equipment	1990	565	857	60.3	74.6	7.8	25.4	4.3	10.4	1.0
	2000	725	3,049	80.8	73.8	10.1	26.2	3.0	13.7	1.2
Wooden furniture	1990	132	55	29.4	74.3	8.6	25.7	2.6	11.6	0.1
	2000	3,502	155	4.2	78.3	8.1	21.7	1.7	10.4	1.2
Basic industrial chemicals	1990	101	1,530	93.8	70.9	5.6	29.1	3.8	7.9	1.1
	2000	123	3,315	96.4	73.3	6.2	26.7	2.1	8.5	1.1
Knitting	1990	2,142	106	4.7	71.5	8.0	28.5	5.2	11.2	1.5
	2000	717	1,878	72.4	70.1	11.4	29.9	3.1	16.3	0.8
Other made-up textile products	1990	1,168	357	23.4	69.3	7.2	30.7	6.7	10.4	1.0
	2000	1,717	865	33.5	77.1	8.5	22.9	2.4	11.0	0.8
Non-ferrous metal	1990	15	1,141	98.7	61.6	6.4	38.4	5.8	10.4	0.8
	2000	67	2,464	97.4	69.4	7.6	30.6	2.2	10.9	0.8

Sector	Year	Final goods exports	Int. goods exports	Int. share in gross exports	Share of domestic content	Indirect DVA via others in East Asia	Share of foreign content	Domestic content of U.S. imports	East Asia VS1/total DVA	Share of gross manufac. Exports
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Other chemical products	1990	139	238	63.1	77.8	5.2	22.2	3.7	6.6	0.3
	2000	544	1,833	77.1	76.9	7.2	23.1	2.9	9.3	0.8
Drugs and medicine	1990	278	119	30.0	90.6	1.6	9.4	1.2	1.8	0.3
	2000	1,533	824	35.0	87.8	3.0	12.2	1.5	3.4	0.8
Other non-metallic mineral products	1990	694	577	45.4	84.3	3.6	15.7	1.9	4.3	0.9
	2000	1,074	980	47.7	85.5	4.4	14.5	1.1	5.2	0.7
Other rubber products	1990	2,764	486	14.9	74.2	7.8	25.8	5.5	10.5	2.2
	2000	208	1,568	88.3	75.3	10.4	24.7	2.5	13.8	0.6
Boilers, Engines and turbines	1990	222	459	67.4	91.3	1.3	8.7	1.6	1.4	0.5
	2000	617	1,153	65.2	84.1	3.9	15.9	3.6	4.7	0.6
Tires and tubes	1990	477	595	55.5	78.1	8.3	21.9	2.6	10.7	0.7
	2000	691	1,078	60.9	78.7	7.2	21.3	2.3	9.2	0.6
Synthetic resins and fiber	1990	6	585	99.0	72.3	5.5	27.7	5.5	7.6	0.4
	2000	27	1,529	98.3	70.6	7.9	29.4	3.6	11.1	0.5
Weaving and dyeing	1990	210	1,255	85.6	86.8	2.6	13.2	2.6	3.0	1.0
	2000	343	1,155	77.1	73.3	9.8	26.7	2.6	13.4	0.5
Other wooden products	1990	214	623	74.4	74.9	9.5	25.1	3.9	12.7	0.6
	2000	164	1,214	88.1	79.6	6.3	20.4	1.7	8.0	0.4
Pulp and paper	1990	62	495	88.9	74.2	4.8	25.8	6.9	6.4	0.4
	2000	179	1,152	86.5	75.9	5.4	24.1	4.0	7.1	0.4
Shipbuilding	1990	107	5	4.5	70.2	13.9	29.8	4.3	19.7	0.1
	2000	867	158	15.4	67.8	12.4	32.2	4.6	18.3	0.3
Glass and glass products	1990	51	292	85.2	81.4	5.0	18.6	2.9	6.1	0.2
	2000	97	899	90.3	83.9	5.2	16.1	1.7	6.2	0.3
Refined petroleum and its products	1990	160	203	55.9	45.1	10.7	54.9	0.9	23.9	0.2
	2000	315	620	66.3	50.6	7.0	49.4	1.1	13.8	0.3
Cement and cement products	1990	0	56	99.6	91.8	1.4	8.2	0.6	1.5	0.0
	2000	11	659	98.3	85.2	4.9	14.8	1.0	5.8	0.2
Printing and publishing	1990	160	156	49.3	84.3	3.9	15.7	2.7	4.6	0.2
	2000	264	298	53.0	78.5	6.7	21.5	2.7	8.5	0.2
Spinning	1990	3	59	95.3	62.3	8.6	37.7	7.9	13.8	0.0
	2000	37	167	82.0	65.0	10.2	35.0	5.3	15.6	0.1
Chemical fertilizers and pesticides	1990	8	68	89.4	79.8	3.1	20.2	3.7	3.9	0.1
	2000	14	90	86.9	79.9	4.9	20.1	3.0	6.2	0.0

Data Source: Author computed from Asia Input-Output Table, compiled by the Institute of Development Economics, Ministry of Economics, Trade and Industry, Japan.

Note: a. in Millions of U.S. Dollars

Table 2b: Tracing Net Value Added Contribution in Manufacturing Products Made in East Asia Sold at the U.S. Market to their Sources by Sectors, 1009 and 2000, in percent

Sectors	year	China	Indo-nesia	Japan	Korea	Malay-sia	Taiwan	Philip-pines	Singa-pore	Thai-land	USA	Hong Kong	Rest of the World
Electronics and electronic products	1990	3.2	0.3	56.7	6.1	3.1	6.8	0.5	5.8	1.4	5.9	1.4	8.7
	2000	13.5	1.5	34.2	8.1	5.3	7.0	0.7	4.6	2.1	6.8	2.6	13.5
Motor vehicles	1990	0.2	0.3	88.2	3.7	0.1	0.3	0.1	0.0	0.1	1.3	0.0	5.5
	2000	1.7	0.4	79.8	9.5	0.2	0.5	0.1	0.1	0.4	1.5	0.1	5.8
Machinery	1990	1.9	0.3	65.5	2.0	0.4	17.9	0.2	0.8	0.2	2.1	0.3	8.4
	2000	8.2	0.7	68.5	4.2	1.2	6.2	0.2	0.7	0.4	1.9	0.3	7.3
Other manufacturing products	1990	5.8	0.9	39.5	10.0	1.2	18.2	0.4	0.7	5.9	3.1	1.4	12.7
	2000	48.2	1.6	21.2	4.7	1.4	6.0	0.1	0.2	3.0	1.8	1.0	10.8
Other electric machinery and appliance	1990	4.5	0.6	46.5	13.0	1.3	9.6	2.3	2.7	3.9	3.4	0.5	11.6
	2000	40.3	1.0	27.4	7.2	1.6	3.8	0.9	0.6	2.1	2.4	1.0	11.8
Wearing apparel	1990	7.2	8.1	7.2	15.3	3.9	18.0	6.7	5.6	4.3	3.9	3.8	16.0
	2000	26.8	10.3	3.9	15.4	2.0	6.0	9.2	1.8	9.2	2.0	1.9	11.6
Metal products	1990	16.1	3.0	32.0	9.2	1.7	14.4	1.6	1.8	3.6	2.4	0.6	13.6
	2000	48.3	2.9	10.9	4.8	0.6	13.9	1.1	0.2	2.5	1.4	0.5	12.8
Precision machines	1990	5.8	0.3	67.6	4.7	0.6	6.9	0.1	1.6	1.2	2.9	1.1	7.2
	2000	10.6	1.2	38.3	4.6	3.0	5.0	12.6	3.2	3.4	5.7	1.6	10.8
Leather and leather products	1990	12.6	4.5	4.7	13.9	0.4	24.5	1.8	0.2	10.1	8.7	2.5	16.1
	2000	60.3	8.6	2.3	5.2	0.2	1.8	0.3	0.2	6.7	2.5	1.3	10.7
Other transport equipment	1990	2.1	0.4	51.3	4.2	0.4	24.8	0.1	2.0	0.4	5.3	0.4	8.9
	2000	23.4	0.5	51.1	4.0	0.3	5.7	0.4	0.3	0.3	5.0	0.3	8.6
Plastic products	1990	1.7	0.5	9.4	1.2	0.3	63.7	0.1	0.4	0.2	6.8	0.5	15.1
	2000	46.9	1.4	16.6	5.7	1.5	10.4	0.7	0.6	1.1	2.7	0.7	11.7
Iron and steel	1990	4.1	1.2	58.8	14.0	0.3	2.6	0.7	0.3	0.0	2.1	0.1	15.6
	2000	20.8	1.8	27.7	17.0	1.0	12.2	0.4	0.2	2.3	1.2	0.2	15.2
Heavy Electrical equipment	1990	3.5	0.4	48.9	4.3	0.6	22.2	0.2	1.7	0.6	4.3	1.0	12.3
	2000	9.4	1.8	38.7	14.4	1.3	14.6	0.2	1.0	2.6	3.0	1.1	12.0
Wooden furniture	1990	0.6	16.2	3.7	0.5	3.9	1.5	9.2	12.3	35.0	2.6	0.5	14.1
	2000	46.9	8.9	3.1	1.8	8.5	9.6	2.2	0.4	5.1	1.7	0.7	11.1
Basic industrial chemicals	1990	12.4	1.2	46.2	2.7	1.4	2.6	0.5	9.2	0.2	3.8	0.3	19.4
	2000	18.0	2.0	48.3	4.4	3.9	1.9	0.2	0.4	0.4	2.1	0.2	18.2
Knitting	1990	0.3	0.5	4.9	23.5	3.2	39.0	4.8	0.3	3.0	5.2	1.0	14.4
	2000	14.9	13.6	4.3	5.2	7.7	23.9	0.2	0.5	11.3	3.1	0.9	14.6
Other made-up textile products	1990	3.2	0.6	9.5	48.1	0.6	10.4	2.4	0.1	1.6	6.7	1.1	15.7
	2000	42.7	2.0	6.2	15.6	0.4	14.2	0.9	0.3	3.3	2.4	0.8	11.3
Non-ferrous metal	1990	4.0	1.0	30.9	1.8	0.4	20.1	0.9	0.5	8.4	5.8	1.1	25.1
	2000	38.8	2.3	17.3	3.9	3.5	9.1	0.2	0.7	1.2	2.2	0.7	20.2
Other chemical products	1990	15.6	1.3	42.7	6.0	3.2	11.0	1.6	0.9	0.9	3.7	0.6	12.8
	2000	17.5	1.9	44.8	4.2	7.5	3.4	0.3	3.2	1.1	2.9	0.4	12.7
Drugs and medicine	1990	14.3	0.6	71.0	4.0	0.1	0.3	0.0	1.8	0.1	1.2	0.3	6.3
	2000	26.7	1.0	38.7	2.2	0.5	1.0	0.0	20.5	0.2	1.5	0.2	7.4
Other non-metallic mineral products	1990	19.7	1.3	31.4	6.0	2.5	21.9	1.2	0.1	3.7	1.9	0.5	9.7
	2000	53.4	4.4	18.9	1.3	1.8	2.1	1.6	0.2	6.2	1.1	0.4	8.5
Other rubber	1990	7.2	3.0	3.9	60.0	3.2	2.6	0.2	0.1	1.8	5.5	0.2	12.3

Sectors	year	China	Indo-nesia	Japan	Korea	Malay-sia	Taiwan	Philip-pines	Singa-pore	Thai-land	USA	Hong Kong	Rest of the World
products	2000	11.4	10.2	13.6	6.1	24.1	4.3	0.4	0.6	14.9	2.5	0.4	11.4
Boilers, Engines and turbines	1990	0.8	0.3	89.6	1.0	0.1	0.5	0.1	0.1	0.1	1.6	0.1	5.7
	2000	5.0	1.2	66.5	11.8	2.0	0.4	0.4	0.1	0.6	3.6	0.2	8.2
Tires and tubes	1990	0.5	1.6	58.5	13.2	2.1	7.6	0.1	0.2	2.6	2.6	0.1	10.9
	2000	14.0	2.6	48.4	12.0	0.6	4.8	0.2	0.5	2.8	2.3	0.2	11.5
Synthetic resins and fiber	1990	2.1	0.8	56.7	7.6	0.4	6.1	0.1	3.8	0.1	5.5	0.1	16.6
	2000	3.0	3.5	46.8	11.9	1.3	6.0	0.1	0.7	5.0	3.6	0.1	17.8
Weaving and dyeing	1990	75.2	0.7	6.2	3.3	0.5	2.8	0.0	0.1	0.6	2.6	1.9	6.1
	2000	21.8	5.3	14.2	20.9	2.3	10.2	0.9	0.3	7.3	2.6	0.7	13.6
Other wooden products	1990	17.5	9.6	2.9	1.9	5.5	28.1	9.0	0.2	9.8	3.9	0.6	11.0
	2000	50.8	10.4	2.6	1.0	5.1	5.3	4.5	0.2	6.1	1.7	0.5	11.8
Pulp and paper	1990	20.8	0.8	21.8	10.5	1.3	19.8	1.7	1.1	1.2	6.9	0.9	13.2
	2000	23.8	6.8	32.5	12.7	0.5	2.0	0.8	0.3	1.9	4.0	0.5	14.3
Shipbuilding	1990	1.2	0.5	40.4	1.4	0.5	30.7	0.2	9.0	0.3	4.3	0.3	11.4
	2000	2.1	0.4	12.4	53.2	1.0	8.7	0.1	2.1	0.2	4.6	0.7	14.6
Glass and glass products	1990	12.6	1.7	37.0	7.0	0.7	24.4	0.4	0.6	1.8	2.9	0.5	10.3
	2000	33.5	2.3	37.5	2.6	3.2	6.5	1.6	0.3	1.6	1.7	0.3	8.8
Refined petroleum and its products	1990	12.6	24.0	3.7	1.7	6.2	0.1	0.0	7.4	0.0	0.9	0.2	43.1
	2000	17.3	9.3	6.6	9.7	10.9	0.3	0.1	2.3	1.2	1.1	0.2	41.1
Cement and cement products	1990	0.4	0.4	91.8	0.3	0.1	0.1	0.0	0.0	0.1	0.6	0.0	6.1
	2000	56.7	1.5	2.4	6.5	0.3	1.3	0.7	0.1	20.7	1.0	0.5	8.4
Printing and publishing	1990	4.5	0.4	58.4	6.1	0.9	4.6	0.0	12.7	0.5	2.7	0.3	8.9
	2000	33.3	10.9	16.7	6.4	2.0	2.0	0.1	12.4	1.3	2.7	0.7	11.4
Spinning	1990	13.7	2.4	6.8	13.2	2.0	13.6	2.1	3.7	13.3	7.9	0.8	20.5
	2000	7.9	7.8	7.6	19.8	0.8	2.8	6.7	0.3	21.4	5.3	0.5	19.0
Chemical fertilizers and pesticides	1990	4.4	0.6	67.9	1.3	5.4	2.9	0.0	0.2	0.1	3.7	0.2	13.3
	2000	17.8	0.8	54.5	6.6	1.5	0.6	0.3	0.2	2.6	3.0	0.2	11.9

Data Source: Author computed from Asia Input-Output Table, compiled by the Institute of Development Economics, Ministry of Economics, Trade and Industry, Japan.

Table 2c Decomposition of Manufacture Trade Flow between East Asia and the United States, by Sector, 1990 and 2000, in Millions of U.S. Dollars

Sector	Year	Gross Trade		Value-added Imports from U.S		Value-added Exports to U.S.		U.S. Balance of trade		Share of VA manufac. Exports
(1)	(2)	Exports (3)	Imports (4)	Total (5)	Indirect (6)	Total (7)	Indirect (8)	Value-added (9)	Gross (10)	(11)
Electronics and electronic products	1990	47,934	15,516	15,116	1,555	40,003	6,030	-24,887	-32,418	31.8
	2000	126,855	42,531	45,949	11,542	96,619	23,625	-50,670	-84,324	37.5
Motor vehicles	1990	30,249	1,897	1,658	87	28,135	495	-26,477	-28,352	22.4
	2000	47,904	3,056	2,645	172	44,271	1,567	-41,626	-44,848	17.2
Machinery	1990	10,685	7,139	6,960	312	9,538	472	-2,578	-3,546	7.6
	2000	20,958	14,356	13,523	929	18,893	1,043	-5,370	-6,602	7.3
Other manufacturing products	1990	7,781	1,718	1,670	120	6,431	462	-4,761	-6,063	5.1
	2000	13,523	2,198	2,071	132	11,675	963	-9,604	-11,325	4.5
Other electric machinery and appliance	1990	4,699	1,031	1,008	67	4,028	296	-3,020	-3,667	3.2
	2000	12,698	2,609	2,574	348	10,836	958	-8,263	-10,090	4.2
Wearing apparel	1990	5,923	128	178	64	4,514	696	-4,337	-5,795	3.6
	2000	10,555	219	272	88	8,917	1,299	-8,645	-10,336	3.5
Metal products	1990	5,109	1,225	1,213	88	4,295	288	-3,083	-3,884	3.4
	2000	8,949	1,734	1,749	201	7,648	672	-5,899	-7,215	3.0
Precision machines	1990	4,886	2,973	2,840	111	4,360	219	-1,521	-1,913	3.5
	2000	8,396	8,743	8,246	475	6,867	958	1,379	347	2.7
Leather and leather products	1990	2,246	332	482	182	1,640	162	-1,157	-1,914	1.3
	2000	5,792	524	689	247	4,948	471	-4,260	-5,268	1.9
Other transport equipment	1990	1,857	7,197	6,521	69	1,585	111	4,936	5,340	1.3
	2000	5,691	11,749	9,499	145	4,842	256	4,657	6,057	1.9
Plastic products	1990	2,870	640	696	107	2,318	192	-1,622	-2,230	1.8
	2000	4,508	1,698	1,773	291	3,823	417	-2,050	-2,811	1.5
Iron and steel	1990	2,900	1,205	1,300	214	2,385	108	-1,085	-1,695	1.9
	2000	4,457	858	918	192	3,734	343	-2,816	-3,599	1.5
Heavy Electrical equipment	1990	1,421	1,508	1,587	181	1,219	87	368	87	1.0
	2000	3,773	2,130	2,199	358	3,189	375	-990	-1,643	1.2
Wooden furniture	1990	187	168	176	20	156	16	20	-19	0.1
	2000	3,657	349	350	39	3,163	296	-2,813	-3,308	1.2
Basic industrial chemicals	1990	1,632	4,343	4,069	205	1,249	91	2,820	2,712	1.0
	2000	3,439	5,653	5,240	603	2,709	222	2,531	2,215	1.1
Knitting	1990	2,248	130	242	122	1,789	181	-1,546	-2,117	1.4
	2000	2,595	246	321	112	2,114	296	-1,792	-2,349	0.8
Other made-up textile products	1990	1,525	344	406	98	1,184	103	-778	-1,181	0.9
	2000	2,582	435	479	104	2,211	214	-1,732	-2,147	0.9
Non-ferrous metal	1990	1,156	4,001	3,678	238	808	66	2,870	2,845	0.6
	2000	2,531	3,358	2,845	252	1,913	189	933	826	0.7

Sector	Year	Gross Trade		Value-added Imports from U.S		Value-added Exports to U.S.		U.S. Balance of trade		Share of VA manufac. Exports
(1)	(2)	Exports	Imports	Total	Indirect	Total	Indirect	Value-added	Gross	(11)
		(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
Other chemical products	1990	377	2,300	2,225	105	321	16	1,904	1,923	0.3
	2000	2,377	4,165	3,991	331	2,047	124	1,944	1,788	0.8
Drugs and medicine	1990	397	744	708	9	366	6	342	347	0.3
	2000	2,357	2,246	1,879	21	2,142	71	-263	-112	0.8
Other non-metallic mineral products	1990	1,271	301	301	20	1,129	41	-828	-970	0.9
	2000	2,054	440	434	33	1,843	91	-1,409	-1,615	0.7
Other rubber products	1990	3,250	190	208	34	2,696	246	-2,488	-3,061	2.1
	2000	1,776	267	275	42	1,522	183	-1,246	-1,509	0.6
Boilers, Engines and turbines	1990	682	504	483	19	632	9	-149	-178	0.5
	2000	1,770	2,691	2,360	60	1,578	54	782	921	0.6
Tires and tubes	1990	1,072	134	124	6	927	89	-803	-939	0.7
	2000	1,769	133	143	30	1,520	128	-1,377	-1,636	0.6
Synthetic resins and fiber	1990	591	1,663	1,705	228	457	34	1,247	1,072	0.4
	2000	1,556	1,695	1,778	382	1,215	127	564	139	0.5
Weaving and dyeing	1990	1,466	265	382	142	1,221	73	-839	-1,200	1.0
	2000	1,498	235	435	237	1,246	145	-811	-1,263	0.5
Other wooden products	1990	837	628	610	30	729	64	-119	-209	0.6
	2000	1,378	660	647	74	1,186	84	-539	-718	0.5
Pulp and paper	1990	557	2,606	2,402	75	446	24	1,956	2,049	0.4
	2000	1,331	3,573	3,330	250	1,078	73	2,252	2,242	0.4
Shipbuilding	1990	112	793	776	33	94	16	682	681	0.1
	2000	1,025	573	552	46	823	124	-270	-452	0.3
Glass and glass products	1990	342	312	314	21	296	17	18	-31	0.2
	2000	995	762	761	62	886	52	-125	-233	0.3
Refined petroleum and its products	1990	363	1,546	1,200	94	191	43	1,010	1,184	0.2
	2000	936	1,972	1,487	222	539	66	948	1,037	0.2
Cement and cement products	1990	56	10	13	4	52	1	-39	-46	0.0
	2000	670	22	24	4	605	33	-581	-648	0.2
Printing and publishing	1990	316	328	316	7	280	11	36	12	0.2
	2000	562	627	603	18	483	34	120	65	0.2
Spinning	1990	62	272	360	111	44	5	316	210	0.0
	2000	203	160	225	88	153	21	72	-44	0.1
Chemical fertilizers and pesticides	1990	76	926	855	27	63	2	793	850	0.0
	2000	104	1,056	917	32	87	6	830	952	0.0

Data Source: Author computed from Asia Input-Output Table, compiled by the Institute of Development Economics, Ministry of Economics, Trade and Industry, Japan.

Note: a. in Millions of U.S. Dollars

Table-3a Foreign vs. Domestic Value-added in East Asia Electronics Exports to the U.S. Market, 1990 and 2000

Source Country *(1)*	*Final goods exports* *(2)*	*Interme-diate goods exports* *(3)*	*Int. share in gross exports* *(4)*	*Total domestic Value-added* *(5)*	*Domestic value-added via others in East Asia* *(6)*	*Foreign value-added from others in East Asia* *(7)*	*Total foreign value-added* *(8)*	*U.S. Domestic Content* *(9)*
				1990				
China	1,130	294	20.7	75.7	6.3	6.3	24.3	1.4
Indonesia	10	10	48.6	62.0	-	15.4	38.0	3.4
Japan	15,299	8,963	36.9	91.4	15.7	1.6	8.6	2.2
Korea	2,566	2,210	46.3	60.3	8.0	20.4	39.7	8.2
Malaysia	1,321	1,571	54.3	50.9	16.9	19.4	49.1	7.3
Philippines	203	350	63.3	49.2	28.9	27.5	50.8	12.4
Singapore	4,101	2,502	37.9	37.6	3.6	32.4	62.4	13.5
Thailand	832	516	38.3	38.4	8.6	30.0	61.6	17.0
Taiwan	3,415	2,642	43.6	51.0	6.1	21.8	49.0	9.9
Total	28,876	19,057	39.8	83.9	12.0	0.0	16.1	5.9
				2000				
China	10,247	4,359	29.8	63.4	6.9	14.1	36.6	3.9
Indonesia	667	330	33.1	73.3	44.6	8.3	26.7	2.1
Japan	15,733	20,305	56.3	87.7	28.8	4.0	12.3	2.5
Korea	5,971	12,450	67.6	54.9	17.5	18.0	45.1	10.3
Malaysia	7,470	8,359	52.8	30.0	7.8	32.1	70.0	13.3
Philippines	281	4,395	94.0	33.4	104.0	30.1	66.6	13.4
Singapore	4,681	8,183	63.6	37.3	15.2	29.5	62.7	9.7
Thailand	2,314	3,191	58.0	35.2	13.8	32.5	64.8	11.1
Taiwan	6,145	11,773	65.7	46.0	15.3	25.8	54.0	8.0
Total	53,509	73,346	57.8	77.0	17.6	0.0	23.0	6.8

Data Source: Author computed from Asia Input-Output Table, compiled by the Institute of Development Economics, Ministry of Economics, Trade and Industry, Japan.

Note: a. in Millions of U.S. Dollars

Table 3b: Tracing Foreign Value Added in Electronics Made in East Asian Sold at the U.S. Market

Source country	China	Indo-nesia	Japan	Korea	Malay-sia	Taiwan	Philip-pines	Singa-pore	Thai-land	United States	Hong Kong	Rest of World	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
						1990, in percent							
China	-	0.5	19.3	2.2	0.8	2.3	0.1	0.4	0.2	5.9	53.2	15.2	100.0
Indonesia	1.1	-	26.3	3.1	1.0	5.1	0.2	3.0	0.6	8.9	4.6	46.0	100.0
Japan	2.3	3.0	-	4.3	1.7	4.3	0.9	1.1	0.9	25.1	1.3	55.0	100.0
Korea	0.2	0.8	45.1	-	1.4	2.0	0.4	1.0	0.3	20.7	3.3	24.6	100.0
Malaysia	1.1	1.0	23.0	1.9	-	3.2	0.6	7.9	0.8	14.8	2.1	43.6	100.0
Taiwan	0.2	0.6	37.2	2.2	1.7	-	0.6	1.6	0.4	20.2	4.6	30.6	100.0
Philippines	0.3	0.4	41.4	2.2	1.3	2.8	-	5.2	0.4	24.3	6.2	15.3	100.0
Singapore	0.9	0.8	35.7	3.0	5.6	3.3	1.0	-	1.6	21.6	4.3	22.2	100.0
Thailand	0.8	0.4	32.2	2.4	2.1	3.3	0.4	7.0	-	27.6	2.3	21.5	100.0
Total[a]	**3.2**	**0.3**	**56.7**	**6.1**	**3.1**	**6.8**	**0.5**	**5.8**	**1.4**	**5.9**	**1.4**	**8.7**	**100.0**
						2000, in percent							
China	-	0.9	16.2	7.4	2.2	7.8	1.0	2.0	1.2	10.6	16.5	34.3	100.0
Indonesia	3.9	-	14.9	3.9	1.8	2.1	0.2	2.4	1.7	7.9	1.2	59.9	100.0
Japan	5.4	2.7	-	7.4	3.5	8.3	2.1	2.1	1.4	20.7	4.2	42.2	100.0
Korea	4.0	0.9	24.7	-	2.3	4.0	1.2	2.1	0.8	22.9	5.2	32.0	100.0
Malaysia	3.2	1.5	21.4	4.0	-	4.4	1.6	7.2	2.5	19.0	5.2	29.9	100.0
Taiwan	3.2	1.2	28.3	6.5	2.7	-	1.9	2.6	1.3	14.9	4.0	33.3	100.0
Philippines	1.5	0.6	27.9	5.7	1.8	3.1	-	3.4	1.3	20.1	5.7	29.0	100.0
Singapore	4.3	1.4	25.4	3.5	7.3	3.0	0.5	-	1.7	15.4	2.7	35.0	100.0
Thailand	5.7	1.8	24.9	5.0	3.8	3.6	1.1	4.3	-	17.2	3.9	28.9	100.0
Total[a]	**13.5**	**1.5**	**34.2**	**8.1**	**5.3**	**7.0**	**0.7**	**4.6**	**2.1**	**6.8**	**2.6**	**13.5**	**100.0**

Data Source: Author computed from Asia Input-Output Table, compiled by the Institute of Development Economics, Ministry of Economics, Trade and Industry, Japan.

Note. a. The total also include each countries domestic value-added, it is the value-added structure of final goods made in East Asia sold at U.S. market

Table 3c Decomposition of Electronic Trade Flow between East Asia and the United States by Countries, in Millions of U.S. Dollars

	Gross Trade		Value-added Imports from U.S			Value-added Exports to U.S.			U.S. Balance of trade		% of Each Country			
Source country (1)	Exports (2)	Imports (3)	Total (4)	Direct (5)	Indirect (6)	Total (7)	Direct (8)	Indirect (9)	Gross (10)	Value-added (11)	Gross exports (12)	VA exports (13)	Gross imports (14)	VA imports (15)
							1990							
China	1,424	369	366	322	43	1,196	1,077	119	-1,055	-830	3.0	3.0	2.4	2.4
Indonesia	20	52	59	45	13	159	12	147	32	-101	0.0	0.4	0.3	0.4
Japan	24,262	6,881	6,358	6,015	343	26,377	22,170	4,207	-17,381	-20,019	50.6	65.9	44.3	42.1
Korea	4,776	1,881	1,815	1,644	171	3,222	2,880	342	-2,895	-1,407	10.0	8.1	12.1	12.0
Malaysia	2,892	1,577	1,637	1,378	259	1,839	1,471	368	-1,315	-202	6.0	4.6	10.2	10.8
Philippines	554	247	247	215	32	372	272	99	-307	-124	1.2	0.9	1.6	1.6
Singapore	6,602	1,974	2,080	1,726	355	2,760	2,483	277	-4,628	-680	13.8	6.9	12.7	13.8
Thailand	1,348	881	919	770	149	637	518	119	-467	282	2.8	1.6	5.7	6.1
Taiwan	6,057	1,655	1,635	1,446	188	3,441	3,090	352	-4,402	-1,806	12.6	8.6	10.7	10.8
Total	47,934	15,516	15,116	13,562	1,555	40,003	33,973	6,030	-32,418	-24,887	100.0	100.0	100.0	100.0
							2000							
China	14,606	4,400	5,398	3,559	1,839	11,104	9,262	1,841	-10,206	-5,705	11.5	11.5	10.3	11.7
Indonesia	997	83	101	67	34	1,449	731	718	-915	-1,348	0.8	1.5	0.2	0.2
Japan	36,038	12,451	13,167	10,073	3,094	43,476	31,607	11,869	-23,587	-30,309	28.4	45.0	29.3	28.7
Korea	18,421	8,021	7,517	6,489	1,029	12,557	10,111	2,446	-10,401	-5,039	14.5	13.0	18.9	16.4
Malaysia	15,829	6,243	6,658	5,050	1,608	6,260	4,750	1,511	-9,586	398	12.5	6.5	14.7	14.5
Philippines	4,676	2,029	2,050	1,642	408	2,257	1,561	697	-2,647	-207	3.7	2.3	4.8	4.5
Singapore	12,864	2,899	3,697	2,345	1,351	6,491	4,794	1,697	-9,965	-2,794	10.1	6.7	6.8	8.0
Thailand	5,505	2,099	2,282	1,698	584	2,709	1,937	772	-3,407	-427	4.3	2.8	4.9	5.0
Taiwan	17,918	4,307	5,079	3,485	1,594	10,316	8,241	2,075	-13,611	-5,237	14.1	10.7	10.1	11.1
Total	126,855	42,531	45,949	34,407	11,542	96,619	72,994	23,625	-84,324	-50,670	100.0	100.0	100.0	100.0

Data Source: Author computed from Asia Input-Output Table, compiled by the Institute of Development Economics, Ministry of Economics, Trade and Industry, Japan.

Table-4a Foreign vs. Domestic Value-added in East Asia Machinery Exports to the U.S. Market, 1990 and 2000

Source Country *(1)*	*Final goods exports* *(2)*	*Interme-diate goods exports* *(3)*	*Int. share in gross exports* *(4)*	*Total domestic Value-added* *(5)*	*Domestic value-added via others in East Asia* *(6)*	*Foreign value-added from others in East Asia* *(7)*	*Total foreign value-added* *(8)*	*U.S. Domestic Content* *(9)*
				1990				
China	134	208	60.8	89.1	8.9	2.7	10.9	1.2
Indonesia	1	0	0.0	39.6	-	6.8	60.4	0.9
Japan	4,591	2,596	36.1	92.7	4.3	1.2	7.3	1.1
Korea	155	117	43.1	73.5	13.0	9.8	26.5	4.7
Malaysia	26	57	68.9	67.8	47.1	13.1	32.2	2.9
Philippines	10	7	39.7	68.0	50.8	12.9	32.0	6.2
Singapore	91	194	68.1	49.5	7.1	23.9	50.5	10.7
Thailand	13	43	76.6	60.6	49.1	16.4	39.4	2.3
Taiwan	1,787	654	26.8	67.6	0.5	10.8	32.4	4.1
Total	6,809	3,877	36.3	89.2	4.3	0.0	11.8.	2.1
				2000				
China	1,207	1,121	48.2	82.1	7.6	6.5	17.9	1.3
Indonesia	117	65	35.6	42.6	39.9	23.9	57.4	7.9
Japan	9,452	4,878	34.0	92.2	3.1	1.8	7.8	1.2
Korea	665	656	49.7	74.0	9.7	8.4	26.0	3.5
Malaysia	218	184	45.7	60.1	13.1	16.9	39.9	4.9
Philippines	36	15	29.9	55.2	26.7	19.4	44.8	2.4
Singapore	144	58	28.6	51.4	12.9	22.5	48.6	9.0
Thailand	49	81	62.4	57.3	44.0	20.5	42.7	3.2
Taiwan	1,249	763	37.9	60.9	4.0	16.4	39.1	5.1
Total	13,137	7,821	37.3	90.5	4.7	0.0	9.5	1.9

Data Source: Author computed from Asia Input-Output Table, compiled by the Institute of Development Economics, Ministry of Economics, Trade and Industry, Japan.

Note: a. in Millions of U.S. Dollars

Table 4b: Tracing Foreign Value Added in Machinery Made in East Asian Sold at the U.S. Market

Source country	China	Indo-nesia	Japan	Korea	Malay-sia	Taiwan	Philip-pines	Singa-pore	Thai-land	United States	Hong Kong	Rest of World	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
						1990, in percent							
China	-	1.4	17.1	1.0	1.6	2.2	0.2	0.5	0.6	10.6	24.4	40.4	100.0
Indonesia	0.2	-	10.0	0.3	0.1	0.2	0.0	0.3	0.1	1.5	0.1	87.0	100.0
Japan	2.9	4.0	-	2.8	1.4	2.1	0.8	0.7	1.3	15.1	0.7	68.4	100.0
Korea	0.2	1.4	32.4	-	1.2	1.1	0.2	0.4	0.3	17.7	0.5	44.8	100.0
Malaysia	2.4	1.2	25.8	2.4	-	3.1	0.3	4.7	0.9	9.1	1.3	48.9	100.0
Taiwan	0.2	1.2	28.1	1.6	0.9	-	0.4	0.6	0.3	12.5	2.2	51.9	100.0
Philippines	0.4	0.5	24.5	4.9	1.4	5.7	-	2.5	0.3	19.3	2.5	38.0	100.0
Singapore	1.9	1.1	36.4	1.9	3.1	2.1	0.2	-	0.7	21.1	0.7	30.9	100.0
Thailand	2.7	0.5	30.7	1.7	1.3	3.2	0.2	1.4	-	5.9	1.0	51.3	100.0
Total[a]	1.9	0.3	65.5	2.0	0.4	17.9	0.2	0.8	0.2	2.1	0.3	8.4	100.0
						2000, in percent							
China	-	1.4	18.4	6.4	1.0	7.1	0.3	0.7	0.8	7.2	4.8	51.9	100.0
Indonesia	3.3	-	27.3	2.8	2.1	3.8	0.3	1.3	0.7	13.7	0.8	43.7	100.0
Japan	7.0	3.9	-	3.9	1.9	3.2	0.7	0.8	1.6	15.7	1.8	59.5	100.0
Korea	4.3	1.9	23.2	-	0.9	1.1	0.2	0.6	0.4	13.5	1.5	52.4	100.0
Malaysia	3.4	2.2	22.9	3.5	-	3.8	0.4	4.5	1.8	12.4	2.2	43.1	100.0
Taiwan	5.0	1.3	29.3	2.8	1.1	-	0.6	1.0	0.9	13.0	2.1	43.1	100.0
Philippines	3.1	4.6	19.3	5.3	3.7	4.6	-	1.6	1.1	5.3	1.6	49.8	100.0
Singapore	2.9	4.0	29.5	2.3	4.0	1.8	0.2	-	1.4	18.5	1.2	34.0	100.0
Thailand	3.4	1.1	34.3	2.1	1.9	3.3	0.4	1.4	-	7.6	0.8	43.7	100.0
Total[a]	8.2	0.7	68.5	4.2	1.2	6.2	0.2	0.7	0.4	1.9	0.3	7.3	100.0

Data Source: Author computed from Asia Input-Output Table, compiled by the Institute of Development Economics, Ministry of Economics, Trade and Industry, Japan.

Note. a. The total also include each countries domestic value-added, it is the value-added structure of final goods made in East Asia sold at U.S. market.

Table 4c Decomposition of Machinery Trade Flow between East Asia and the United States by Countries, in Millions of U.S. Dollars

	Gross Trade		Value-added Imports from U.S			Value-added Exports to U.S.			U.S. Balance of trade		% of Each Country			
Source country (1)	Exports (2)	Imports (3)	Total (4)	Direct (5)	Indirect (6)	Total (7)	Direct (8)	Indirect (9)	Gross (10)	Value-added (11)	Gross exports (12)	VA exports (13)	Gross imports (14)	VA imports (15)
							1990							
China	342.9	761.5	748.5	709.2	39.3	326.2	305.5	20.6	418.6	422.3	3.2	3.4	10.7	10.8
Indonesia	0.5	44.8	64.3	41.7	22.5	33.9	0.2	33.7	44.3	30.4	0.0	0.4	0.6	0.9
Japan	7,187.1	1,808.2	1,726.0	1,684.0	42.0	6,985.1	6,665.7	319.4	-5,378.8	-5,259.0	67.3	73.2	25.3	24.8
Korea	272.6	1,565.2	1,504.6	1,457.7	46.9	232.1	200.3	31.8	1,292.6	1,272.5	2.6	2.4	21.9	21.6
Malaysia	82.5	328.7	352.5	306.1	46.4	76.5	55.9	20.6	246.2	276.0	0.8	0.8	4.6	5.1
Philippines	16.9	536.5	516.2	499.7	16.5	19.4	11.5	7.9	519.6	496.7	0.2	0.2	7.5	7.4
Singapore	285.2	1,084.5	1,035.1	1,010.0	25.1	151.5	141.1	10.3	799.3	883.6	2.7	1.6	15.2	14.9
Thailand	56.4	146.8	171.3	136.7	34.6	44.7	34.2	10.5	90.4	126.6	0.5	0.5	2.1	2.5
Taiwan	2,441.1	863.0	842.0	803.8	38.3	1,668.7	1,651.3	17.4	-1,578.0	-826.7	22.8	17.5	12.1	12.1
Total	10,685.2	7,139.3	6,960.5	6,648.9	311.6	9,538.0	9,065.9	472.2	-3,545.9	-2,577.6	100.0	100.0	100.0	100.0
							2000							
China	2,328.2	1,895.0	1,906.5	1,662.3	244.2	2,059.7	1,912.4	147.3	-433.2	-153.2	11.1	10.9	13.2	14.1
Indonesia	182.3	347.2	346.2	304.6	41.6	152.6	77.7	75.0	164.9	193.5	0.9	0.8	2.4	2.6
Japan	14,330.0	3,602.9	3,272.3	3,160.6	111.7	13,711.9	13,207.8	504.1	-10,727.1	-10,439.6	68.4	72.6	25.1	24.2
Korea	1,320.2	2,607.6	2,375.8	2,287.5	88.3	1,082.7	977.1	105.6	1,287.5	1,293.1	6.3	5.7	18.2	17.6
Malaysia	402.1	825.6	829.6	724.3	105.3	287.2	241.7	45.5	423.6	542.3	1.9	1.5	5.8	6.1
Philippines	51.5	382.7	376.3	335.7	40.6	43.9	28.4	15.4	331.2	332.5	0.2	0.2	2.7	2.8
Singapore	201.8	1,551.5	1,478.0	1,361.0	116.9	135.1	103.7	31.4	1,349.7	1,342.9	1.0	0.7	10.8	10.9
Thailand	130.4	276.8	291.0	242.8	48.2	109.2	74.7	34.5	146.5	181.8	0.6	0.6	1.9	2.2
Taiwan	2,011.5	2,866.9	2,647.4	2,514.9	132.5	1,310.2	1,225.9	84.3	855.4	1,337.2	9.6	6.9	20.0	19.6
Total	20,957.9	14,356.3	13,523.1	12,593.7	929.4	18,892.6	17,849.4	1,043.2	-6,601.7	-5,369.5	100.0	100.0	100.0	100.0

Data Source: Author computed from Asia Input-Output Table, compiled by the Institute of Development Economics, Ministry of Economics, Trade and Industry, Japan.

Table-5a Foreign vs. Domestic Value-added in East Asia Wearing Apparel exports to U.S. Market, 1990 and 2000

Source Country	*Final goods exports*	*Interme-diate goods exports*	*Int. share in gross exports*	*Total domestic Value-added*	*Domestic value-added via others in East Asia*	*Foreign value-added from others in East Asia*	*Total foreign value-added*	*U.S. Domestic Content*
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*
				1990				
China	424	55	11.6	73.9	10.1	3.1	26.1	0.9
Indonesia	495	64	11.5	74.4	6.7	8.0	25.6	3.2
Japan	99	12	11.1	88.8	272.8	2.6	11.2	1.1
Korea	1,113	337	23.2	63.9	4.4	9.5	36.1	4.4
Malaysia	289	31	9.7	57.7	8.9	23.5	42.3	2.4
Philippines	673	88	11.5	49.0	0.3	16.0	51.0	8.2
Singapore	527	69	11.6	49.9	2.7	27.2	50.1	3.5
Thailand	280	36	11.4	70.7	5.1	11.4	29.3	3.2
Taiwan	1,059	270	20.3	71.0	13.2	7.6	29.0	3.5
Total	4,960	963	16.3	76.3	11.9	0.0	24.7	3.9
				2000				
China	2,805	232	7.6	85.1	8.1	6.7	14.9	0.9
Indonesia	1,230	102	7.6	75.1	6.3	9.7	24.9	1.6
Japan	38	3	7.6	88.6	896.6	3.8	11.4	0.9
Korea	1,814	150	7.6	73.0	9.5	10.7	27.0	2.1
Malaysia	437	36	7.6	35.5	9.3	32.3	64.5	5.6
Philippines	1,514	125	7.6	58.9	0.3	21.3	41.1	3.0
Singapore	296	24	7.6	46.1	11.9	16.5	53.9	2.9
Thailand	1,109	92	7.6	75.9	4.8	11.0	24.1	1.8
Taiwan	505	42	7.6	68.1	48.3	12.1	31.9	3.3
Total	9,750	805	7.6	84.5	12.3	0.0	15.5	2.0

Data Source: Author computed from Asia Input-Output Table, compiled by the Institute of Development Economics, Ministry of Economics, Trade and Industry, Japan.

Note: a. in Millions of U.S. Dollars.

Table 5b: Tracing Foreign Value Added in Wearing Apparel Made in East Asian Sold at the U.S. Market

Source country	China	Indo-nesia	Japan	Korea	Malay-sia	Taiwan	Philip-pines	Singa-pore	Thai-land	United States	Hong Kong	Rest of World	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
						1990, in percent							
China	-	0.3	6.2	0.7	0.3	4.2	0.0	0.1	0.2	3.3	73.1	11.6	100.0
Indonesia	3.8	-	10.5	5.8	1.1	7.3	0.2	1.7	0.9	12.4	4.6	51.6	100.0
Japan	11.3	2.6	-	4.6	1.1	2.4	0.2	0.3	0.8	10.2	1.2	65.3	100.0
Korea	0.3	1.2	19.8	-	0.6	3.7	0.1	0.2	0.3	12.1	1.5	60.2	100.0
Malaysia	6.6	2.9	15.8	4.4	-	19.1	0.2	4.5	2.0	5.7	12.1	26.8	100.0
Taiwan	0.3	1.2	18.8	4.2	0.6	-	0.1	0.4	0.5	12.1	3.4	58.4	100.0
Philippines	1.8	1.5	9.1	3.7	0.8	13.0	-	0.9	0.5	16.0	12.7	40.0	100.0
Singapore	5.9	5.3	19.2	1.7	6.0	14.0	0.1	-	2.2	6.9	9.4	29.4	100.0
Thailand	6.4	1.5	14.8	6.0	1.4	7.2	0.1	1.4	-	10.8	3.3	47.0	100.0
Total[a]	7.2	8.1	7.2	15.3	3.9	18.0	6.7	5.6	4.3	3.9	3.8	16.0	100.0
						2000, in percent							
China	-	1.9	19.4	10.5	0.9	10.3	0.2	0.6	1.0	6.2	7.1	41.8	100.0
Indonesia	6.9	-	9.4	10.1	1.9	8.2	0.2	0.8	1.6	6.6	4.9	49.5	100.0
Japan	16.3	5.1	-	5.3	1.8	2.4	0.2	0.2	2.2	7.8	2.0	56.7	100.0
Korea	18.9	3.5	11.5	-	1.0	3.4	0.1	0.2	1.1	7.7	0.8	51.8	100.0
Malaysia	6.6	4.7	16.8	3.0	-	10.4	0.3	5.3	2.9	8.7	7.9	33.3	100.0
Taiwan	4.5	4.1	18.2	6.6	1.5	-	0.5	0.5	2.1	10.3	1.5	50.2	100.0
Philippines	7.3	3.6	9.1	9.1	1.2	17.0	-	0.8	3.7	7.2	14.1	26.9	100.0
Singapore	7.8	0.9	5.6	3.6	7.1	2.5	0.4	-	2.8	5.3	9.3	54.7	100.0
Thailand	11.0	3.2	13.1	5.7	1.8	7.4	0.3	3.1	-	7.3	2.5	44.6	100.0
Total[a]	26.8	10.3	3.9	15.4	2.0	6.0	9.2	1.8	9.2	2.0	1.9	11.6	100.0

Data Source: Author computed from Asia Input-Output Table, compiled by the Institute of Development Economics, Ministry of Economics, Trade and Industry, Japan.

Note. a. The total also include each countries domestic value-added, it is the value-added structure of final goods made in East Asia sold at U.S. market

Table 5c Decomposition of Wearing Apparel Trade Flow between East Asia and the United States by Countries, in Millions of U.S. Dollars

	Gross Trade		Value-added Imports from U.S			Value-added Exports to U.S.			U.S. Balance of trade		% of Each Country			
Source country (1)	Exports (2)	Imports (3)	Total (4)	Direct (5)	Indirect (6)	Total (7)	Direct (8)	Indirect (9)	Gross (10)	Value-added (11)	Gross exports (12)	VA exports (13)	Gross imports (14)	VA imports (15)
							1990							
China	479.6	0.2	0.2	0.2	0.0	403.1	354.4	48.7	-479.4	-402.9	8.1	8.9	0.1	0.1
Indonesia	559.2	0.4	0.5	0.4	0.1	454.8	416.2	38.7	-558.8	-454.4	9.4	10.1	0.3	0.3
Japan	111.7	110.1	156.6	97.8	58.7	425.7	99.2	326.6	-1.7	-269.2	1.9	9.4	85.9	88.1
Korea	1,450.3	2.5	2.5	2.2	0.2	983.2	926.3	56.8	-1,447.8	-980.7	24.5	21.8	1.9	1.4
Malaysia	320.1	0.3	0.8	0.3	0.5	214.5	184.6	29.9	-319.8	-213.8	5.4	4.8	0.3	0.4
Philippines	760.9	8.6	9.0	7.7	1.4	374.6	372.5	2.1	-752.2	-365.5	12.8	8.3	6.7	5.1
Singapore	596.1	3.3	4.5	2.9	1.6	313.5	297.4	16.1	-592.9	-309.0	10.1	6.9	2.6	2.5
Thailand	315.6	1.3	1.3	1.2	0.2	239.8	223.2	16.5	-314.3	-238.4	5.3	5.3	1.0	0.8
Taiwan	1,329.7	1.5	2.4	1.3	1.1	1,105.1	944.5	160.6	-1,328.2	-1,102.7	22.4	24.5	1.2	1.4
Total	5,923.2	128.2	177.8	114.0	63.8	4,514.3	3,818.4	695.9	-5,795.0	-4,336.6	100.0	100.0	100.0	100.0
							2000							
China	3,036.4	1.6	3.8	1.3	2.5	2,829.9	2,583.2	246.7	-3,034.8	-2,826.0	28.8	31.7	0.7	1.4
Indonesia	1,331.8	0.7	0.8	0.6	0.2	1,084.3	1,000.2	84.1	-1,331.1	-1,083.5	12.6	12.2	0.3	0.3
Japan	41.5	137.0	180.4	114.5	65.9	408.9	36.8	372.1	95.5	-228.4	0.4	4.6	62.4	66.4
Korea	1,964.3	10.1	15.0	8.5	6.5	1,620.8	1,434.5	186.3	-1,954.2	-1,605.8	18.6	18.2	4.6	5.5
Malaysia	473.6	2.0	2.3	1.7	0.6	212.0	168.1	43.9	-471.6	-209.7	4.5	2.4	0.9	0.9
Philippines	1,639.3	11.7	13.1	9.8	3.3	970.7	965.1	5.6	-1,627.5	-957.6	15.5	10.9	5.3	4.8
Singapore	320.5	19.7	20.5	16.5	4.0	185.7	147.6	38.1	-300.8	-165.3	3.0	2.1	9.0	7.5
Thailand	1,201.0	32.7	31.1	27.3	3.8	969.1	911.0	58.0	-1,168.4	-937.9	11.4	10.9	14.9	11.5
Taiwan	546.6	3.8	4.8	3.2	1.6	636.0	372.1	263.9	-542.7	-631.3	5.2	7.1	1.7	1.7
Total	10,555.0	219.4	271.9	183.4	88.5	8,917.4	7,618.6	1,298.8	-10,336	-8,645.4	100.0	100.0	100.0	100.0

Data Source: Author computed from Asia Input-Output Table, compiled by the Institute of Development Economics, Ministry of Economics, Trade and Industry, Japan.

Table-6a Foreign vs. Domestic Value-added in East Asia Motor vehicles exports to U.S. Market, 1990 and 2000

Source Country *(1)*	*Final goods exports* *(2)*	*Interme-diate goods exports* *(3)*	*Int. share in gross exports* *(4)*	*Total domestic Value-added* *(5)*	*Domestic value-added via others in East Asia* *(6)*	*Foreign value-added from others in East Asia* *(7)*	*Total foreign value-added* *(8)*	*U.S. Domestic Content* *(9)*
				1990				
China	2	12	86.1	84.5	-	4.5	15.5	1.2
Indonesia	0	1	71.5	72.5	-	15.3	27.5	1.1
Japan	24,587	3,924	13.8	92.3	0.4	1.2	7.7	1.2
Korea	1,177	179	13.2	78.2	3.7	8.7	21.8	3.5
Malaysia	0	4	94.6	57.1	-	30.2	42.9	1.3
Philippines	1	13	93.9	63.3	-	27.7	36.7	1.5
Singapore	2	14	87.1	44.8	440.4	27.6	55.2	8.0
Thailand	1	11	93.5	54.6	-	27.9	45.4	2.9
Taiwan	63	257	80.2	69.8	57.3	9.8	30.2	5.1
Total	25,834	4,416	14.6	93.1	1.5	0.0	6.9	1.3
				2000				
China	481	920	65.6	81.0	42.8	7.1	19.0	1.2
Indonesia	4	76	94.6	79.4	-	9.6	20.6	1.3
Japan	30,270	9,846	24.5	92.1	0.9	2.0	7.9	1.2
Korea	4,331	623	12.6	75.3	1.9	8.2	24.7	3.1
Malaysia	4	33	89.8	57.8	-	24.8	42.2	3.4
Philippines	18	345	95.1	53.8	148.4	22.3	46.2	3.0
Singapore	0	1	93.8	49.2	-	19.0	50.8	5.2
Thailand	14	267	95.0	53.3	843.5	27.7	46.7	3.0
Taiwan	137	535	79.6	70.2	65.4	13.1	29.8	2.5
Total	35,259	12,645	26.4	92.6	2.9	0.0	7.4	1.5

Data Source: Author computed from Asia Input-Output Table, compiled by the Institute of Development Economics, Ministry of Economics, Trade and Industry, Japan.

Note: a. in Millions of U.S. Dollars

Table 6b: Tracing Foreign Value Added in Motor Vehicle and Parts Made in East Asian Sold at the U.S. Market

Source country	China	Indo-nesia	Japan	Korea	Malay-sia	Taiwan	Philip-pines	Singa-pore	Thai-land	United States	Hong Kong	Rest of World	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
						1990, in percent							
China	-	0.8	23.9	0.6	1.4	1.3	0.1	0.3	0.9	7.5	10.3	52.8	100.0
Indonesia	1.1	-	49.6	1.7	0.6	1.4	0.1	0.9	0.3	4.1	0.7	39.5	100.0
Japan	2.5	4.2	-	2.3	1.8	1.8	0.9	0.4	1.3	15.2	0.6	69.0	100.0
Korea	0.2	1.6	34.4	-	1.7	1.1	0.2	0.4	0.3	16.2	0.5	43.4	100.0
Malaysia	0.4	0.8	67.1	0.4	-	0.7	0.1	0.6	0.4	3.1	0.2	26.2	100.0
Taiwan	0.2	0.9	28.0	1.9	0.8	-	0.2	0.3	0.2	16.8	1.2	49.4	100.0
Philippines	0.4	0.6	65.3	5.5	1.1	1.5	-	0.5	0.6	4.2	0.6	19.8	100.0
Singapore	1.1	2.1	39.2	0.6	3.8	1.2	0.1	-	1.6	14.6	0.8	34.7	100.0
Thailand	2.4	0.7	52.4	1.4	1.5	1.6	0.2	1.2	-	6.3	0.6	31.6	100.0
Total[a]	0.2	0.3	88.2	3.7	0.1	0.3	0.1	0.0	0.1	1.3	0.0	5.5	100.0
						2000, in percent							
China	-	1.2	23.1	5.4	0.8	5.5	0.2	0.5	0.7	6.4	3.1	53.3	100.0
Indonesia	3.2	-	33.7	2.5	1.5	2.1	0.3	1.1	1.9	6.1	0.5	47.0	100.0
Japan	6.3	4.2	-	3.2	2.1	3.0	1.0	0.6	4.7	15.7	1.2	58.0	100.0
Korea	5.0	2.2	22.7	-	1.1	1.1	0.2	0.5	0.6	12.7	1.4	52.6	100.0
Malaysia	3.2	2.1	41.4	3.0	-	3.1	0.3	3.5	2.1	8.0	1.7	31.6	100.0
Taiwan	3.3	1.5	33.9	2.9	0.9	-	0.4	0.4	0.7	8.5	1.1	46.5	100.0
Philippines	4.2	5.0	22.0	5.9	2.6	4.3	-	2.0	2.2	6.5	2.6	42.7	100.0
Singapore	4.1	1.9	21.7	2.1	5.0	1.3	0.2	-	1.2	10.2	3.1	49.2	100.0
Thailand	2.8	1.4	47.0	2.1	1.6	2.1	1.4	0.9	-	6.5	0.8	33.3	100.0
Total[a]	1.7	0.4	79.8	9.5	0.2	0.5	0.1	0.1	0.4	1.5	0.1	5.8	100.0

Data Source: Author computed from Asia Input-Output Table, compiled by the Institute of Development Economics, Ministry of Economics, Trade and Industry, Japan.

Note. a. The total also include each countries domestic value-added, it is the value-added structure of final goods made in East Asia sold at U.S. market

Table 6c Decomposition of Motor Vehicle and Parts Trade Flow between East Asia and the United States by Countries, in Millions of U.S. Dollars

	Gross Trade		Value-added Imports from U.S			Value-added Exports to U.S.			U.S. Balance of trade		% of Each Country			
Source country	Exports	Imports	Total	Direct	Indirect	Total	Direct	Indirect	Gross	Value-added	Gross exports	VA exports	Gross imports	VA imports
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
							1990							
China	13.5	56.7	52.0	47.0	5.1	66.5	11.4	55.1	43.2	-14.5	0.0	0.2	3.0	3.1
Indonesia	1.7	22.4	32.0	18.5	13.5	99.7	1.2	98.4	20.7	-67.6	0.0	0.4	1.2	1.9
Japan	28,511.2	841.6	702.6	696.8	5.8	26,457.8	26,317.6	140.3	-27,669.6	-25,755.2	94.3	94.0	44.4	42.4
Korea	1,356.0	152.5	132.4	126.3	6.1	1,112.8	1,061.0	51.9	-1,203.5	-980.5	4.5	4.0	8.0	8.0
Malaysia	4.8	18.8	26.1	15.6	10.6	47.5	2.7	44.8	14.0	-21.4	0.0	0.2	1.0	1.6
Philippines	14.0	26.1	28.5	21.6	6.9	30.2	8.9	21.3	12.1	-1.7	0.0	0.1	1.4	1.7
Singapore	16.2	121.7	108.4	100.7	7.7	18.2	7.3	11.0	105.4	90.1	0.1	0.1	6.4	6.5
Thailand	11.7	52.2	62.5	43.2	19.3	36.7	6.4	30.3	40.5	25.9	0.0	0.1	2.8	3.8
Taiwan	320.3	605.1	513.4	501.0	12.4	266.0	223.5	42.4	284.8	247.4	1.1	0.9	31.9	31.0
Total	30,249.4	1,896.9	1,658.0	1,570.7	87.3	28,135.4	27,640.0	495.4	-28,352.5	-26,477.4	100.0	100.0	100.0	100.0
							2000							
China	1,401.4	190.7	176.9	154.3	22.6	1,415.0	1,135.8	279.2	-1,210.7	-1,238.0	2.9	3.2	6.2	6.7
Indonesia	80.3	163.7	155.2	132.5	22.7	240.5	63.7	176.8	83.5	-85.3	0.2	0.5	5.4	5.9
Japan	40,115.5	2,063.5	1,703.9	1,669.6	34.3	37,452.8	36,935.7	517.2	-38,052.0	-35,748.9	83.7	84.6	67.5	64.4
Korea	4,953.6	285.4	240.1	230.9	9.2	3,867.9	3,731.4	136.5	-4,668.2	-3,627.8	10.3	8.7	9.3	9.1
Malaysia	36.7	42.1	59.0	34.0	25.0	111.8	21.2	90.6	5.4	-52.7	0.1	0.3	1.4	2.2
Philippines	363.0	76.7	75.0	62.1	12.9	232.5	195.2	37.3	-286.3	-157.6	0.8	0.5	2.5	2.8
Singapore	0.9	51.3	49.4	41.5	7.9	32.1	0.4	31.7	50.4	17.3	0.0	0.1	1.7	1.9
Thailand	281.3	66.1	75.8	53.5	22.3	313.0	150.0	162.9	-215.2	-237.2	0.6	0.7	2.2	2.9
Taiwan	671.7	116.5	109.6	94.2	15.4	605.7	471.3	134.4	-555.2	-496.1	1.4	1.4	3.8	4.1
Total	47,904.3	3,055.9	2,644.9	2,472.6	172.3	44,271.3	42,704.7	1,566.6	-44,848.4	-41,626.4	100.0	100.0	100.0	100.0

Data Source: Author computed from Asia Input-Output Table, compiled by the Institute of Development Economics, Ministry of Economics, Trade and Industry, Japan.