11.F

Southeast Asia

Kazuhiko Oyamada, Shinya Arakawa, Satoshi Inomata, Hiroshi Kuwamori, Jun Nakamura, Nobuhiro Okamoto, Takao Sano and Yoko Uchida

11.F.1.   Introduction

The main objective of this document is to explain the characteristics and making procedures of the *Asian International Input-Output Table 1995* (AIO) compiled by the Institute of Developing Economies, Japan External Trade Organization (IDE-JETRO), which is partly included in the GTAP version 6 databases. The original AIO is designed to depict the industrial network extended over the 10 countries in the Asia-Pacific region, i.e., China, Indonesia, Japan, Korea, Malaysia, the Philippines, Singapore, Taiwan, Thailand, and the United States. AIO presents pictures of each domestic industry with its input composition from and output distribution to home industries as well as industries overseas. AIO series are fully available for the years of 1985, 1990, and 1995, and partly available for the year of 1975 in which China and Taiwan are excluded, and the table for the year 2000 will be available in near future.

The main differences of AIO from the input-output tables and trade flow matrix presented by GTAP database are: (1) values of international shipping margin and trade protection are not presented by commodity in AIO, but given as row vectors; (2) AIO includes import matrices by

commodity, by industry, and by country of origin, so that one may capture the input structure of imported commodities from every country included in the table.

The structure of the rest of the document is as follows. In the next section, we present the general outline of AIO, and the relationships between the original AIO and the table we delivered to GTAP. A schematic image of the original AIO may help one to understand those two differences mentioned above. Based on the table we delivered, the Center of Global Trade Analysis, Purdue University, made several modifications to fit the table into the GTAP framework. The procedures adopted in constructing import matrices by commodity, by industry, and by country of origin, and export matrices by commodity and by country of destination in AIO are explained in Section 3.

11.F.2. General Outline of the *Asian International Input-Output Table* in GTAP database

Schematic Image of the Original *Asian International Input-Output Table 1995*

The whole picture of the AIO is given in Figure 1. As seen column-wise, each cell in the table shows input compositions of the industries of respective countries. A^{II}, for instance, shows the input compositions of Indonesian industries vis-à-vis domestically produced goods and services. A^{MI}, on the other hand, shows input compositions of Indonesian industries for the imported goods and services from Malaysia. The cells A^{PI}, A^{SI}, A^{TI}, A^{CI}, A^{NI}, A^{KI}, A^{JI}, and A^{UI} allow the similar interpretation for the imports from other countries.

The transaction values thus tabulated are all given at producers' prices of the origin countries. International freight and insurance paid by Indonesian industries for these imported transactions are all recorded in the row vector BA^{I}. HA^{I} and WA^{I} are input compositions of Indonesian industries vis-à-vis imported goods and services from Hong-Kong and those from the rest of the world, and they are given in C.I.F. values. Import duties and import sales taxes levied on all Indonesian imports are recorded in the row vector DA^{I}.

The value-added items of Indonesian industries are shown in V^{I}. The bottom of the column, X^{I}, is the gross output of Indonesian industries.

Turning to the 11th column from the left side of the table, it shows the compositions of goods and services that have gone to final demand sectors of Indonesia. F^{II} and F^{MI}, for example, respectively map the flow of goods and services produced domestically and imported from Malaysia into final demand sectors of Indonesia. The "Rest of the World" column is read in the similar manner as done for the 1st column of the table.

As seen in row-wise direction, the table shows the output distributions of the commodities produced by domestic industries, to Malaysian industries, the Philippines industries, and so on. F^{II} is

the distribution of Indonesian goods and services to final demand sectors of Indonesia, and F^{IM} is to the final demand sectors of Malaysia, and so on.

LH^I, LE^I, LF^I, LG^I, and LW^I are Indonesian exports to Hong-Kong, the United Kingdom, France, Germany, and the Rest of the World. Q^I is the statistical discrepancies and X^I shows the gross output of Indonesian industries.

All the columns and rows for the other countries can be read in the same manner as the Indonesian example above.

(Figure 1)

Relationships between the Original *Asian International Input-Output Table* and the Data Included in the GTAP Database

The newly released version of the GTAP database includes data for 5 countries from AIO. The countries adopted are Indonesia, Malaysia, the Philippines, Singapore, and Thailand. Before stacking into the GTAP data, the Center of Global Trade Analysis performed several modifications onto the AIO, such as sector conversion, updating from 1995, further estimations of agricultural and services sectors at more disaggregated level, estimations of trade protections and international shipping margin by commodity. Since the center prepares the notes on those modifications, we show the concordance between AIO and GTAP classifications here.

While GTAP database maintains agricultural and services sectors at relatively disaggregated levels, AIO does so for manufacturing sectors. The original AIO includes 50 manufacturing sectors out of 78 industries/commodities, and we aggregated them into 40 sectors to meet the GTAP classification. Since GTAP database includes comparatively detailed agricultural and services sectors, the Center of Global Trade Analysis performs estimation based on the 40-sector AIO to obtain more disaggregated agricultural and services sectors, before stacking it into the database. The concordance between the original 78-sector AIO, 40-sector AIO, and the GTAP classification is shown in Table 1.

(Table 1)

11.F.3.   Compilation Procedures of the *Asian International Input-Output Table*

The compilation of AIO is just like a patchwork using the pieces from each National

Input-Output Table (NIO) of the countries concerned. In this section, we show the steps how the original AIO is constructed.

Step 1: Updating the National Input-Output Tables

Since our AIO have been prepared for the years 1975, 1985, 1990, and 1995, there are countries that do not release their benchmark NIOs for the target years. For the 1995 table, these countries include China, Malaysia, the Philippines, Singapore, and Taiwan. Since the newest available benchmark table of Malaysia is targeted the year 1987, we updated the Malaysian part based on the input-output structure given by our 1990 table, instead of using their NIO. The Singapore part was also updated in the similar way.

The data for updating, such as sectoral gross output (Control Total, CT), sectoral value-added, final demand by commodity, are collected by our local counterparts, i.e., State Information Center and State Statistical Bureau (China), Department of Statistics (Malaysia), National Statistics Office (the Philippines), The National University of Singapore (Singapore), and Taiwan Research Institute (Taiwan). Using the collected data, we apply RAS method to obtain the estimated NIOs that are included in our AIO.

Step 2: Framework Adjustment on National Input-Output Tables for the Compilation of the *Asian International Input-Output Table*

Prior to the compilation, the styles of the national tables have to be modified to the uniform format, so that each constituent table becomes consistent when they are linked one another. Presented below is the method of adjustment for the compilation of AIO.

A. Public Administration

Direction of adjustment: Gross output (CT) is defined as the total amount of expenditure for producing governmental services, with no element of Operating Surplus.

National Tables to be adjusted: Thailand and Indonesia.

Methodology: If the country concerned has backing data of government expenditure, they are utilized to enumerate intermediate transactions of Public Administration sector. If not, the following treatment is to be applied. Each element in the vector of Government Consumption Expenditure (final demand), except those in the cells intersecting with Public Administration, Public Education, and Public Medical Services, is transplanted to the corresponding cell on the column vector of Public Administration (intermediate input). The total input (CT) of Public Administration is increased accordingly. For the output distribution, the same amount as total input is allocated to the intersection with Government Consumption Expenditure as a sole output.

B. Education and Medical Services

Direction of adjustment: Any educational activities, public or private, should be classified into Education/Research sector, and any medical services, public or private, should be classified into Other Services.

National Table to be adjusted: Singapore.

Methodology: The sectors of Public Education and of Public Medical Services are separated from Producers of Government Services, and the former is classified into Education/Research sector and the latter is into Other Services.

C. Imputed Interest (Column Vector)

Direction of adjustment: Intermediate sectors should have an input from Imputed Interest activity of financial services sector.

National Tables to be adjusted: Malaysia and Singapore.

Methodology: The column vector of Imputed Interest is distributed proportionally over to the rows of financial services sectors using the ratios of each sector's value-added to the total value-added of all industry. The increase in the total input of each sector is neutralized by subtracting the same amount from the corresponding sector's Operating Surplus. For the sector whose Operating Surplus is bound to be negative as a result of this operation, the amount must instead be subtracted from the

value-added item showing the largest record.

D. Imputed Interest (Row Vector)

Direction of adjustment: The sector of Imputed Interest should produce its services to intermediate sectors only.

National Tables to be adjusted: the Philippines and Thailand.

Methodology: First, the amount of Imputed Interest on Housing Loans is removed from the cell intersecting with Private Consumption Expenditure, and added to the intersection with the Ownership of Dwelling sector. The same amount if subtracted from the Operating Surplus of Ownership of Dwelling. Next, the rest of Imputed Interest given to the final demand sectors is all weeded away. Since the gross output is reduced as a result, the same amount should be subtracted from the Operating Surplus of corresponding financial services sector in order to resume row-column balances.

E. State-based Account and National (Resident)-based Account

Direction of adjustment: Private Consumption Expenditure should be estimated on the national-based account. All the rest should be estimated on the state-based account.

National Table to be adjusted: Malaysia.

Methodology: Private Consumption Expenditure is re-estimated to the national-based account by using the following conversion formula:

  PCE (national-based) = PCE (state-based) + Direct Purchase (import) - Direct Purchase (export).

For Malaysian table, the totals of Direct Purchases (both import and export) are given in the forth quadrant of the Input-Output table, and hence the figures are to be distributed to each sector.

F. Re-export

Direction of adjustment: The amount of re-export should be subtracted from total import, making it composed of retained import only.

National Table to be adjusted: Malaysia.

Methodology: The domestic trade margins and transportation cost on the re-exported goods, shown in the intersection between Re-export vector (column) and domestic trading/transportation sectors, are removed, and added respectively, after the job of separating the Export vector by country of destination, over to the corresponding cells in the vector of Export to the Rest of the World. The amount of Re-export itself should be subtracted from the total import.

G. Dummy Sectors

Direction of adjustment: Dummy sectors (except Unclassified) should not exist in the table.

National Tables to be adjusted: Japan and Korea.

Methodology: Dummy vectors are distributed proportionally into intermediate sectors, as in the case of bilateral tables. For the Japanese table, Self-operated Passenger Transport, Self-operated Freight Transport, Intra-enterprises Research and Development, Office Supplies are considered to be dummy sectors, and the Korean table, only Office Supplies is the one.

H. Business Consumption

Direction of adjustment: Business Consumption should not be independently presented.

National Tables to be adjusted: Japan and Korea.

Methodology: The column and row vectors of Business Consumption are removed by distributing them proportionally onto intermediate sectors.

I. Repair of Machinery

Direction of adjustment: The sector of Repair of Machinery should not exist in the table.

National Tables to be adjusted: Japan and China.

Methodology: In the Japanese and Chinese tables, the transactions of repairing activities for a machinery equipment are separated from manufacturing activities of the commodity, and grouped into one independent sector. This sector is hence removed and distributed to the appropriate cell of the matrix, and adjusted by the RAS method. For the Japanese table, the row vector is proportionally distributed by using the output shared of machinery manufacturing industries, and the column vector is distributed in accordance with the ratios obtained from the Capital Formation Matrix. For the Chinese table, if no appropriate data is available, the column vector is distributed row-wise in accordance with the output distribution ratios of Repair of Machinery sector.

J. Scraps and By-products

Direction of adjustment: Scrap and by-products should not be explicitly presented.

National Tables to be adjusted: Japan and Korea.

Methodology: Iron Scrap is added to Iron Steel, and Non-ferrous Metal Scrap to Non-ferrous Metal.

K. Valuation

Direction of adjustment: All figures should be valued at producers' prices.

National Tables to be adjusted: Malaysia and Singapore.

Methodology: The matrix of commodity taxes is added to the matrix of intermediate transactions, element by element, and (the transpose of) the vector of row totals of commodity taxes will replace the vector of Indirect Taxes. Gross output and gross input of each sector are increased by the

corresponding amount.

Step 3: Compilation of Import Matrices by Commodity, by Industry, and by Country of Origin

A. Compilation of a Matrix of Special Imports

i. The vector of Direct Purchases by commodity is defined by subtracting commodity imports, presented by trade statistics with NIO classification, from the vector of sectoral total of import excluding services sectors, obtained by summing-up row-wise the original import matrix of NIO.

ii. A Matrix of Special Imports is compiled by putting the Direct Purchases by commodity into the Private Consumption part of the original import matrix of NIO, which includes only services sectors.

iii. The value on the transacting point of the Private Consumption and Petroleum Products in the Matrix of Special Imports, obtained in **Step 3-A-ii**, is divided and moved to the Sea Transportation and Air Transportation sectors.

iv. The Matrix of Special Imports, obtained in **Step 3-A-iii**, will be included into the matrix of imports from the Rest of the World.

B. Compilation of a Matrix of Commodity Imports

i. A Modified Import Matrix is obtained by subtracting the Matrix of Special Imports, which is obtained in **Step 3-A-iii**, from the original import matrix of NIO.

ii. An Import Duties and Sales Taxes Matrix is compiled by distributing the column vectors of Import Tariff and Sales Taxes, which is included in the original NIO, using the distribution ratio by industry, which is calculated from the Modified Import Matrix obtained in **Step 3-B-i**.

iii. A Matrix of Commodity Imports at C.I.F. prices is compiled by subtracting the Import Duties and Sales Taxes Matrix, obtained in **Step 3-B-ii**, from the Modified Import Matrix obtained in **Step 3-B-i**.

iv. The Import Duties and Sales Taxes Matrix is summed-up column-wise to be a row vector.

C. Compilation of Basic Import Matrices by Commodity, by Industry, and by Country of Origin

i. Using the trade statistics converted to the NIO classification, proportions of source countries of imports are calculated.

ii. Using the source country shares obtained in **Step 3-C-i**, the Matrix of Commodity Imports at C.I.F. prices, obtained in **Step 3-B-iii**, is divided into Import Matrices consists of 12 countries (10 endogenous countries listed in the first section, plus Hong-Kong and the Rest of the World). The supplement surveys conducted in some countries, such as Thailand, and the superior data collected in some countries, such as China, are used in the final reconciliation work of constructing import matrices.

iii. To the Import Matrix for the Rest of the World obtained in **Step 3-C-ii**, the Matrix of Special Imports, obtained in **Step 3-A-iii** is added to be a part of AIO.

Step 4: Compilation of Export Matrix by Commodity and by Country of Destination

i. Using the trade statistics converted to the NIO classification, a Basic Export Matrix by Commodity and by Country of Destination is obtained.

ii. Multiplying the Domestic Trade Margin Rate to the Basic Export Matrix, which is obtained in **Step 4-A-i**, we obtain a Matrix of Domestic Trade Margin on Exports. Then, summing it up column-wise, a row Vector of Domestic Trade Margin by Destination Country is compiled.

iii. In the same way, a Matrix of Domestic Transportation Cost on Exports and a row Vector of Domestic Transportation Cost are made.

iv. Subtracting the Matrix of Domestic Trade Margin and Domestic Transportation Cost on Exports, respectively obtained in **Steps 4-A-ii** and **iii**, from the Basic Export Matrix obtained in **Step 4-A-i**, an Export Matrix at Producers' Prices is made.

v. Two row vectors obtained in **Steps 4-A-ii** and **iii**, the Vector of Domestic Trade Margin and the

Vector of Domestic Transportation Cost, are respectively added to the Trade Services and Transportation Services sectors in the Export Matrix at Producers' Prices obtained **Step 4-A-iv**, and the Export Matrix is compiled and utilized in the AIO.

vi. The discrepancies between the row-wise total of the Export Matrix compiled in **Step 4-A-v** and the export vector appeared in NIO is included into the part of the Rest of the World in the Export Matrix compiled in **Step 4-A-v**.

Step 5: Price Conversion for Endogenous Imports to Producers' Prices

i. Using the Domestic Trade Margin Rate and Domestic Transportation Cost Rate utilized in **Step 4**, the endogenous part (consists of 10 countries) of Import Matrices compiled in **Step 3-C-ii** are converted to Import Matrices at producers' prices.

ii. When both Import data at F.O.B. prices are available along with those at C.I.F. prices in trade statistics, International Freight and Insurance Rate is also calculated.

Step 6: Converting data on the Framework of National Input-Output Classifications to the Uniform Asian International Input-Output Classification

The following parts compiled in the previous steps are converted from the NIO classification to the uniform AIO classification. The concordance between AIO and NIOs for 5 countries, adopted in GTAP database, is shown in Table 2.

＊ The row Vector of Import Duties and Sales Taxes (**3-B-iv**)

＊ The Import Matrix at C.I.F. prices for Hong-Kong (**3-C-ii**)

＊ The Import Matrix for the Rest of the World that includes Special Imports (**3-C-iii**)

＊ The Export Matrix at Producers' Prices (**4-v**)

＊ The Export Matrix at Producers' Prices for the Rest of the World that includes discrepancies (**4-vi**)

＊ The Import Matrices at Producers' Prices for the endogenous 10 countries (**5-i**)

(Table 2)

Step 7: Currency Units

Since AIO is valued at U.S. $1000, the values should be converted from local currency units to U.S. dollar. For most of the countries, the Period Averages (rf.) in *International Financial Statistics Yearbook* (IFS), International Monetary Fund, are employed. For Malaysia and Thailand, Official Rates in IFS are employed. For Taiwan, the Period Average in *KEY INDICATORS of Developing Asian and Pacific Countries*, Asian Development Bank, is employed. The exchange rates between U.S. dollar and local currencies of 5 countries, adopted in GTAP database, are shown in Table 3.

(Table 3)

Step 8: Linking the Processed National Input-Output Tables and Final Reconciliation

A preliminary AIO is formed replacing the exports part of every NIO with the unit converted Import Matrices. For 10 endogenous countries, the unit converted Export Matrix is utilized as important information in the final reconciliation work. When the results of surveys on input structure, which presents the proportion of each commodity used as intermediate input and the source country of the imported commodity, we also utilize them. Suggestions given by the local specialists also play important roles in our final adjustment process.

References

Asian Development Bank (1997), *KEY INDICATORS of Developing Asian and Pacific Countries 1997*, Vol. XXVIII, Oxford University Press, Hong Kong.

Institute of Developing Economies (2001), *Asian International Input-Output Table 1995*, I.D.E. Statistical Data Series, No. 82, Institute of Developing Economies, Chiba.

International Monetary Fund (1997), *International Financial Statistics Yearbook 1997*, International Monetary Fund, Washington D.C.

Inomata, Satoshi (1997), "On the Adjustment of National I-O Framework for the Compilation of 1990 Asian International Input-Output Table", in *Report on Compilation Work for 1990*

International Input-Output Table (IV), Asian International Input-Output Series, No. 54, Institute

of Developing Economies, Tokyo.

Kuwamori, Hiroshi (1999), "IIAP Working Manual", mimeo.