

Adjustment methods of national input-output tables for harmonized and consistent multi-regional input-output databases

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Abstract

Despite the fact that input–output (IO) tables form a central part of the System of National Accounts, each individual country’s national IO table exhibits more or less different features and characteristics, reflecting the country’s socioeconomic idiosyncrasies. Consequently, the compilers of a multi-regional input–output table (MRIOT) are advised to thoroughly examine the conceptual as well as methodological differences among countries in the estimation of basic statistics for national IO tables and, if necessary, to carry out pre-adjustment of these tables into a common format prior to the MRIOT compilation.

The objective of this study is to provide a practical guide for harmonizing national IO tables to construct a consistent MRIOT, referring to the adjustment practices used by the Institute of Developing Economies, JETRO (IDE-JETRO) in compiling the Asian International Input–Output Table.

Keywords: input-output tables, national accounts, global value chains, MRIOT

JEL classification: C67, F14

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1. INTRODUCTION

Multi-regional input–output tables (MRIOTs) are principally constructed using the pieces taken from various national input–output (IO) data sources; hence, the results can be read exactly in the same manner as national IO tables. The major difference is that MRIOTs explicitly present international transactions between industries in the form of import/export matrices by trading partners, which enables us to draw a comprehensive map of global production networks.

Despite the fact that IO tables (or supply/use tables in general) form a central part of the System of National Accounts (SNA), each individual country’s national IO table exhibits more or less different features and characteristics, reflecting the country’s socioeconomic idiosyncrasies. Consequently, MRIOT compilers are advised to thoroughly examine the conceptual as well as methodological differences among countries in the estimation of basic statistics for national IO tables and, if necessary, to carry out pre-adjustment of these tables into a common format prior to the MRIOT compilation.

In general, it is often the statistics of detailed, information-rich tables that have to be adjusted to conform to less-detailed ones to achieve commonality (unless there is a good prospect of obtaining additional information for upgrading the latter type of tables). Therefore, a trade-off must always be made between the level of uniformity and the level of embedded information in generating consistent MRIOTs; hence, careful and thorough consideration is required in making adjustment rules.

The objective of this study is to provide a practical guide for harmonizing national IO tables to construct a consistent MRIOT, referring to the adjustment practices used by the Institute of Developing Economies, JETRO (IDE-JETRO) in compiling the Asian International Input–Output Table (AIIOT).¹

2. BASIC LAYOUT OF AN MRIOT

The figure below provides an overview of the AIIOT of 2000, which is considered in this study. Looking first at the columns, each cell shows the input compositions of industries in each respective country, with one country reported per column. \mathbf{A}^I , for example, shows the input compositions of Indonesian industries vis-à-vis domestically produced goods and services, i.e., Indonesia’s domestic transactions. \mathbf{A}^{MI} in contrast shows the input composition of Indonesian industries for goods and services imported from Malaysia. The cells \mathbf{A}^{PI} , \mathbf{A}^{SI} , \mathbf{A}^{TI} , \mathbf{A}^{CI} , \mathbf{A}^{NI} , \mathbf{A}^{KI} , \mathbf{A}^{JI} , \mathbf{A}^{UI} , \mathbf{A}^{HI} , \mathbf{A}^{OI} , and \mathbf{A}^{WI} offer the same

¹ I would like to express my sincere gratitude to Ms. Maki Tokoyama of the Economic and Social Research Institute, the Cabinet Office, for her invaluable comments on the treatment and adjustment methods of the US and Japanese IO tables.

information for imports from other countries. **BA** and **DA** give international freight and insurance as well as taxes on these import transactions.

Turning to the 11th column from the left edge of the table, this column shows the compositions of goods and services that have gone to final demand sectors of Indonesia. F^{II} and F^{MI} , for example, map the inflows into Indonesian final demand sectors for domestically produced goods and services and those imported from Malaysia, respectively. The rest of the column can be read in the same manner as the 1st column of the table.

L^H , L^O , and L^W are exports (vectors) to Hong Kong, the EU, and the Rest of the World, respectively, whereas **Vs** and **Xs** are value-added and total input/output, as seen in conventional national IO tables.

<A schematic image of the Asian International Input–Output Table of 2000>

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

* Each cell of A** and F** represents a matrix of 76 x 76 and 76 x 4 dimension, respectively.

Source: IDE-JETRO (2006)

3. HARMONIZATION OF NATIONAL INPUT-OUTPUT TABLES

Presented below is a list of adjustment targets for national IO tables that constitute the 2000 AIIOT. The list reveals the diversity of presentation formats existing across the tables as well as the difficulty inherent in the task of harmonization. Based on the survey findings,² the following sections illustrate the adjustment methods that were devised and applied to each of the corresponding tables.

² The adjustment targets were set in accordance with the survey result regarding the presentation format of constituent national IO tables. The survey was conducted in the period of 2003–2004, in order to provide the basic information reservoirs for designing the common format and adjustment

<Adjustment targets for national IO tables>

	China	Indonesia	Japan	Korea	Malaysia	Taiwan	Philippines	Singapore	Thailand	United States
1. Conversion of valuation										
of the entire matrix								X		
of Private Consumption Expenditure					X			X		X
of Import matrix / vector			X	X			X		X	X
2. Negative entries				X						
3. Dummy sectors										
of office supplies, in-house activities, etc.			X	X						
of scraps and by-products	X		X							X
of royalties										X
of "rural industry"	X									
of management of companies										X
of used and second-hand goods										X
4. Machine-repair sector	X		X				X			X
5. Financial intermediaries (FISIM) sector										
FISIM to final demand			X							
FISIM dummy sector					X			X		
Housing loans									X	
6. Special treatment of import / export										
for water transport										X
for "Pure import" of gold										X
for re-export					X					
for telecommunication				X						
7. Computer software products						X				
8. Producers of government services									X	X

Source: Constructed by the author.

Note: Cells with a cross (x) indicate the adjustment targets that are relevant to each national IO table.

3.1. Conversion of valuation

3.1.1 Basic price to producer's price

The AIIOT's general principle is that the table should be valued at the producer's price. However, the Singaporean table is valued at the basic price.³ Therefore, the taxes on products in the Singaporean table, which are presented in a separate row vector of "3177 Commodity taxes", should be distributed over the entire transaction matrix.⁴

What follows illustrates the adjustment method. The arrows in the diagram indicate how the adjustment procedure refers to information derived from different sets of data. For example, tracing the broken lines shows that the taxes on liquor (=250) is first divided between those levied on domestic products (=200) and on imported products (=50), each of which is further distributed along the row vector of the

rules. The questionnaire for the survey was carefully tailored so as to capture every important aspect of IO statistics.

A word of caution is needed in that some of the national IO tables considered in this study may currently feature different formats from those reported herein, which were based on the information at the time of the year 2003. Therefore, the adjustment rule may no longer apply to the present status of the corresponding tables.

³ The relation between the two pricing schemes is <producer's price = basic price + taxes on products>.

⁴ "3177 Commodity taxes" include taxes on domestic products, taxes on imported products, import duties, and Goods and Services Tax (GST).

corresponding sector (“022 Alcoholic drink”) using its output structures (0.08, 0.13, 0.00... etc.). In addition, throughout all the diagrams in this paper, the values shown in parentheses indicate that they will ultimately disappear as a result of the adjustment.

<Adjustment procedure>

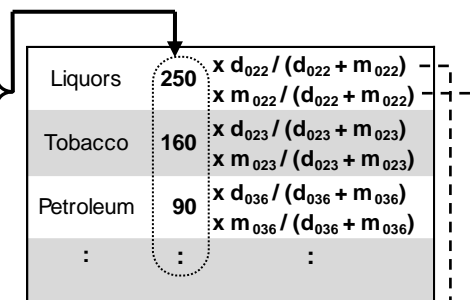
Singapore

(1) The values of taxes levied on each taxable good (liquors, tobacco, petroleum, motor vehicles, etc.) are taken from reliable sources.⁵

(2) These figures are split into those taxes levied on domestic products and those levied on imported products, using total output (TO) ratios of the corresponding Singapore IO sectors.

<Example: “Liquors” = “022 Alcoholic drink”>

(3) The figures derived in step (2) are allocated row-wise and added to the rows of the corresponding Singapore IO sectors,⁶ using their output distribution ratios.⁷



	A	B	C	...	Z	PCE	TO
:							
022 Alcoholic Drk	60	100	80	...	40	240 ...	800 (=d ₀₂₂)
	0.08	0.13	0.00	...	0.05	0.30	
Tax on 022	+16	+26	+0	...	+10	+60	+200
023 Tobacco	80	50	24	...	20	200 ...	1200 (=d ₀₂₃)
	0.07	0.04	0.00	...	0.02	0.17	
Tax on 023	+8	+5	+0	...	+2	+20	+120
:							
022 Alcoholic (imp)	16	20	6	...	0	40 ...	200 (=m ₀₂₂)
	0.08	0.10	0.00	...	0.00	0.20	
Tax on 022	+4	+5	+0	...	+0	+10	+50
023 Tobacco (imp)	10	25	5	...	20	35 ...	400 (=m ₀₂₃)
	0.03	0.06	0.00	...	0.05	0.09	
Tax on 023	+1	+2	+0	...	+2	+4	+40
:							
3177 Com.taxes	78	92	0	...	63	388	
TO							

⁵ For example, from *the Public Finance Yearbook of Statistics*, Department of Commerce.

⁶ The negative entries in the “Changes in Stock” column are excluded from assigning taxes, since taxes on products are considered to be levied only in the year of production.

⁷ Note, however, that if the industry has zero or a considerably small number of entries in 3177, the sector should be precluded from a calculation of distribution ratio so as to receive no allocation of taxes. See the example of industry C in the figure.

(4) Each column total of allocated taxes (on both domestic products and imported products [highlighted]) is subtracted from 3177. This leaves 3177 as a row vector of GST.⁸

	A	B	C	...	Z	PCE	TO	
:								Tax
022 Alcoholic Drk	60	100	80	...	40	240	...	totals
Tax on 022	+16	+26	+0	...	+10	+60		+200
023 Tobacco	80	50	24	...	20	200	...	
Tax on 023	+8	+5	+0	...	+2	+20		+120
:								
036 Petroleum	85	100	60	...	90	100	...	
Tax on 036	+12	+18	+0	...	+15	+18		+80
:								
092 Motor Vehcl	65	55	30	...	70	950	...	
Tax on 092	+26	+18	+0	...	+28	+130		+250
:								
022 Alcoholic (imp)	16	20	6	...	0	40	...	
Tax on 022	+4	+5	+0	...	+0	+10		+50
023 Tobacco (imp)	10	25	5	...	20	35	...	
Tax on 023	+1	+2	+0	...	+2	+4		+40
:								
036 Petroleum (imp)	12	3	8	...	2	25	...	
Tax on 036	+1	+0	+0	...	+0	+2		+10
:								
092 Motor Veh (imp)	15	4	12	...	6	60	...	
Tax on 092	+3	+0	+0	...	+1	+10		+30
:								
3177 Com.taxes	78	92	0	...	63	388		
	-71	-74	-0	...	-58	-254		Sum up and subtract -> 3177 becomes GST only
TO								

⁸ If, however, the subtraction results in a negative value, this negative figure is redistributed along the same column over to the intersections with the four taxable items. As a result of this operation, the row totals for taxes become lower than the figures from the original source.

(5) An adjustment column is set up to counterbalance the increase in row totals by addition of taxes in order to keep TOs unchanged.

	A	B	C	...	Z	PCE	adj	TO
:								
022 Alcoholic Drk	↑ 16	...		...	↑ 10	↑ 60	...	-200 ±0
023 Tobacco	↑ 8	...		...	↑ 2	↑ 20	...	-120 ±0
:								
036 Petroleum	↑ 12	...		...	↑ 15	↑ 18	...	-80 ±0
:								
092 Motor Vehcl	↑ 26	...		...	↑ 28	↑ 130	...	-250 ±0
:								
022 Alcoholic (imp)		...		...			...
023 Tobacco (imp)		...		...			...
:								
036 Petroleum (imp)		...		...			...
:								
092 Motor Veh (imp)		...		...			...
:								
3177 => GST	7	18	0	...	5	134		
TO								

(6) Taxes on imported products are aggregated column-wise to form a row vector.

(7) The row vector of GST is split into two vectors: one for taxes levied on domestic goods and services, and the other for imported goods, again using TO ratios.

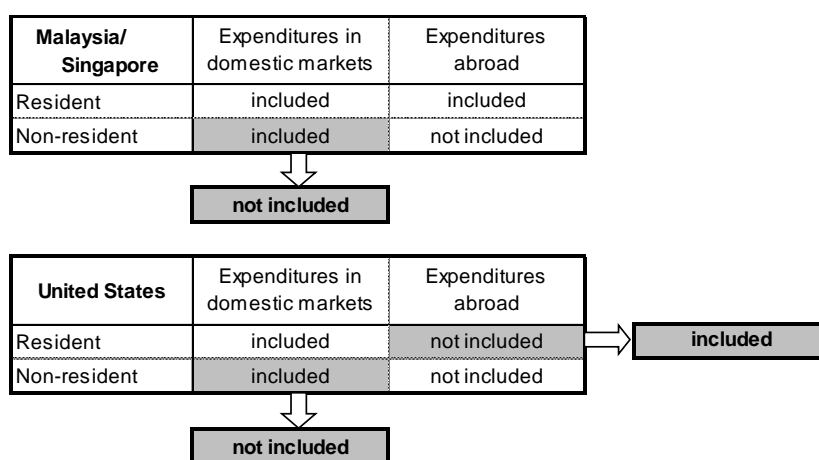
(8) GST on domestic goods and services is distributed over the domestic transaction, using the input structure of each sector. GST on imports is merged with the vector of import commodity taxes.

	A	B	C	...	Z	PCE	adj	TO	
Product A	↑					↑	-2	±0	
Product B		↑				↑	-6	±0	
Product C			↑			↑	-3	±0	
:									
Product Z					↑	↑	-4	±0	
	distributed								
Product A									
Product B									
Product C									
:									
Product Z									
Import com. taxes	+9	+7	0	...	+3	+26		merged	
3177 => GST	7	18	0	...	5	134			
	split								
	GST on domestic goods & services								
	GST on imported goods								
TO									

3.1.2 Private Consumption Expenditures

The entries in an IO table are generally recorded on a domestic basis, covering all the activities within a country’s legal boundaries (including its embassies located abroad), regardless of whether they are carried out by residents or non-residents. The only exception is Private Consumption Expenditure (PCE), which is recorded on the national basis—at least for its macro-aggregate—but preferably at each individual product level, as required under the AIIOT scheme.

The necessary conversion for the three national IO tables for this case, Malaysian, Singaporean, and the US tables, is shown below.⁹



<Adjustment procedure>

Malaysia, United States

- (1) The ratio of non-residents' expenditures, by product, is constructed by referring to the “Direct Sales (exports)” vector of the Japanese IO table.
- (2) Along with PCE, there is a negative-value adjustment scalar, which represents non-residents' total expenditure in domestic markets. This figure is expanded to a column vector using the ratios prepared in step (1). For the Malaysian table, the figure is given at the intersection of “094 Import commodities (row)” and PCE, and for the US table, at the intersection of “S00600 Rest of the world adjustment to final uses (row)” and PCE.
- (3) The column vector (negative entries) thus derived is added to the original PCE.
- (4) The inverse values of that column vector are added to the Export vector as direct sales to non-residents.
- (5) The adjustment scalar is deleted.
- (6) (US table only) The entries at the intersection with “F07C00 Nondefense consumption expenditure” as well as with “Imports” are deleted. These values represent

⁹ Singapore’s PCE also includes in the cell [Non-resident × Expenditure in domestic markets] tourists’ purchases of imported goods, such as branded commodities.

the Army Corps of Engineers' overseas construction programs and donations for overseas relief activities, respectively. They do not accord to the accounting frameworks of the AIIOT and are thus simply deleted.

	A	B	C	...	PCE ...	Exp	TO
Product A					↓ 8	↑ 8	±0
Product B					↓ 0	↑ 0	±0
Product C					↓ 4	↑ 4	±0
:					:	:	:
Import commodities (Malaysia)							
Rest of the world adjustment (the United States)					(-40)		
Value-added							
TO							

8	0.20
0	0.00
4	0.10
:	:

Distribution ratios for foreigner's expenditures on home goods & services

United States (continued)

- (7) The ratio of residents' expenditures abroad, by product, is constructed by referring to the "Direct Purchases (imports)" vector of the Japanese IO table.
- (8) There is a positive-value adjustment scalar representing residents' total expenditure abroad at the intersection of "S00300 Noncomparable imports" and PCE. This figure is expanded to a column vector using the ratios prepared in step (1).
- (9) The column vector thus derived is added to PCE.
- (10) The inverse values of that column vector are added to the Import vector as residents' direct purchases abroad.
- (11) The adjustment scalar is deleted.
- (12) Other entries in the intermediate uses and final demand of "Noncomparable imports" are classified into "AIIOT076 Unclassified" in the import matrix.¹⁰

	A	B	C	...	PCE ...	Imp	TO
Product A					↑ 8	↓ 8	±0
Product B					↑ 12	↓ 12	±0
Product C					↑ 4	↓ 4	±0
:					:	:	:
Noncomparable imports (5) (2) (10) ...					(50)		
Value-added							
TO							

8	0.16
12	0.24
4	0.08
:	:

Distribution ratios of resident's expenditures abroad

To "AIIOT076 Unclassified" in the import matrix

¹⁰ The category "Noncomparable imports" as intermediate inputs represents the values of goods and services purchased by US residents on business trips abroad. The sector also includes the types of commodities that are not produced in the United States (e.g., bananas, coffee beans).

Singapore

Non-residents' expenditures on domestic products, including those on trade margins, are added to the Export vector as direct sales of goods and services to non-residents using the following process.

- (1) The values of non-residents' expenditures in broad categories (like "Shopping" or "Accommodation") are taken from *the Tourist Expenditure Survey 2000* for the expenditures on domestic products and on trade margins, respectively.¹¹
- (2) Expenditures on trade margins are aggregated and allocated to the intersection of the "Wholesale and Retail Trade" sector (row) and the Export vector.
- (3) Expenditures on domestic products are expanded where necessary (such as for the "Shopping" category) into further details by product using the ratio derived from sample data on *the Expenditures of Rotary Delegates to Singapore*. They are allocated to the intersection of corresponding industrial sectors (row) and the Export vector.
- (4) All the figures thus derived in the process above are subtracted from the original PCE.

3.1.3 Import matrix/vector

The import matrices for some countries include import duties in the transaction. When compiling the AIIOTs, import matrices should be ultimately converted to the producer's price from the source country's perspective, which necessitates the prior separation of import duties in the original import matrices. The current status of the relevant tables is as follows.

For the tables of Japan, Korea, the Philippines, and Thailand, the import matrix is valued at *cost, insurance, and freight* (c.i.f.) plus duties and import commodity taxes included in the transaction.

In the US table, import duties are included in the entries along the Import vector (column). At the same time, the total amount is given at the intersection of "420000 Wholesale trade (row)" and the Import vector as a positive value, in order to cancel out each duty entry. (As a result, the total value of the import vector is given at c.i.f., net of taxes.) The equivalent amount is added to value-added items, at the intersection of the "V00200 Indirect business tax and nontax liability" and "Wholesale trade (column)" sector in order to balance with final demand.

<Adjustment procedure>

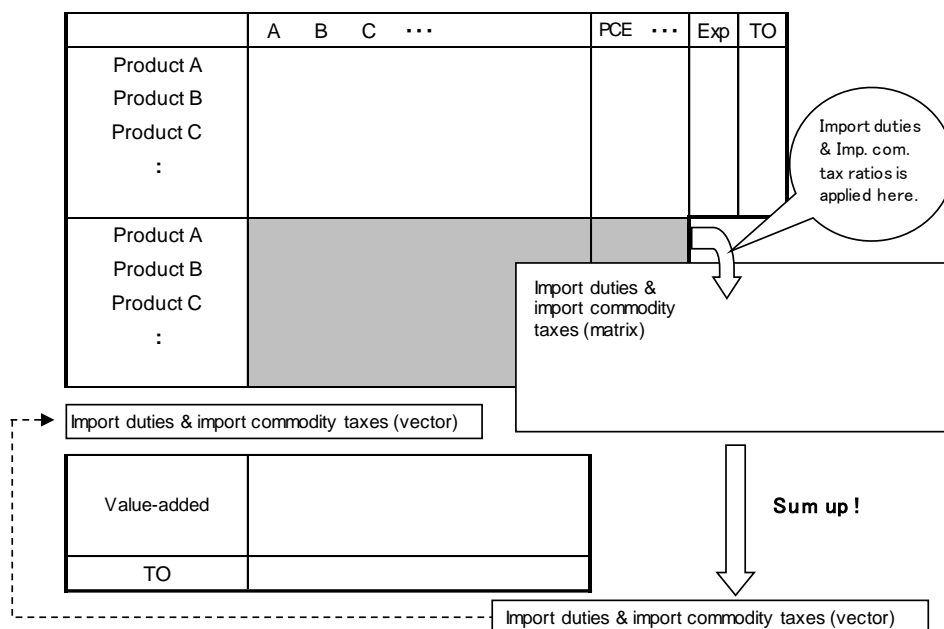
Japan, Korea, the Philippines, Thailand

- (1) A column vector of import duties and import commodity taxes ratios is constructed if not available from the table.

¹¹ Tourists' expenditures on imported goods are to remain in the import element of PCE in order to maintain consistency with the National Accounts, although the entries can be conceptually regarded as re-exports.

(2) These ratios are applied in order to separate the values of duties and import commodity taxes from the current import matrix.

(3) The matrix of duties and import commodity taxes thus derived is aggregated column-wise to obtain a row vector, which is to be independently presented.



United States

(1) The entry at the intersection of “420000 Wholesale trade (row)” and the Import vector are deleted. The row TO is decreased by the same amount. Also, corresponding value is deducted from the intersection of “Indirect business tax ...” in value-added items and “Wholesale trade (column)”. The column TO is decreased accordingly to resume the row-column balance of the “Wholesale trade” sector.

	A	B	C	...	WT	Imp	Exp	TO
Product A										
Product B										
Product C										
:								:		
Wholesale trade								(100)		↓ 100
:								:		
Comp. of employee										
Indirect tax										↓ 100
Other value-added										
TO										↓ 100

- (2) The composition ratio of the import duties vector is derived as follows:
- (2)-1 Using the values of import (c.i.f.) and customs duties obtained from the Foreign Trade Statistics, the import duty ratio is calculated for each IO item, where:
- $$\text{Import duty ratio} = \text{customs duty} / (\text{import, c.i.f.} + \text{customs duty})$$
- (2)-2 The values of import duties for IO are derived by multiplying each entry in the Import vector by the ratios prepared above.¹²
- $$\text{Import duties (value) for IO table} = \text{The Import vector in IO table} \times \text{Import duty ratio}$$
- (2)-3 The composition ratio of the above product is calculated.
- $$\text{Composition ratio} = \text{Import duty for an IO sector} / \text{Import duties for all IO sectors}$$
- (3) The Import duties' vector is derived by expanding the total import duties (originally given in the Import vector), using the composition ratio calculated in step (2).
- (4) The import duties vector is separated from the Import vector and is independently presented (as a negative value), leaving the import values at c.i.f.

	A	B	C	...	WT	Imp	Dty	Exp	TO
Product A							0.01	↑ 1	-1		
Product B							0.00	↑ 0	-0		
Product C							0.02	↑ 2	-2		
:							:	:	:		
Wholesale trade									(100)		
:											
Comp. of employee											
Indirect tax											
Other value-added											
TO											

↑
Composition ratio of import duties vector

3.2. Negative entries

No negative entry, except for the generation of scrap and by-products,¹³ and dealings of second-hand goods, are allowed in the intermediate transaction of AIIOTs. However, the Korean table has negative entries along the “Retail trade (row)”, where government subsidies are associated.

¹² This operation is necessary since the import data from the Foreign Trade Statistics, aggregated to IO classifications, do not necessarily match the entries in the Import vector of the IO table.

¹³ These negative entries exist as a result of applying the Stone (or negative-transfer) method for the treatment of scraps and by-products. See Appendix 1 for different treatments for scraps and by-products.

<Adjustment procedure>

Korea

- (1) Since the negative trade margins represent the subsidies given to sectors having those negative inputs, the negative values are shifted to Subsidies in value-added items.
- (2) The resulting increase in the trade sector’s row TO is matched by the corresponding increase in its Operating surplus (and thus the sector’s column TO).

	A	B	C	...	RT	...	PCE	...	Exp	TO
Product A										
Product B										
Product C										
:										
Retail Trade		(-5)	10	(-3)	...					↑ 8
:										
Product A										
Product B										
Product C										
:										
Operating surplus										↑ 8
:										
Subsidies		↓ 5		↓ 3						
TO										↑ 8

3.3. Dummy sectors

3.3.1. Office supplies, In-house activities,¹⁴ and Business consumption¹⁵

In some cases, the IO table can be made much more tractable by hypothetically forming a stand-alone sector for an activity that cannot be regarded as an independent industry. Consider office supplies as an example. No matter which industry takes them as inputs, the composition of office supplies is known to be more or less the same across all industries. Hence, instead of letting each respective industry record the purchase of every minor product (erasers from the rubber products industry, notebooks from the paper products industry, etc.), these purchasing activities are bundled together under a single sector labelled “office supplies”, and each industry in turn purchases a composite of office supplies from this hypothetical sector.

¹⁴ Firms often use their own resources to carry out some supporting activities to raise their productivity. These include the in-house training of staff, research and development, self-transport, and self-advertisement.

¹⁵ “Business consumption” mainly consists of
 – lodging expenses and daily allowances for business trips,
 – expenses for social exchanges to promote business partnerships, and
 – expenses for welfare and recreation facilities for staff.

Despite its analytical convenience, however, no dummy sectors are allowed in the AIIOT owing to the lack of relevant information in some countries.

<Adjustment procedure>

Japan, Korea

Japan: “9110-00 Business consumption (in final demand and in value-added)”, “8222-01 In-house research”, and “8900-00P Office supplies”

Korea: “403 Business consumption”, “380 In-house research”, and “402 Office supplies”

(1) The column vector of the dummy is expanded into a matrix using the output distribution ratios derived from its row vectors (domestic transaction and import transaction independently).

(2) Once the matrix is derived, the column and row vectors are deleted.

(3) The matrix thus derived is added onto the table.

(4) The resulting increase in each sector’s total intermediate input is offset by the decrease in its Operating surplus by the same amount.

	A	B	C	...	Dmy	...	PCE	...	Exp	TO
Product A	←←←←				(20)				→	
Product B	←←←←				(10)				→	
Product C	←←←←				(35)				→	
:	0.14	0.08	0.20		:		0.30		0.02	← Distribution ratios: domestic
Dummy	(14)	(8)	(20)	...	(0)	...	(30)	...	(2)	(100)
:					:					
Product A	←←←←				(12)				→	
Product B	←←←←				(0)				→	
Product C	←←←←				(4)				→	
:	0.30	0.00	0.10		:		0.80			← Distribution ratios: import
Dummy	(3)	(0)	(1)	...	(0)	...	(8)			
:					:					
Operating surplus	↓ 15	↓ 13	↓ 18	...						
TO	±0	±0	±0	...						

3.3.2. Scraps and by-products

When more than two different types of goods are produced from a single production activity, the minor products are categorized either into “scraps” or into “by-products”. Should an industry exist that specializes in producing that minor product, the product is regarded as a by-product. If no other industry competes for that product, it is a scrap. Both scraps and by-products have positive market values and hence should be differentiated from wastes and disposables.

<Example>

Scraps: metal scraps generated out of the metal product industry

By-products: coke generated out of the gas supply industry

<Adjustment procedure>

China

“2343085 Scrap and waste (row and column)”

(1) Currently, the uses of scrap and by-products are placed along a row. An amount equivalent to the row total is given in Operating surplus as a sole input of the industry. So, It is assumed that scrap and by-products are generated by sectors that have a higher scrap input. Therefore, its Operating surplus is distributed to other sectors, using the output structure of the “Scrap and waste” sector.

	A	B	C	...	SW	...	PCE	...	Exp	TO
Product A										
Product B										
Product C										
:										
scrap & waste	(20)	(50)	(30)	...						200
:	0.10	0.25	0.15	...						1.00
:										
Operating surplus	↑ 20	↑ 50	↑ 30	...	(200)					
:										
TO	↑ 20	↑ 50	↑ 30	...	(200)					

(2) The resulting increases in column TOs are matched by the increases in row TOs, which defines the distribution ratios for the row vector. After the column-wise distribution of the row vector, the row and column of the “Scrap and waste” sector are deleted.

	A	B	C	...	SW	...	PCE	...	Exp	TO
Product A	↑ 2	↑ 5	↑ 3							↑ 20 0.10
Product B	↑ 5	↑ 12	↑ 7							↑ 50 0.25
Product C	↑ 3	↑ 7	↑ 4							↑ 30 0.15
:	:	:	:							:
scrap & waste	(20)	(50)	(30)	...						(200)
:										
:										
Operating surplus	↑ 20	↑ 50	↑ 30	...						
:										
TO	↑ 20	↑ 50	↑ 30							

Japan

“1811-012P, 2612-011P, 2712-011P Scrap (rows)”

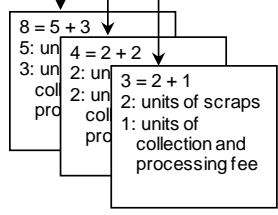
From the 2000 IO table, the sector, “3921-01 Recycling of reproducible resources” is introduced. The inputs and outputs of scrap/by-products are collectively recorded into this sector. It also records the values of collection and processing activities.

[Comparison between the old and the new methods: An illustrative example]

old method	...	Pulp & Paper	Paper prdct	Metal prdct	Printing	...	PCE	...	Exp	TO
:										
Paper products										
Metal products										
Used paper		5	2		-4		-3			0
Metal scrap				2			-2			0
:										
Value-added										
TO										

Industry “Pulp and paper” uses 5 units of used paper
 Industry “Paper products” uses 2 units of used paper
 Industry “Metal products” uses 2 units of metal scrap
 Industry “Printing” generates 4 units of used paper
 Household (PCE) generates 3 units of used paper and 2 units of metal scrap

new method	...	Pulp & Paper	Paper prdct	Metal prdct	Printing	Recycling...	PCE	...	Exp	TO
:										
Paper products										
Metal products										
Used paper					-4	7	-3			0
Metal scrap						2	-2			0
:										
Recycling...		8	4	3	...					20
:										
Gas & electricity					2					
Wages					4					
Operating surplus					1					
:										
TO					20					



The “Recycling of reproducible resources” sector is divided into the actual scrap/by-products themselves and the activities of collecting and processing them. This is done in accordance with the following procedure.

(1) By referring to the supporting table “Inputs and outputs of wastes and by-products”, the input and output amounts of scrap/by-products are identified.

(2) The inputs and outputs of scrap/by-products are deducted from the “Recycling ...” sector by type of good and by industry, which leaves the column and row of “Collection & processing activities”.

< Supporting table of wastes and by-products >

	...	Pulp & Paper Paper prdct	Metal prdct Printing	...	PCE	...
:						
Used paper		5	2	-4		-3
Metal scrap			2			-2
:						



	...	Pulp & Paper Paper prd	Met. prdct Printing	Ser./byp Recycling...	...	...	PCE	...	Exp	TO
:										
Paper products				:						
Metal products				:						
Used paper			-4	(7) ←			-3			
Metal scrap				(2) ←			-2			
:				:						
scrap/by-prdct		(5) ↗	(2) ↗	(2) ↗	...					(12) ↗
Recycling...		(3) ↘	(2) ↘	(1) ↘	...					(8) ↘
:				:						
Gas & electricity				(2)						
Wages				(4)						
Operating surplus				(1)						
:				:						
TO				(12) ←						(8) ←

(3) The row and column of the “activities” part are merged with the “Wholesale” sector.

	...	Pulp & Paper	Paper prd	Met. prdct	Printing	Scr./byp	col./proc.	...	Wholesale	...	PCE	...	Exp	TO
:														
Paper products														
Metal products						:								
Used paper					-4	(7)					-3			
Metal scrap						(2)					-2			
:						:								
scrap/by-prdct		(5)	(2)	(2)	...									(12)
collect./process.		(3)	(2)	(1)	...									(8)
:														
Wholesale		↑ 3	↑ 2	↑ 1	...									↑ 8
:														
Gas & electricity						(2)			↑ 2					
Wages						(4)			↑ 4					
Operating surplus						(1)			↑ 1					
:						:			:					
TO						(12)	(8)		↑ 8					

(4) With the help of the supporting table, the entries along the “scrap/by-products” row are redistributed to appropriate intersections with scrap dummy sectors (row), etc.

(5) The “scrap/by-products” row and column are then deleted.

	...	Pulp & Paper	Paper prd	Met. prdct	Printing	Scr./byp	...	Wholesale	...	PCE	...	Exp	TO
:													
Paper products								:					
Metal products													
Used paper		5	2		-4	(7)				-3			
Metal scrap		↑	↑	2		(2)				-2			
:													
scrap/by-prdct		(5)	(2)	(2)	...								(12)
:													
Wholesale		↑ 3	↑ 2	↑ 1	...								↑ 8
:													
Gas & electricity								↑ 2					
Wages								↑ 4					
Operating surplus								↑ 1					
:								:					
TO						(12)		↑ 8					

(6) The dummy sectors of scrap are merged with the sectors whose principal products are similar in use and physical attributes; namely,

“1811-012P Used paper” --> “1811-01Pulp”

“2612-01P Scrap iron” --> “2611-03 Crude steel”

“2712-011P Nonferrous metal scrap” --> “2711-09 Other nonferrous metals”

United States

“S00401 Scrap (row only) is a single row vector showing the generation and uses of scrap and by-products for all products. The generation of materials is represented as a negative input of the sector generating it, and their use is recorded as a positive input as usual. Since no further information is available for dividing the sector by type of materials, the sector is placed in “AIIOT076 Unclassified”.¹⁶

3.3.3 FISIM (imputed interest)

In the Malaysian and Singaporean tables, there is a stand-alone FISIM sector (column only) in the table. (Malaysia: 094, Singapore: 156)

<Adjustment procedure>

Malaysia, Singapore

See “3.5. Financial intermediary”.

3.3.4 Royalties

In the US table, “533000 Lessors of non-financial intangible assets” consists of two elements: (1) royalties/license fees themselves, which are the payment for the use of patents, trademarks, franchises, etc., and (2) activities of the establishments that are primarily engaged in assigning rights to these assets, for which royalties/license fees are paid to the asset holders. While most of the Asian tables include royalties/license fees in operating surplus, the US table presents this industry as a standalone sector. Therefore, the industry in the US table should be unbundled and redefined. This is done in the following manner.

<Adjustment procedure>

United States

“533000 Royalties”

(1) As the first step, the entries in the final demand part of the “Lessors of ... (row)” are deleted from the table. The row TO changes accordingly. In order to resume the row–column balance, the value of “Other value-added”, and hence the column TO, is changed by the same amount.

¹⁶ When the US table is converted to a non-competitive import type, all negative entries for this sector stay as domestic transactions.

	A	...	Les	...	...	Imp	Exp	TO
Product A			(18)					
Product B			(10)					
Product C			(35)					
:			:					
Lessors of ...	(10)	(40)		...		(-12)	(17)	(255)
:			:					
Comp. of employee			(10)					
Indirect tax			(20)					
Other value-added			(85)					
TO			(255)					

Annotations: A callout bubble with "↓ 5" points to the TO cell of the "Lessors of ..." row. Another callout bubble with "↓ 5" points to the TO cell of the "Comp. of employee" row. A third callout bubble with "↓ 5" points to the TO cell of the "Indirect tax" row. A fourth callout bubble with "↓ 5" points to the TO cell of the "Other value-added" row. A fifth callout bubble with "↓ 5" points to the TO cell of the "TO" row. A sixth callout bubble with "↓ 5" points to the TO cell of the "TO" row. A seventh callout bubble with "↓ 5" points to the TO cell of the "TO" row. A bracket groups the "Imp" and "Exp" columns, with a callout bubble "↓ 5" pointing to it. A final callout bubble with "↓ 5" points to the TO cell of the "TO" row.

(2) It is assumed that all the intermediate inputs and Compensation of employees (= wages) in the value-added of the industry belong to the “Establishment” sector. Next, the “Establishment” sector’s TO is estimated by blowing up the value of Compensation of employees using the ratio of “output” versus “payroll” obtained from *the U.S. Economic Census*.

	A	...	Les	Est	...	...	Imp	Exp	TO
Product A			→	(18)					
Product B			→	(10)					
Product C			→	(35)					
:			→	:					
Lessors of ...	(10)	(40)		...	...		
:			→	:					
Comp. of employee			→	(10)					
Indirect tax									
Other value-added									
TO				(175)					

Annotation: A callout box with the text "Estimation using the ratio from economic census data" points to the "Est" column of the "Comp. of employee" row.

(3) After intermediate inputs and Compensation of employees are deducted from the “establishment” sector's TO thus derived in step (2), the residual value is further divided into two items: “Indirect business tax and nontax liability” and “Other value-added”. This is done by applying the ratio taken from the value-added of “Lessors of ...” (i.e., the original vector). This completes the column vector of the “Establishment” sector”.

	A	...	Les	Est	...	...	Imp	Exp	TO
Product A				(18)					
Product B				(10)					
Product C				(35)					
:				:					
Lessors of ...	(10)	(40)							
:									
Comp. of employee			25	(10)					
Indirect tax			(20)	0.2	5				
Other value-added			(80)	0.8	20				
TO				(175)					

(4) If all the inputs of the “Establishment” sector are removed from the vector “Lessors of ...”, this leaves the column vector for the “Royalty” sector, which in fact consists of only “Indirect business tax ...” and “Other value-added”.

	A	...	Les	Est	Rty	...	Imp	Exp	TO
Product A			0	(18)					
Product B			0	(10)					
Product C			0	(35)					
:			:	:					
Lessors of ...	(10)	(40)							(250)
:			:	:					
Comp. of employee				(10)					
Indirect tax			0	(5)	(15)				
Other value-added			0	(20)	(60)				
TO			0	(175)	(75)				

(5) The row vectors of the “Establishment” sector and “Royalty” sector are derived by splitting the row vector “Lessors of ...” using the ratio of column TOs given in step (4).

	A	B	...	Est	Rty	...	Imp	Exp	TO
Product A				(18)					
Product B				(10)					
Product C				(35)					
:				:					
Lessors of ...	(10)	(40)							
:									
Establishment	(7)	(28)	...						(175)
Royalty	(3)	(12)	...						(75)
Comp. of employee				(10)					
Indirect tax				(5)	(15)				
Other value-added				(20)	(60)				
TO				(175)	(75)				

(6) The “Establishment” row and column are moved into “AllIOT060 Other services”.

	A	B	...	Est	Rty	Os	...	Imp	Exp	TO
Product A				(18)	→	↑ 18				
Product B				(10)	→	↑ 10				
Product C				(35)	→	↑ 35				
:				:						
Establishment	(7)	(28)	...							(175)
Royalty	↓	↓				↓				↓
Other service	↑ 7	↑ 28	...							↑ 175
Comp. of employee				(10)	→	↑ 10				
Indirect tax				(5)	→	↑ 5				
Other value-added				(20)	→	↑ 20				
TO				(175)	→	↑ 175				

(7) The column vector of the “Royalty” sector, which consists of two value-added items, is distributed across other industries using the output structure of “Royalty”. The increased amount in the value-added for each industry is indeed equal to the corresponding entry in the row vector of the “Royalty” sector. So, if the “Royalty” sector (row) is ultimately deleted, this cancels out the increases in the value-added and keeps the column total of each industry intact.

	A	B	...	Rty	...	Imp	Exp	TO
Product A								
Product B								
Product C								
:								
Royalty	(3)	(12)	...					(75)
	{ 0.04	0.16	...	Output distribution ratio				
Comp. of employee								
Indirect tax	↑ 0.6	↑ 2.4	...		(15)	→		
Other value-added	↑ 2.4	↑ 9.6	...		(60)	→		
TO	±0	±0	...		(75)			

3.3.5 Rural industry

In the Chinese table, “0101005F Rural industry” is a dummy sector that represents the activities of small-scale light manufacturing in rural districts of China. Three industrial groupings are covered: foods, textiles, and other industries.¹⁷

¹⁷ Detailed activities of “Rural industry” are identified by referring to the Chinese Standard Industrial Classification.

<Adjustment procedure>

China

“0101005F Rural industry (row and column)”

(1) The row vector is split into the three related sectors using their TOs as split ratios.

	Fd	Tx	Oi	...	RI	...	PCE	...	Exp	TO
:										
Food									200	0.20
Textile									500	0.50
Other industry									300	0.30
:										
Rural industry	(10)	(12)	(8)	(24)	...		(32)		(200)	
:										
Product A										
Product B										
Product C										
:										
Value-added										
TO										

(2) After the row-wise distribution of the column vector, both the row and column of the rural industry sector are deleted.

	Fd	Tx	Oi	...	RI	...	PCE	...	Exp	TO
:					(16)					
Food	↑ 2	↑ 2	↑ 2	↑ 4	...	(8)	↑ 6	...	↑ 40	0.20
Textile	↑ 5	↑ 6	↑ 4	↑ 10	...	(0)	↑ 16	...	↑ 100	0.50
Other industry	↑ 3	↑ 4	↑ 2	↑ 6	...	(12)	↑ 9	...	↑ 60	0.30
:					:					
Rural industry										
:										
Product A										
Product B										
Product C										
:										
Value-added					(24)	(8)				
TO					(200)					

0.20 0.50 0.30

3.3.6. Management of companies and enterprises

In the US table, “550000 Management of companies and enterprises” is a sector that covers (a) holding companies and (b) enterprise headquarters. According to *the 1997 U.S. Economic Census*, the activities of an enterprise’s headquarters occupy quite a large proportion in producing the output of the sector. Therefore, it is assumed that the “Management of companies and enterprises” sector is entirely represented by enterprise headquarters.

<Adjustment procedure>

United States

“550000 Management of companies”

(1) The “Exports” of the “Management of companies and enterprises” sector is deleted. At the same time, the equivalent amount is deducted from “Other value-added” in the “Management of companies and enterprises” sector.

	A	B	C	...	Mgt	...	...	Imp	Exp	TO
Product A					(5)					
Product B					(5)					
Product C					(1)					
:					:				-10	-10
Mgt.of comp.&ent.		(20)	(10)	...		...	(4)		(10)	(110)
:					:					
Comp. of employee					(15)					
Indirect tax					:					-10
Other value-added					(30)					-10
TO					(110)					

(2) The row of “Management of companies and enterprises” is expanded column-wise in proportion to the sector’s input structure.

(3) The row and column vectors of “Management of ...” are deleted.

	A	B	C	...	Mgt	...	...	Imp	Exp	TO
Product A		↑	↑		(5)	0.05				
Product B					(5)	0.05				
Product C					(1)	0.01				
:					:	:				
Mgt.of comp.&ent.		(20)	(10)	...		...	(4)		0	(100)
:					:					
Comp. of employee					(15)	0.15				
Indirect tax					:	:				
Other value-added		↓	↓		(20)	0.20				
TO					(100)					

3.3.7. Used and second-hand goods

In the US table, “S00402 Used and second-hand goods” is a single-row vector showing dealings in second-hand sales for all commodities. The sale of goods is represented as a negative input for the sector selling it and the purchase as a positive input as usual.

<Adjustment procedure>

United States

“S00402 Used and second-hand goods (row only)”,

Since no further information is available for dividing the sector by goods type, the sector is placed in “AIIOT076 Unclassified”.¹⁸

3.4. Machine-repair

The tables for China, Japan, the Philippines, and the United States have stand-alone machine-repair sectors. Just like dummy sectors, machine-repairing activities are often presented as an independent sector for the sake of analytical convenience. Due to a lack of relevant data in some other countries, however, the AIIOT does not accommodate stand-alone machine-repair sectors. Individual adjustments are required to the above four tables, which feature different statuses, as follows.

China: “2138082 Machine-repair”

Japan: “3611-10 Repair of ships”, “3621-10 Repair of rolling stock”, “3622-10 Repair of aircraft”, “8515-10 Repair of motor vehicles”, and “8516-10 Repair of machines”.

The Philippines: “218 Repair shops for motor vehicles” and “219 Other repair shops, n.e.c.”

United States: “8111A0 Automotive repair and maintenance, except car washes”, “811200 Electronic equipment repair and maintenance”, “811300 Commercial machinery repair and maintenance”, and “811400 Household goods repair and maintenance”.

<Adjustment procedure>

For the repair of transport equipment, sectors are placed in “AIIOT055 Motor vehicles”

Japan: 3611-10, 3621-10, 3622-10, 8515-10 United States: 8111A0

For the repair of household equipment (the service provided at retail shops), the sectors are put in “AIIOT074 Other services:”

The Philippines: 218, 219 United States: 811400

¹⁸ When the US table is converted into a non-competitive import type, all negative entries of this sector remain as domestic transactions.

The remaining stand-alone machine-repair sectors are adjusted as follows:

Unites States

(1) With the help of the North American Industry Classification System (NAICS) 1997, the commodities listed under the Machine-repair sector are assumed to have been repaired.

(2) For the commodities identified in step (1), the ratios are derived from their outputs to the vector of Fixed Capital Formation (from domestic transaction and import matrix independently) in the final demand.

(3) Using the ratios thus derived, the row vector of “Machine-repair” is expanded to a matrix for intermediate transactions. [To be continued in step (4) below.]

	A	B	C	...	FCF	...	TO
:							
Machinery x	↑ 60	↑ 54	↑ 30	0.30	$\left\{ \begin{array}{l} 72 \\ 120 \\ 48 \end{array} \right.$		
Machinery y	↑ 100	↑ 90	↑ 50	0.50			
Machinery z	↑ 40	↑ 36	↑ 20	0.20			
:					↑ Distribution ratios: domestic		
Machine-repair	(200)(180)(100)						
:							
Machinery x	↑ 16	↑ 8	↑ 0	0.40	$\left\{ \begin{array}{l} 8 \\ 5 \\ 7 \end{array} \right.$		
Machinery y	↑ 10	↑ 5	↑ 0	0.25			
Machinery z	↑ 14	↑ 7	↑ 0	0.35			
:					↑ Distribution ratios: import		
Machine-repair	(40)(20)(0)						
:							
Value-added							
TO							

China, Japan

(1) The types of machines repaired in the Machine-repair sector are identified.

China: All the machines that have entries in the Capital Formation Matrix are assumed to have been repaired.

Japan: In consultation with the Japanese Standard Industrial Classification, the machines listed under the Machine-repair sector are assumed to have been repaired.

(2) For the commodities identified in step (1), the distribution ratio for each industry (column) is derived from the Capital Formation Matrix¹⁹ at the level of groupings permitted by the data's classification.

¹⁹ The Capital Formation Matrix of China is estimated by the National Bureau of Statistics, but the data are for internal use only.

(3) Using the ratios thus derived, the row vector of “Machine-repair” is expanded to a matrix for intermediate transactions.

	A	B	C	...	...	TO
:						
Machinery x	↑ 60	0.30	↑ 36	↑ 20	0.20	...
Machinery y	↑ 100	0.50	↑ 72	↑ 40	0.40	...
Machinery z	↑ 40	0.20	↑ 72	↑ 40	0.40	...
:						
Machine-repair	(200)	(180)	(100)	...		
:						
:						
Machinery x	↑ 12	0.30	↑ 4	↑ 0	0.20	...
Machinery y	↑ 20	0.50	↑ 8	↑ 0	0.40	...
Machinery z	↑ 8	0.20	↑ 8	↑ 0	0.40	...
:						
Machine-repair	(40)	(20)	(0)	...		
:						
Value-added						
TO						

	A	B, C	D	...
Mach. x	15	4	12	...
Mach. y	25	8	0	...
Mach. z	10	8	8	...
Total	50	20	20	

	A	B, C	D	...
Mach. x	0.30	0.20	0.60	...
Mach. y	0.50	0.40	0.00	...
Mach. z	0.20	0.40	0.40	...
Total	1.00	1.00	1.00	

(4) If entries are present at the intersection of Machine-repair and PCE, the ratios are derived with respect to PCE (domestic transactions and import matrix independently). Using the ratios thus derived, the entries are distributed along PCE.

	A	B	C	...	PCE	...	TO
:							
Machinery x					+3	30	0.33
Machinery y					+5	45	0.50
Machinery z					+2	15	0.17
:							
Machine-repair					(10)		
:							
:							
Machinery x					+0	0	0.00
Machinery y					+2	4	0.67
Machinery z					+0	2	0.33
:							
Machine-repair					(2)		
:							
Value-added							
TO							

(5) The sums of increased values are calculated row-wise, which form the TO of machine-repair activity for each type of machinery.

	A	B	C	...	PCE	...	TO
:							
Machinery x	↑ 60	↑ 36	↑ 20		↑ 3		↑ 119
Machinery y	↑ 100	↑ 72	↑ 40		↑ 5		↑ 217
Machinery z	↑ 40	↑ 72	↑ 40		↑ 2		↑ 154
:							
Machine-repair							
:							
:							
Machinery x	↑ 12	↑ 4	↑ 0		↑ 0		
Machinery y	↑ 20	↑ 8	↑ 0		↑ 2		
Machinery z	↑ 8	↑ 8	↑ 0		↑ 0		
:							
Machine-repair							
:							
Value-added							
TO							

(6) The TO ratios are calculated and then applied to splitting the column vector of “Machine-repair”.

(7) The “Machine-repair matrix” thus derived is added on to the table.

(8) The row and column vectors of “Machine-repair” are deleted.

	...	Industry x	Industry y	Industry z	Machine repair	PCE	...	TO
:								↑ 119
:								↑ 217
:								↑ 154
:								
:								
Value-added								
TO		↑ 119	↑ 217	↑ 154				

0.24 0.44 0.31 ←

{ 0.24
 0.44
 0.31 }
 TO ratio

3.5. Financial intermediaries

Banks or financial intermediaries provide their services in the form of channeling the lender’s desire to lend on the one hand, and the borrower’s need to borrow on the other. The conventional treatment of this service is to measure its output by taking the difference between interest receivable and interest payable by banks. This amount is known as Financial Intermediary Services Indirectly Measured (FISIM).²⁰

3.5.1 FISIM to final demand

The IO tables of some countries pose a restriction on FISIM, requiring it to be allocated to intermediate transactions only. For example, the Japanese table uses the amount of each industry’s outstanding loans as a referential ratio for allocating FISIM among industrial sectors. FISIM is thus allocated only to intermediate demand, disregarding education loans or car loans consumed by households.

In the AIIOT framework, the adjustment is made so as to allow FISIM output to final demand sectors as well.

<Adjustment procedure>

Japan

(1) The value found at the intersection between “6211-011, 6211-012 Financial service: imputed interest (row)” and “9000-000 Activities not elsewhere classified (column)” (= x) is shifted to the intersection with PCE. This is because the value (x) is known to in effect represent FISIM to final demand sectors.

(2) The Operating surplus of “9000-000 Activities not elsewhere classified” is increased by the same amount.

	A	B	...	Financial services	...	...	Unclassified		PCE	...	TO
Product A				10							
Product B				5							
Product C				25							
:				:							
FISIM	5	18	...	70	0	...	(x)	→	+x		±0
Bank commission	2	10	...	50	0	...			20		
:				:							
Operating surplus							+x				
TO				±0			±0				

²⁰ Also called “imputed interest” in the older SNA terminology. See Appendix 2 for its treatment after the 1993 SNA.

3.5.2 FISIM dummy sector

The 1968 SNA suggested that due to the difficulty of allocating FISIM among service users, the amount should be grossly entered into the intersection of the financial service sector (row) and a dummy intermediate sector (column), with a negative operating surplus representing the same amount in the value-added of that dummy sector in order to cancel out its intermediate entry.²¹

Following the AIIOT's tabulation principle of having no dummy sector, the FISIM of the Malaysian and Singaporean tables are adjusted in the following manner.

<Adjustment procedure>

Malaysia, Singapore

- (1) The values of education loans, car loans, housing loans, and the amount of debt outstanding of domestic industries are collected from reliable sources.²²
- (2) Distribution ratios are constructed from the data prepared in step (1).
- (3) The value of FISIM (= i) is distributed as follows.
 - (3)-1 The values obtained from the ratios of education loans and car loans are entered into the intersection of the domestic financial service sectors (row) and PCE (= a).
 - (3)-2 The value obtained from the ratio of housing loans is entered into the intersection with "Ownership of dwellings (column)" (= b). See also the next section.
 - (3)-3 For the remaining items, the value is distributed among industries at the first level of classification permitted by the data of debt outstanding.
 - (3)-4 Within a distributional grouping defined by the data of debt outstanding, the value is further distributed by using TOs as ratios for subdivision (= d).
- (4) The resulting increase in the total intermediate input is offset by a corresponding decrease in each industry's Operating surplus.

	...	Own. Dwel	...	FISIM	PCE	...	Exp	TO
:	↑ d							
Financial service	...	↑ b		(i)	↑ a			
:	↓ d							
Operating surplus	...	↓ b		(-i)				
TO	±0	±0		±0				

$i = a + b + \Sigma d$

²¹ As FISIM is not allocated among individual industries, each industry's operating surplus is considered to have been expanded by the amount of FISIM. This is offset row-wise by the negative entry of the dummy (-i) so that GDP remains unaffected.

²² For Singapore, loans and advances from banks/finance companies to industries as well as to professional and private individuals are obtained from *the Yearbook of Statistics*.

3.5.3 Housing loans

Interest on housing loans should be recorded at the intersection between financial service sectors and the “Ownership of dwellings” sector as an intermediate transaction, even though it is in reality paid by households. This is because of the SNA’s treatment of imputing housing activities.²³

In the Thai table, the payment of interest on housing loans is recorded at the intersection of “160 Banking services (row)” and PCE, which requires an adjustment as follows.

<Adjustment procedure>

Thailand

- (1) The amount of interest on housing loans are obtained from reliable sources.
- (2) The figure prepared in step (1) is shifted from the intersection with PCE to that with “163 Real estate (= Ownership of dwellings)”.
- (3) The resulting increase in the total intermediate input of “Real estate” is offset by the corresponding decrease in its Operating surplus.

	A	B	...	Own. Dwel	...	PCE	...		TO
Product A									
Product B									
Product C									
:									
Financial service				↑ x		↓ x			±0
:									
Operating surplus				↓ x					
TO				±0					

²³ Imputation is a special form of recording transaction values where no actual flow of money occurs. For example, if a person owns a house, the individual acquires a double identity: one as a provider of housing services (= industry) and one as a tenant of the building (= household). Therefore, the transaction is recorded as if the person, as a tenant, is paying him/herself, as a landlord, a certain amount of rent evaluated at a market rate for renting a house of the same size and quality. This hypothetical rent is recorded as an output of the “Ownership of dwellings” sector.

3.6. Special treatment of import/export

3.6.1 Water transportation

Any forwarding charges paid to domestic carriers should be recorded as exports of “Water transport” since the payments constitute output of the domestic water-transport sector. In the US table, however, the amount of forwarding charges received by domestic carriers is recorded in the Import vector as a positive value (although entries in the Import vector are supposed to be presented as negative values). The adjustment should be made as follows.

<Adjustment procedure>

United States

- (1) The positive value of “483000 Water transportation” × “Imports” is deleted.
- (2) The same amount is added to that sector’s exports.

	A	B	C	Imp	Exp	TO
Product A								
Product B								
Product C								
:						:	:	
Water transport						(20)	↑ 20	
:						:	:	
Value-added								
TO								

3.6.2 “Pure import” of gold

The transaction value of gold in the Import vector, recorded at the intersection with “2122A0 Gold, silver, and other metal ore mining” is composed of two things: [1] An ordinary import value obtained through the trade statistics, and [2] “pure imports”, which show the difference between the domestic production and domestic consumption of gold. A positive value of “pure imports” means excess domestic production over domestic consumption, and vice versa.

Since excess production is either exported or held in inventories, and since exports are already recorded in the Export vector, it follows that the positive value of “pure imports” in the table should be attributed to the inventory only. Therefore, the US table requires the following adjustment.

<Adjustment procedure>

United States

- (1) The values of “Pure imports”, which can be collected from the data of National Income and Production Accounts, are deducted from the “Gold” sector’s imports.
- (2) The same amount is added to that sector’s “Change in Stocks”.

	A	B	C	...	Sto-cks	Imp	Exp	TO
Product A								
Product B								
Product C								
:								
Gold, silver, ...					↑ 3.1 ↓ 3.1			
:								
Value-added								
TO								

3.6.3 Re-exports

In the AIIOT, re-exports should not be counted in any way, either as an export or as an import.

In the Malaysian table, however, positive entries can be found along the Export vector in the import matrix, which represent the value of re-exports.

<Adjustment procedure>

Malaysia

They are simply deleted from the table.

	A	B	C	...	PCE	...	Exp	TO
Product A								
Product B								
Product C								
:								
Product A							(8) --> 0	
Product B							(0) --> 0	
Product C							(22) --> 0	
:							:	
Value-added								
TO								

3.6.4 Import of telecommunication services

In the Korean table, the import of telecommunication services such as international telephone calls or foreign mail is not directly allocated to the demand industry but is collectively recorded as its own intermediate input of telecommunications. Accordingly, the table is adjusted as follows.

<Adjustment procedure>

Korea

(1) The import value is distributed row-wise using the output ratio of the Telecommunication sector (domestic).

	A	B	C	...	Tel	PCE	...	Exp	TO
Product A					:				
Product B					:				
Product C					:				
:					:				
Telecom.	20	50	30			100			200
	0.10	0.25	0.15			0.50			
Product A									
Product B									
Product C									
:									
Telecom.	+4	+10	+6		(40)	+20			
Value-added									
TO					200				

(2) The same values are subtracted from the entries along the row for Telecommunications in order to keep each industry's total input (column TO) unchanged.

	A	B	C	...	Tel	PCE	...	Exp	TO
Product A					:				
Product B					:				
Product C					:				
:					:				
Telecom.	16	40	24	...		80			↓ 40
Product A									
Product B									
Product C									
:									
Telecom.	4	10	6	...	0	20			
Value-added									
TO	±0	±0	±0	...	↓ 40				

3.8. Producer of government services

The activities of “producers of government services” should be treated as intermediate sectors rather than final-demand items. The US and Thai tables should be adjusted in this respect.

United States

The vectors of final consumption expenditure by the government include not only the expenses paid by the government for providing services at nonmarket prices but also the production cost of activities undertaken by the producers of government services.

In most IO tables, the latter is treated as an independent intermediate sector and not as a final demand item. There are four final demand items in the US table under this concern:

“F06C00 Federal government national defense”

“F07C00 Federal government nondefense”

“F08C00 State and local government education”

“F09C00 State and local government other”

There is also an intermediate sector called “S00500 General government industry”, which is a dummy sector with inputs in value-added items only. The entries represent the total values of the value-added of all government service producers.

Row-wise, there are positive entries at the intersections with the above four final demand items.

Therefore, the general situation is one where the intermediate inputs of government service producers are registered in the corresponding final demands from F06C to F09C, and their value-added are aggregated in “General government industry”.

	A	B	...	...	GGI	PCE	F06 C00	F07 C00	F08 C00	F09 C00	...	TO
Product A					0	150	12	6	3	4		
Product B					0	120	8	4	2	1		
:					0	:	:	:	:	:		
Sectors including	2	25	...		0	300				-120		
public affairs, such as	3	12	...		0	400	-8	-80				
education, medical etc.	1	4	...		0	250		-10		-15		
:					:	:	:	:	:	:		
General gov. ind.	0	0	...		0	0	20	12	10	8		50
Comp. of employee					30							
Indirect tax					0							
Other value-added					20							
TO					50							

Total value-added of government service producers
Values received by the government as compensation for government services.

<Adjustment procedure>

United States: Producers of government service <educational services>

“611000 Education (intermediate sector)” in the table has different scopes of coverage for its row and column. The row vector “Education” covers both private and public education, but the column vector covers only private education. Meanwhile, the cost of public education services is entered in “F08C00 State and local government education” in the final demand.

Payments received by the government as compensation for public education services (such as tuition fees or the sale of textbooks) are registered as a negative value at the intersection of the row “Education” and the F08C00.

Other payments (such as to a student refectory or dormitory) are recorded at the intersections with the corresponding industrial sectors (restaurants/hotels, etc.).

	A	B	...	Edu	...	PCE	F08C00	...	Exp	TO
private & public education										
Product A				4			3			
Product B				1			2			
:				5			10			
Education	2	25	...				-120			
:				9			7			
Restaurant/hotels				:			-20			
General gov. ind.							10			
Comp. of employee										
Indirect tax										
Other value-added										
TO										

(1) First of all, a new industrial sector “Education: public” is added to the table. All positive entries in F08C00, except those with “General government industry”, are shifted to the column of this new sector.

	A	B	...	Edu org	Edu pub	...	PCE	F08C00	...	Exp	TO
Product A				4	3	←		(3)			
Product B				1	2	←		(2)			
:				5	10	←		(10)			
Education (original)	2	25	...					(-120)			
:				9	7	←		(7)			
Restaurant/hotels				:				(-20)			
General gov. ind.								(10)			
Comp. of employee											
Indirect tax											
Other value-added											
TO											

(2) For value-added items of this new sector, the entry at the intersection of “General government industry” and F08C00 is apportioned and assigned using the ratio taken from the value-added of “General government industry”.

	A	B	...	Edu prv	Edu pub	...	GGI	PCE	F08 C00	...	Exp	TO
Product A				4	3		0					
Product B				1	2		0					
:				:	:		0					
Education (original)									(-120)			
:				:	:		0					
Restaurant/hotels									(-20)			
General gov. ind.									(10)			(50)
Comp. of employee					6		0.6 (30)					
Indirect tax							0.0 0					
Other value-added					4		0.4 (20)					
TO							(50)					

(3) Similarly, the row vector of “Education: public” is established. Recalling that the value at the intersection of the original “Education” and F08C00 represents households’ payments for public educational services, this amount is redefined as an entry in the PCE as the purchase of “Education: public”. The equivalent amount is subtracted from the original “Education” × PCE and the entry in F08C00 is deleted.

	A	B	...	Edu prv	Edu pub	...	PCE	F08 C00	...	Exp	TO
Product A				4	3						
Product B				1	2						
:				:	:						
Education (original)								↓120(-120)			
Education: public								+120			
:				:	:						
Restaurant/hotels								(-20)			
Comp. of employee					6						
Indirect tax					0						
Other value-added					4						
TO											

(4) The same treatment is carried out for payments for accommodation/restaurant services provided by public schools, etc., represented by the negative values registered along F08C00.

	A	B	...	Edu prv	Edu pub	...	PCE	F08 C00	...	Exp	TO
Product A				4	3						
Product B				1	2						
:				:	:						
Education: private								↓120			
Education: public								+120			
:				:	:			+20			
Restaurant/hotels								↓20	(-20)		
Comp. of employee					6						
Indirect tax					0						
Other value-added					4						
TO											

At this stage, the separation of public education from the “Education” vector is completed. The remaining values in the original vector become “Education: private”.

(5) Now the vector of F08C00 disappears, while a new final demand item “Government Final Consumption Expenditures (GFCE)” is established. The difference between the column TO of “Education: public” and the aggregated amount of all entries along its row vector is placed at the intersection of “Education: public” and the newly established GFCE.

	A	B	...	Edu prv	Edu pub	...	PCE	GF CE	Exp	TO
Product A				4	3					
Product B				1	2					
:				:	:					
Education: private							-120			
Education: public							140	360		500
:				:	:					
Restaurant/hotels							-20			
Comp. of employee					6					
Indirect tax					0					
Other value-added					4					
TO					500					

Differences between TO and an aggregate amount of all row values

TO is calculated as a sum of intermediate input and Value-added.

United States: Producers of government service <non-educational services>

Using the same process as established for “Education”, the row vectors of the sectors that cover public affairs include both private and public transactions, whereas the corresponding column vectors include private activities only.

	A	B	...	Med	Post	...	GGI	PCE	F06 C00	F07 C00	F08 C00	F09 C00	...	TO
Product A				4	5		0	150	12	6		4		
Product B				12	8		0	120	8	4		1		
:				:	:		0	:	:	:		:		
Medical services	2	20	...				0	400	-5	-25		-60		
Postal services	3	12	...				0	250	0	-80		0		
Public utilities etc.	1	4	...					320	0	0		-15		
:								:	:	:		:		
General gov. ind.	0	0	...				0	0	20	12		8		50
Comp. of employee							30							
Indirect tax							0							
Other value-added							20							
TO							50							

Annotations: "private only" points to Med and Post columns; "private & public" points to A and B columns.

(1) A new sector “Public administration” is established. Nearly the same adjustment is carried out for this sector as done for the “Education” sector, with respect to F06C00, F07C00, and F09C00. The only difference is that instead of shifting the negative entries to PCE, they are moved to the newly established “Government Final Consumption Expenditure” under final demand.

(2) The row and column of “General government industry” are deleted.

	A	B	...	Pub adm	...	GGI	PCE	F06 C00	F07 C00	F08 C00	F09 C00	GF CE	TO
Product A				22				(12)	(6)		(4)		
Product B				13				(8)	(4)		(1)		
:				:				:	:		:		
Medical services	2	20	...					(-5)	(-25)		(-60)		-90
Postal services	3	12	...					(0)	(-80)		(0)		-80
Public utilities etc.	1	4	...					(0)	(0)		(-15)		-15
:								:	:		:		
Public admin.	0	0	...				0					250	250
:													
General gov. ind.	0	0	...					(20)	(12)		(8)		(50)
Comp. of employee				24	0.6	(30)							
Indirect tax				0	0.0	(0)							
Other value-added				16	0.4	(20)							
TO				250		(50)							

Annotations: "The total TO value is apportioned." points to GFCE column; "TO is calculated as a sum of intermediated input and value-added items." points to TO row.

Thailand:

“165 Public administration” has inputs from value-added items only (no intermediate input). Its sole output destination is Government Consumption Expenditure.

<Adjustment procedure>

(1) All the components of Government Consumption Expenditure, except the value at the intersection with “Public administration (domestic)”, are directly shifted to the column vector of “Public administration”.

(2) The resulting increase in total input is matched by an extra entry at the intersection of “Public administration (row)” and Government Consumption Expenditure, equal to the amount of total intermediate inputs.

	A	B	C	...	PA	...	GCE	...	Exp	TO
Product A					12	←	(12)			
Product B					18	←	(18)			
Product C					6	←	(6)			
:					:		:			
Public admin.							86+54			↑ 54
:					:		:			
Product A					4	←	(4)			
Product B					2	←	(2)			
Product C					8	←	(8)			
:					:		:			
Public admin.					3	←	(3)			
:					:		:			
Total Int. Input					↑ 54	←				
Value-added										
TO					↑ 54					

4. CONCLUSION

With increasing awareness among national statistical officers regarding the importance of international comparability of key statistics, the features of national IO tables have been observed to converge over time. Some countries, however, still find it difficult to develop their statistical infrastructure in line with the international standard due to various domestic factors such as legal systems, taxation schemes and, most importantly, the degree of data availability.

Motivated to fill this gap, this study provides a practical guide for data harmonization procedures to construct a consistent and comparable multi-regional input–output table by referring to the adjustment practice of IDE-JETRO’s Asian International Input–Output Table. Even though the examples introduced in this study address many harmonization issues, they are by no means exhaustive and complete, and the readers (MRIOT compilers) are highly encouraged to devise more efficient and effective methods of harmonization.

In particular, in 2016, the United Nation will release a new edition of *The UN Handbook of Supply, Use and Input–Output Tables*, which is expected to provide a comprehensive guideline for the compilation of national as well as multi-regional input–output tables in line with the 2008 SNA.²⁴ The author hereby wishes that supply/use and input–output tables constructed thereafter will closely follow the UN guideline so that the adjustment methods introduced in this study should no longer be relevant in the years to come.

<Important acronyms>

AIOT: Asian International Input–Output Table
FISIM: Financial Intermediaries Indirectly Measured
GFCE: Government Final Consumption Expenditure
IO: input–output
MRIOT: multi-regional input–output table
PCE: Private Consumption Expenditure
SNA: The System of National Accounts
TO: total output

<Reference>

IDE-JETRO (2006), *Asian International Input–Output Table 2000, Vol.1 & Vol.2*, Institute of Developing Economies, JETRO, Japan.

²⁴ The compilation principles recommended in *the Handbook* differ significantly in some respects from those of the Asian International Input-Output Tables. For example, *the Handbook* recommends using the basic price for the valuation scheme, whereas Asian International Input-Output Tables are valued at the producer’s price.

Appendix 1: Treatment of scraps and by-products

Suppose that the Gas Supply sector produces 100 units of city gas as a principal product (to be consumed by a household) and 10 units of coke as a by-product (to be consumed by the Pig Iron sector). This is represented in different ways as follows.

(1) Gross-counting method (“Aggregation method” in SNA terminology)

The gross-counting method does not differentiate between the production of a by-product from that of principal activity. Accordingly, the 10 units of coke produced as a by-product are recorded together with the output of city gas along the row for the Gas Supply sector.

	-- Gas sup.	Coke	Pig iron --	PCE	Total output
Gas supply			10	100	100+10
Coke					
Pig iron					
Value-added					
Total output	110				

(2) Transfer method (No SNA equivalent)

The transfer method presumes that a by-product will reach the final user via the sector that produces that good as a principal product. In the present example, 10 units of coke (as a by-product) will first go to the Coke manufacturing sector, and then undertake a further step to reach the Pig Iron sector (final user). As a result, these 10 units of coke are double-counted in total output.

	-- Gas sup.	Coke	Pig iron --	PCE	Total output
Gas supply		10		100	100+10
Coke			10		+10
Pig iron					
Value-added					
Total output	110	+10			

(3) Stone method (“Negative transfer method” in SNA terminology)

The stone method treats the output of by-products as a negative input of the producing sector, and hence a corresponding negative value is recorded against the row for the sector producing the same good as a principal product. So, –10 units of coke are recorded at the intersection between the Coke sector (row) and the Gas Supply sector (column). Since the input of coke to the Pig Iron sector is recorded as usual, these values cancel each other out and the total output of by-product coke becomes zero.

	-- Gas sup.	Coke	Pig iron --	PCE	Total output
Gas supply				100	100
Coke	-10		10		+0
Pig iron					
Value-added					
Total output	100	+0			

(4) Separation method (“Redefinition method” in SNA terminology)

The separation method does not differentiate between a good as a by-product and the same good as a principal product. Accordingly, the example 10 units of coke are recorded together with other outputs of coke produced by the Coke sector, as shown by the entry at the intersection of the Coke sector (row) and the Pig Iron sector (column). In addition, imputed inputs for producing by-products are separated from the principal activity (Gas Supply sector) and added to the input structure of the activity to which the by-product belongs as a good (Coke sector).

	-- Gas sup.	Coke	Pig iron --	PCE	Total output
Gas supply	-2	+2		100	100
Coke			10		+10
Pig iron	-3	+3			10
Value-added	-5	+5			
Total output	100	+10	10		

Appendix 2: Treatment of FISIM after the 1993 SNA

The 1993 SNA proposes a different scheme from its predecessor for allocating the output of FISIM. The basic philosophy that underlies the new scheme is that the beneficiaries of banks' intermediary services are both borrowers and lenders, and hence output allocation should be considered with reference to both sides of the service.

To take an analogy from trading activities, suppose that a consumer purchases a commodity directly from its producer, without involving any wholesales or retails in-between. The price of that commodity is likely to converge somewhere between its market producer's price and the market purchaser's price, depending on the customer's and producer's relative bargaining powers. The extra rent that accrues to the customer from this transaction is the difference between the purchaser's price and the agreed price, and the rent for the producer being the difference between the producer's price and the agreed price. The sum of these two margins equals the would-be wholesale and retail trade margins, which are these sectors' rewards for their intermediation in the goods flow.

Following the same line of reasoning, an output of a financial intermediary is decomposed into two parts: one for the borrower's side and the other for the lender's side. A borrower is paying the bank a higher interest rate than would be paid if direct contact and bargaining occurred with a lender. The same is true for a lender, who is obliged to receive a lower interest rate than the one that could be negotiated directly with an individual borrower. So both borrowers and lenders are users of financial intermediary services (which implies that allocating output in accordance with only the borrower's debts outstanding is simply one-sided).

The question then becomes merely the issue of how to choose an appropriate reference for the interest rate (i.e., the pure cost of borrowing funds), which delineates the output between the rents of borrowers and those of lenders. The 1993 SNA recommends the use of an inter-bank lending rate, or, alternatively, the central bank lending rate.

