How to Construct the BRICs International Input-Output Table

Satoshi Inomata

Institute of Developing Economies, JETRO

Introduction

An international I-O table is not just a patchwork of the pieces taken from its constituent national I-O tables, but it is a product of careful utilization of supplementary data and manual reconciliation. A number of statistical experts from various countries are involved, exchanging considerable amounts of valuable information and technical expertise. It is, indeed, the work of an artistic practice.

This paper illustrates the construction process of the upcoming BRICs International Input-Output Table, which, roughly speaking, goes through the following three distinctive phases:

(1) Adjustment of presentation format
(2) Preparation of sector concordance and supplementary data
(3) Linking and balancing of the tables

1. Adjustment of presentation format

Despite the fact that input-output tables constitute the central apparatus of the System of National Accounts, each national table of an individual country exhibits more or less different features and characteristics, reflecting the country's economic idiosyncrasies and availability of data. Such a variety in the form, however, poses a practical difficulty when compiling international input-output tables. For even though the international table is composed of the segments taken from each national I-O table, the interpretation of the data should be mutually consistent and comparable for any part of the whole.

Accordingly, one of the most complicated, nerve-racking tasks of compilation is the adjustment of national tables towards the common format. In general, it is the detailed, information-rich table that has to concede to less-detailed ones, as the other way round would require a costly (yet often unrewarding) effort of obtaining relevant data. Therefore, there always exists a trade-off between the level of uniformity and the level of information, and hence careful and thorough consideration is called for in making adjustment rules.

List of adjustment targets for each national table:
- Reference from the 2000 Asian International Input-Output Table

	CHINA	INDONESIA	JAPAN	KOREA	MALAYSIA	TAIWAN	PHILIPPINES	SINGAPORE	THAILAND	U.S.A.
1. Conversion of valuation										
1.1 Basic price to producer's price								X		
1.2 Private Consumption Expenditure					X			X		X
1.3 Export vectors					X			X		
1.4 Import matrix/vector			X	X			X		X	X
2. Negative entries				X						
3. Dummy sectors	X		X	X	X			X		X
4. Machine-repair	X		X				X			X
5. Financial intermediaries			X		X			X	X	
6. Special treatment of import/export										
6.1 Water transportation										X
6.2 "Pure import" of gold										X
6.3 Re-export					X					
6.4 Telecommunication				X						
7. Computer software products						X				
8. Producers of government services									X	X

2. Preparation of sector-concordance and supplementary data

2.1   The table of industrial sector concordance

Each national table has its own industrial classification. In the case of the benchmark tables for the BRICs international I-O table, the number of industrial sectors ranges from 15 for the Russian table to 517 (row) for the Japanese table. The weight of the industrial category also differs. The countries with large agro-based economies have relatively detailed classification of agricultural sectors, while industrialised economies give more comprehensive coverage to manufacturing sectors. As such, the sector

classification reflects the characteristics of the economy concerned, and a precise conversion system that bridges between national I-O codes and BRICs I-O codes is absolutely essential for the construction of consistent international I-O tables.

The system of sector concordance has a treelike image, where BRICs classification (the broadest category with 26 sectors: see Annex) rests on the top, and each BRICs I-O code corresponds to one or several national I-O codes. The national codes are subcategorised into the Harmonised System (HS) of Foreign Trade Statistics, which may be further converted to SITC, another classification system for the trade data.

If the concordance system has such a clear-cut tree structure, the aggregation of national tables into BRICs I-O classification poses no difficulty. The problem arises when a national code is associated with more than two BRICs codes. Here, the sector splitting of the national I-O table is called for before the aggregation procedure.

2.2 Supplementary data

For the construction of international tables, the following supplementary data should be prepared by each country at the BRICs sector classification.

(1) Import data by commodity and by 7 countries of origin*

(2) Export data by commodity and by 7 countries of destination

(3) Import duties and import commodity taxes by commodity

(4) Domestic trade margins and domestic freight transport costs (TTM) on exported goods, by commodity

(5) International freight and insurance, by commodity and by 7 countries of origin

(6) Other relevant information, such as the distribution ratios of imported goods.

* 7 countries: BRICs countries plus Japan, the USA., EU, the Rest of the World

The import and export data can be directly constructed from the Foreign Trade Statistics with the help of the HS (or SITC)—national I-O—BRICs I-O sector concordance. The data on import duties and import commodity taxes, on the other hand, are independently presented in the original national I-O tables in most cases, but if not (as in the case of the U.S. table), they must be also collected from the Foreign Trade Statistics.

The data of trade margins and transportation cost (TTM) comes from auxiliary tables

of the national I-O tables. Ideally, those levied on exported goods (for the delivery from factories to ports) should be used, but if they are not available from the table the average figures of the TTM matrices can be used as proxies.

Finally, the data on international freight and insurance are collected from the Foreign Trade Statistics, where available. Yet, because not all countries have these data, it is necessary to apply some estimation methods to make up for the missing information. In most of the empirical literature on international trade, it is a common exercise to use the distance between countries as a proxy for transport costs, owing to the limited availability of direct transport-cost data. So, the parameter values should be obtained by running a regression of a transport-cost equation for each BRICs I-O sector, and the missing values are then projected upon the estimated parameters.

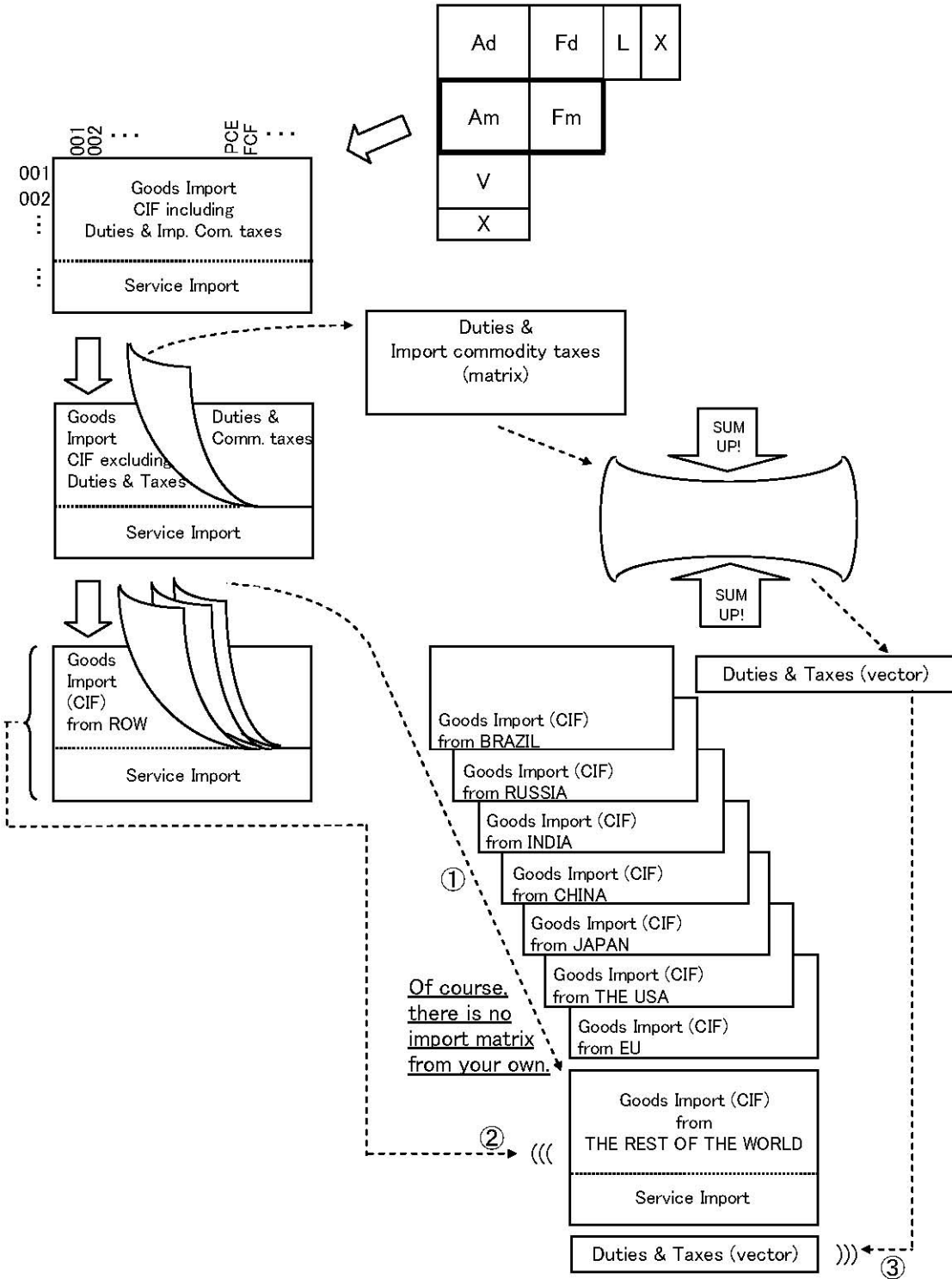# 3. Linking and balancing of the tables

3.1 Linking process

< JOB1> The first job is to construct import matrices by country of origin. Here we start from the original import matrix given in a national table.

Firstly, import duties and import commodity taxes are taken out. I-O tables of some countries include duties and commodity taxes in their import matrices. In such a case, it is necessary to separate them using duties and import commodity tax ratios. The separated duties and taxes are aggregated column-wise into a single row vector, and it will be presented independently in the table.
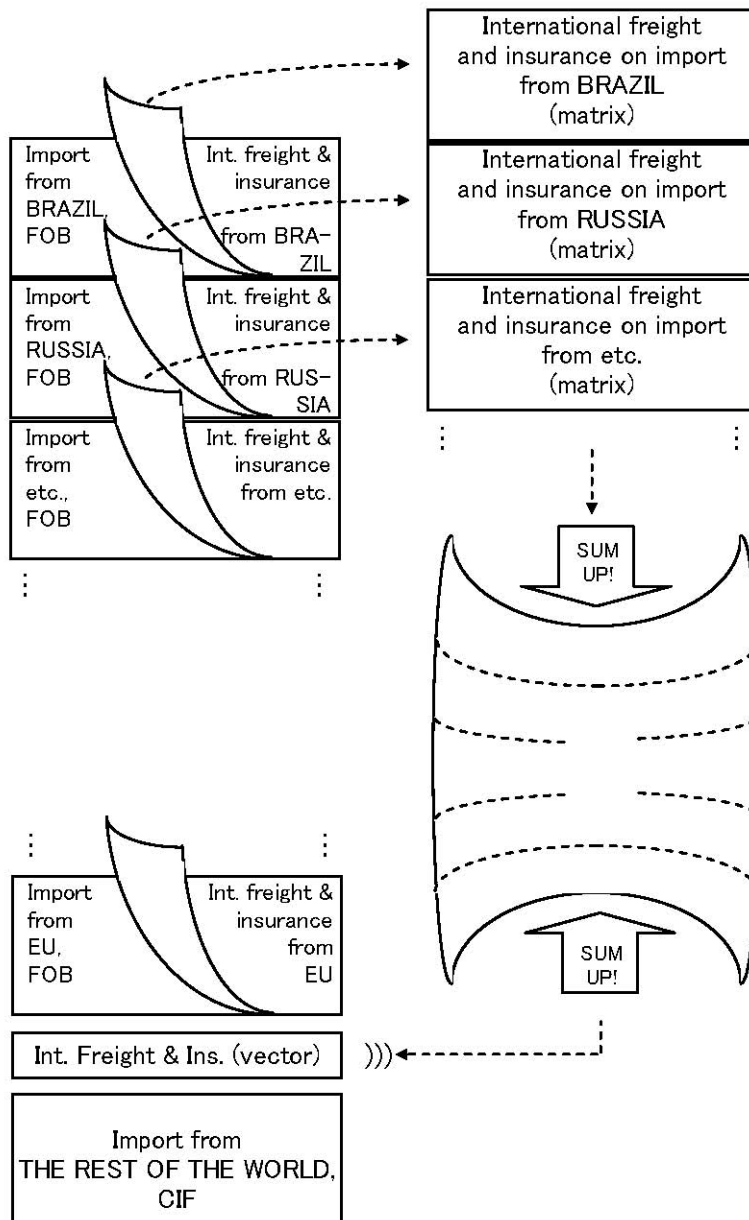
After this, the import matrix is to be split by country of origin. We first derive the country shares of each imported item, and apply them in order to divide the matrix by country of origin. As a result, there will be seven import matrices, including the one from the Rest of the World.

JOB 1: MAKING OF IMPORT MATRICES by countries of origin

Ad	Fd	L	X
Am	Fm		
V			
X			

001 002 ... PCE FCF ...

001
002
⋮
⋮

Goods Import
CIF including
Duties & Imp. Com. taxes

Service Import

Goods
Import
CIF excluding
Duties & Taxes

Duties &
Comm. taxes

Service Import

Duties &
Import commodity taxes
(matrix)

SUM
UP!

SUM
UP!

Goods
Import
(CIF)
from ROW

Service Import

Duties & Taxes (vector)

Goods Import (CIF)
from BRAZIL

Goods Import (CIF)
from RUSSIA

Goods Import (CIF)
from INDIA

① Goods Import (CIF)
from CHINA

Goods Import (CIF)
from JAPAN

Goods Import (CIF)
from THE USA

Of course,
there is no
import matrix
from your own.

Goods Import (CIF)
from EU

② (((Goods Import (CIF)
from
THE REST OF THE WORLD

Service Import
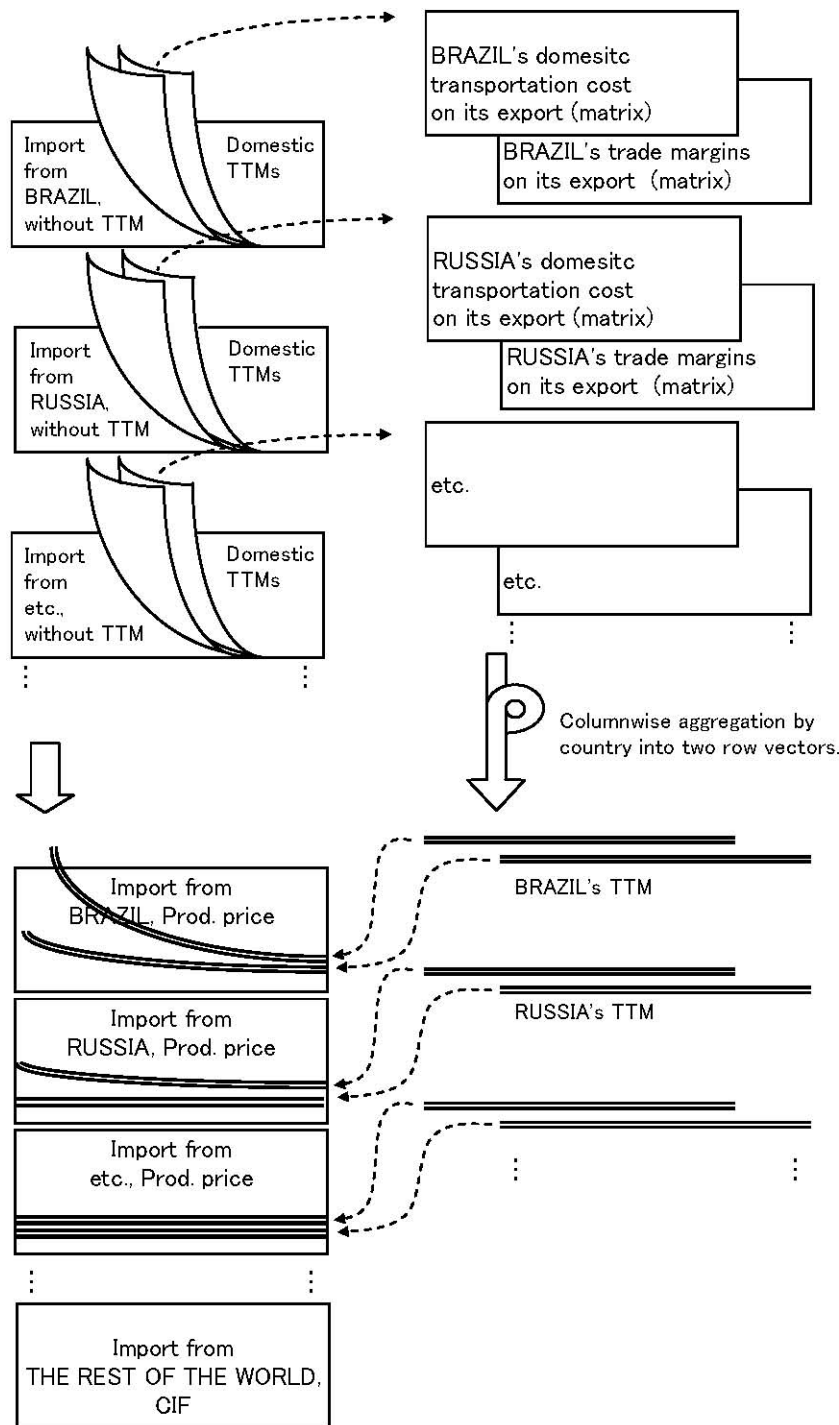
Duties & Taxes (vector)))) ← ③

<JOB2> In the next step, the import matrices have to be re-priced. Firstly, we convert them from c.i.f. to f.o.b., by taking out the international freight and insurance costs. As in the case of duties and commodity taxes, the separated freight and insurance costs are aggregated column-wise into a single row vector, and put independently in the table.

JOB 2: CONVERSION OF IMPORT MATRICIES into producer's price

Import from BRAZIL, FOB	Int. freight & insurance from BRA-ZIL
Import from RUSSIA, FOB	Int. freight & insurance from RUS-SIA
Import from etc., FOB	Int. freight & insurance from etc.

International freight and insurance on import from BRAZIL (matrix)

International freight and insurance on import from RUSSIA (matrix)

International freight and insurance on import from etc. (matrix)

SUM UP!

SUM UP!

Import from EU, FOB	Int. freight & insurance from EU

Int. Freight & Ins. (vector)

Import from THE REST OF THE WORLD, CIF

Then the matrices are further converted into producer's price. Again, this is done by applying the ratio of domestic trade and transport margins, but this time it should be that of the country of origin. The separated TTMs are aggregated column-wise and added on to the corresponding sectors in the import matrices, as the import of services.

<JOB3> Now at this stage, we should have completed most of the parts in the table. The export to the Rest of the World (L) is derived simply as a difference between the export vector of a national table and the totals of exports to member countries constructed from the Foreign Trade Statistics. The remaining parts (shadowed) are in fact directly transplanted from original national I-O tables.

JOB 3: LINKING

	code	Intermediate Demand (A) Brazil (AB)	Russia (AR)	India (AG)	China (AC)	Japan (AJ)	U.S.A. (AU)	EU (AO)	Final Demand (F) Brazil (FB)	Russia (FR)	India (FG)	China (FC)	Japan (FJ)	U.S.A. (FU)	EU (FO)	Export to R.O.W. (LW)	Statistical Discrepancy (QX)	Total Outputs (XX)
Brazil	(AB)	A^{BB}	A^{BR}	A^{BG}	A^{BC}	A^{BJ}	A^{BU}	A^{BO}	F^{BB}	F^{BR}	F^{BG}	F^{BC}	F^{BJ}	F^{BU}	F^{BO}	L^{BW}	Q^{B}	X^{B}
Russia	(AR)	A^{RB}	A^{RR}	A^{RG}	A^{RC}	A^{RJ}	A^{RU}	A^{RO}	F^{RB}	F^{RR}	F^{RG}	F^{RC}	F^{RJ}	F^{RU}	F^{RO}	L^{RW}	Q^{R}	X^{R}
India	(AG)	A^{GB}	A^{GR}	A^{GG}	A^{GC}	A^{GJ}	A^{GU}	A^{GO}	F^{GB}	F^{GR}	F^{GG}	F^{GC}	F^{GJ}	F^{GU}	F^{GO}	L^{GW}	Q^{G}	X^{G}
China	(AC)	A^{CB}	A^{CR}	A^{CG}	A^{CC}	A^{CJ}	A^{CU}	A^{CO}	F^{CB}	F^{CR}	F^{CG}	F^{CC}	F^{CJ}	F^{CU}	F^{CO}	L^{CW}	Q^{C}	X^{C}
Japan	(AJ)	A^{JB}	A^{JR}	A^{JG}	A^{JC}	A^{JJ}	A^{JU}	A^{JO}	F^{JB}	F^{JR}	F^{JG}	F^{JC}	F^{JJ}	F^{JU}	F^{JO}	L^{JW}	Q^{J}	X^{J}
U.S.A.	(AU)	A^{UB}	A^{UR}	A^{UG}	A^{UC}	A^{UJ}	A^{UU}	A^{UO}	F^{UB}	F^{UR}	F^{UG}	F^{UC}	F^{UJ}	F^{UU}	F^{UO}	L^{UW}	Q^{U}	X^{U}
EU	(AO)	A^{OB}	A^{OR}	A^{OG}	A^{OC}	A^{OJ}	A^{OU}	A^{OO}	F^{OB}	F^{OR}	F^{OG}	F^{OC}	F^{OJ}	F^{OU}	F^{OO}	L^{OW}	Q^{O}	X^{O}
Freight and Insurance	(BF)	BA^{B}	BA^{R}	BA^{G}	BA^{C}	BA^{J}	BA^{U}	BA^{O}	BF^{B}	BF^{R}	BF^{G}	FA^{C}	FA^{J}	BF^{U}	BF^{O}			
Import from the R.O.W.	(CW)	A^{WB}	A^{WR}	A^{WG}	A^{WC}	A^{WJ}	A^{WU}	A^{WO}	F^{WB}	F^{WR}	F^{WG}	F^{WC}	F^{WJ}	F^{WU}	F^{WO}			
Duties and Import Commodity Taxes	(DT)	DA^{B}	DA^{R}	DA^{G}	DA^{C}	DA^{J}	DA^{U}	DA^{O}	DF^{B}	DF^{R}	DF^{G}	DF^{C}	DF^{J}	DF^{U}	DF^{O}			
Value Added	(VV)	V^{B}	V^{R}	V^{G}	V^{C}	V^{J}	V^{U}	V^{O}										
Total Inputs	(XX)	X^{B}	X^{R}	X^{G}	X^{C}	X^{J}	X^{U}	X^{O}										

Ad	Fd	L	X
Am	Fm		
V		National I-O table	
X			

3.2 Balancing and reconciliation of data

The column Q presents statistical discrepancies. Any row-wise discrepancies arising out of the difference in data sources will be accumulated here. The table is balanced with respect to the input composition, but total demand is not necessarily consistent with total supply for each country. The discrepancy is mainly caused by the following three factors:

(1) Inconsistency between each country's sector classification: the differences in statistical concepts and sector coverage cannot be eliminated completely.

(2) Entrepot trades are treated in different ways between trading partners. For example, China's import from the U.S.A via Hong Kong may be counted in the U.S. side as its export to Hong Kong, an immediate destination.

(3) Other statistical reasons, including human errors.

The reconciliation work is repeated until the results satisfy a specified criteria (say, the values in the Q column respectively fall below 5% of Control Totals). Additionally, spot-check is conducted at the end of the adjustment. This is to "spot out" any unnatural entries in the table that might have been brought in during the course of the adjustment For example, the output of electricity, gas & water supply or some other service sectors is not supposed to have any entries along Fixed Capital Formation or Change in Stocks. Such mis-tabulation should be cleared and dealt with properly.

Conclusion

The emergence of the BRICs has affected the industrial structures and production networks of the world economy today. The international input-output table that links I-O tables of the BRICs and other major economies (Japan, the USA, and the EU) enables us to grasp the impact of the BRICs expansion and draw the latest map of the dynamics of world economic powers.

This paper is presented to provide a handy reference for the construction process of the BRICs International Input-Output Table. It is sincerely hoped that the data will widely serve the interests of researchers and policy-makers alike, as a powerful analytical tool of the related fields.

References

Miller R.E. and P.D. Blair, Input-Output Analysis: Foundations and Extensions, Prentice-Hall, Inc., 1985.

Furukawa S., International Input-Output Analysis: Compilation and Case Studies of Interaction between ASEAN, Korea, Japan, and the United States, 1975, I.D.E. Occasional Papers Series, No.21, 1986.

I.D.E., Asian International Input-Output Table 1995, I.D.E. Statistical Data Series, No.82, 2001.

Annex: Sector Classification of BRICs International Input-Output Table

Sector Classification of 2005 BRICs Input-Output Table			
7 Sector classification		26 Sector classification	
Code	Description	Code	Description
001	Agriculture, livestock, forestry and fisher	001	Paddy
		002	Other agricultural products
		003	Livestock and poultry
		004	Forestry
		005	Fishery
002	Mining and quarrying	006	Crude petroleum and natural gas
		007	Other mining
003	Manufacturing	008	Food, beverage and tobacco
		009	Textile, leather, and the products thereof
		010	Wooden furniture and other wooden products
		011	Pulp, paper and printing
		012	Chemical products
		013	Petroleum and petro products
		014	Rubber products
		015	Non-metallic mineral products
		016	Metals and metal products
		017	Industrial machinery
		018	Computers and electronic equipment
		019	Other electrical equipment
		020	Transport equipment
		021	Other manufacturing products
004	Electricity, gas and water supply	022	Electricity, gas, and water supply
005	Construction	023	Construction
006	Trade and transport	024	Trade and transport
007	Services	025	Other services
		026	Public administration