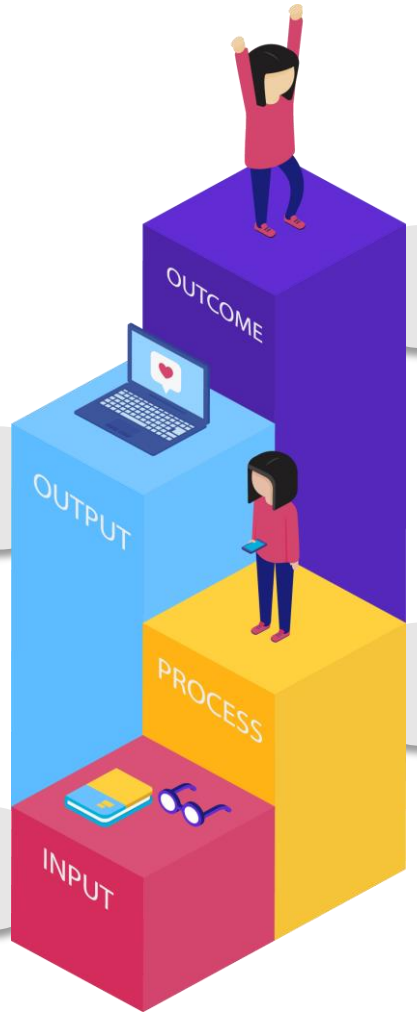
Compilation and Uses of the Multi-Regional Input-Output Tables

22 – 23 October 2019

Yangon, Myanmar

Objectives

Data value chain



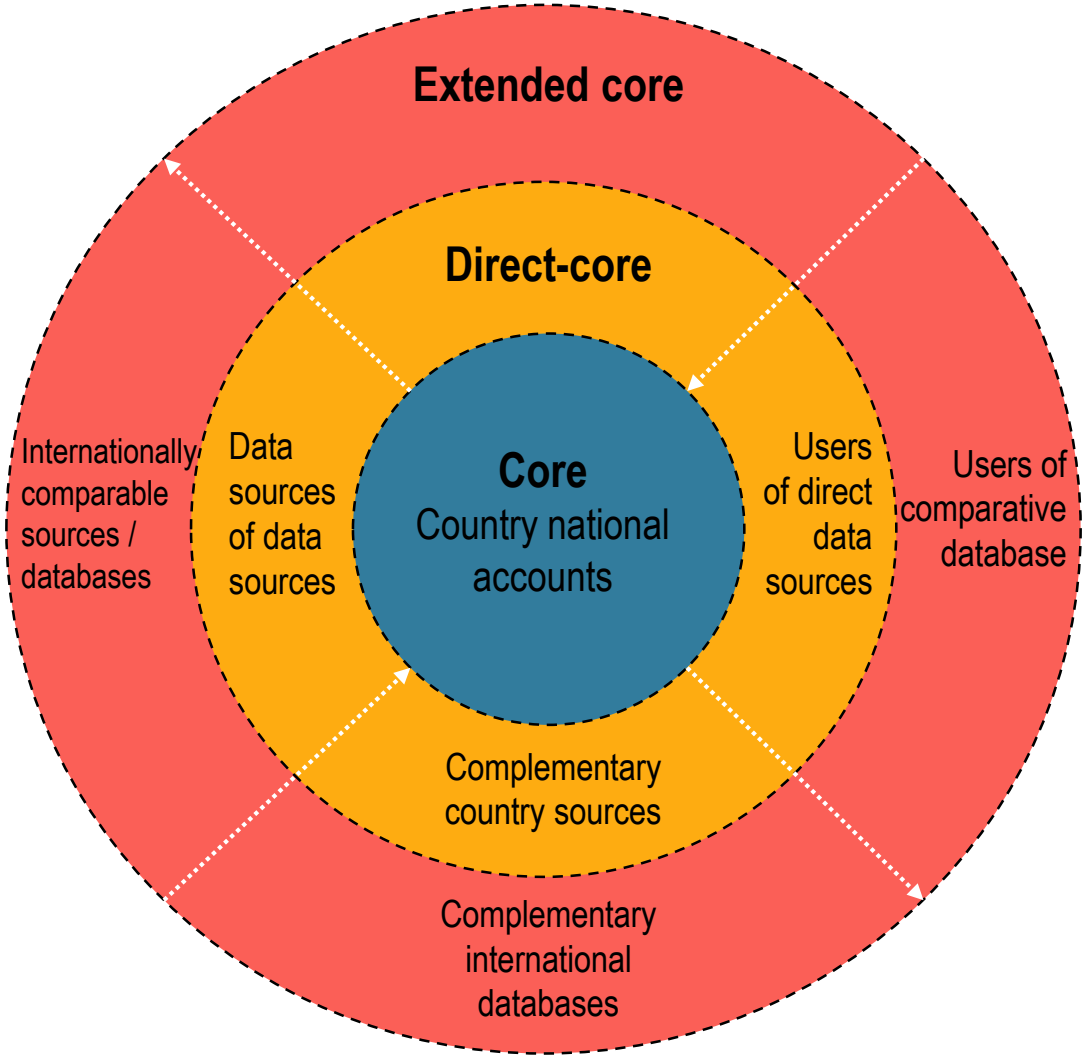
USES AND ANALYSIS
Common applications and utility

THE ADB MRIO TABLES
Structure, and coverage

METHODS AND ISSUES
From compilation to reconciliation

DATA SOURCES
Top-down approach

Data partners and stakeholders



Why compile multiregional IOTs?

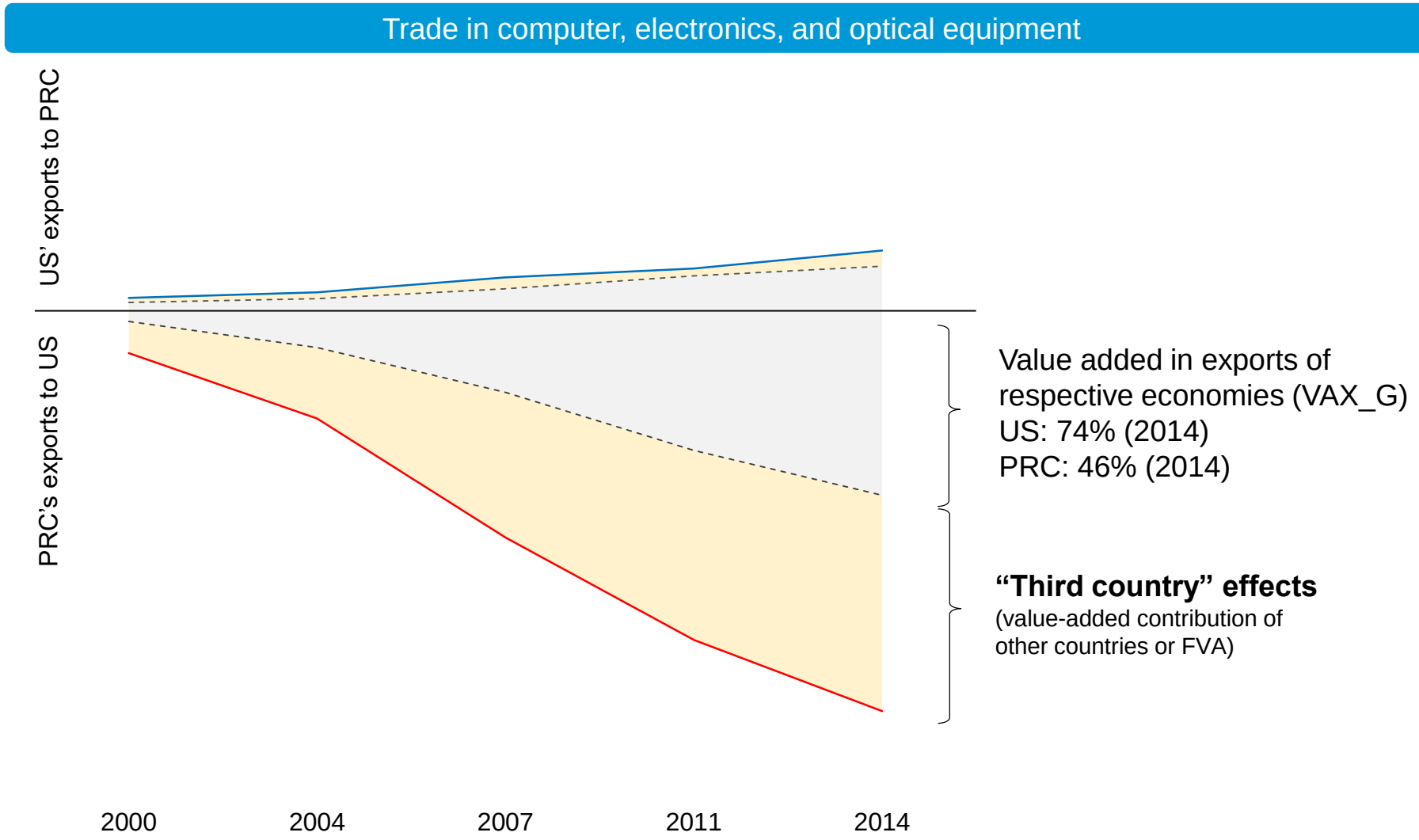
THREE (3) KEY AREAS OF ANALYSIS

1 INTERNATIONAL TRADE

2 ENVIRONMENT & ECONOMY

3 LABOR MARKETS & GLOBALIZATION

Illustration of uses of MRIO



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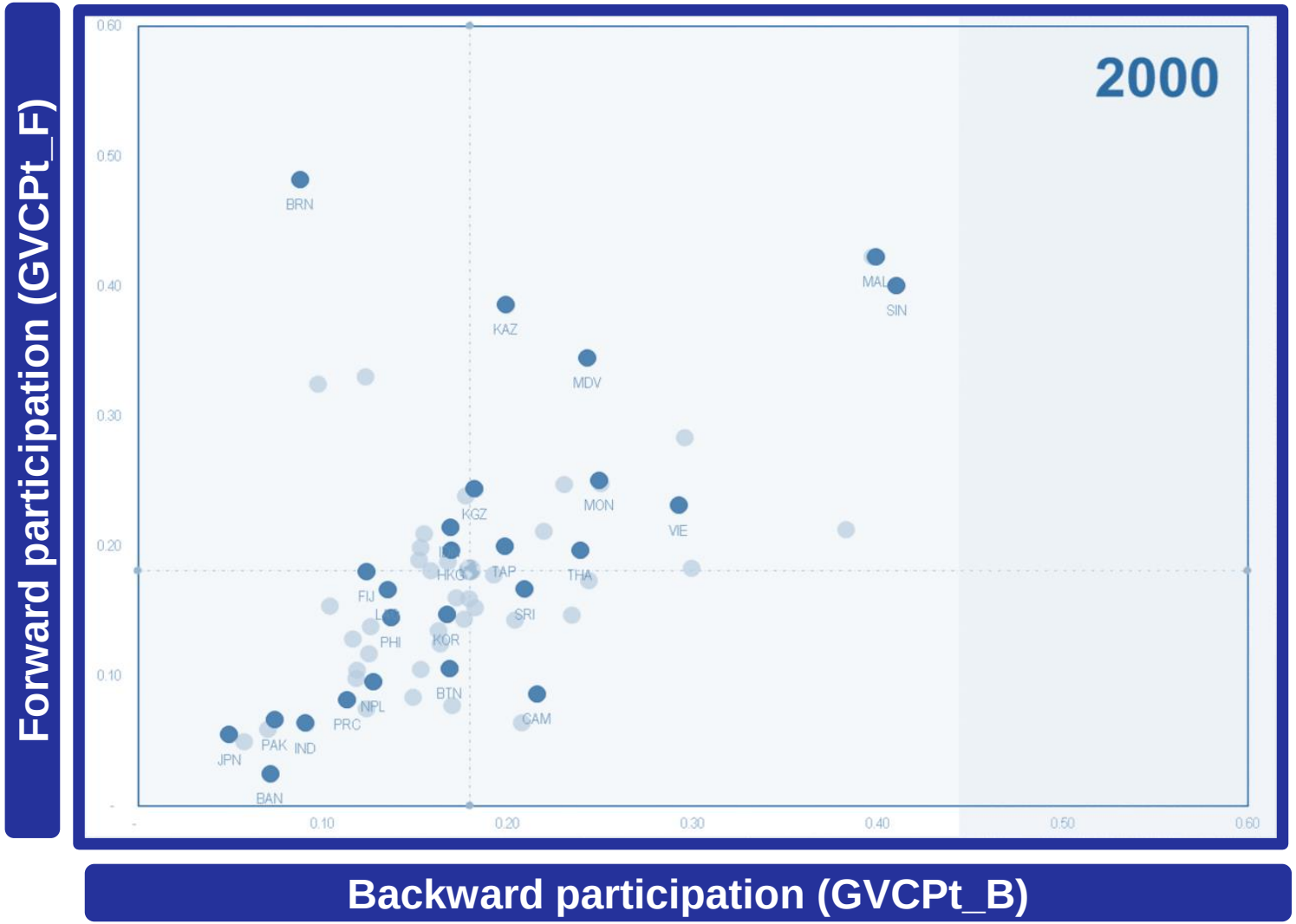

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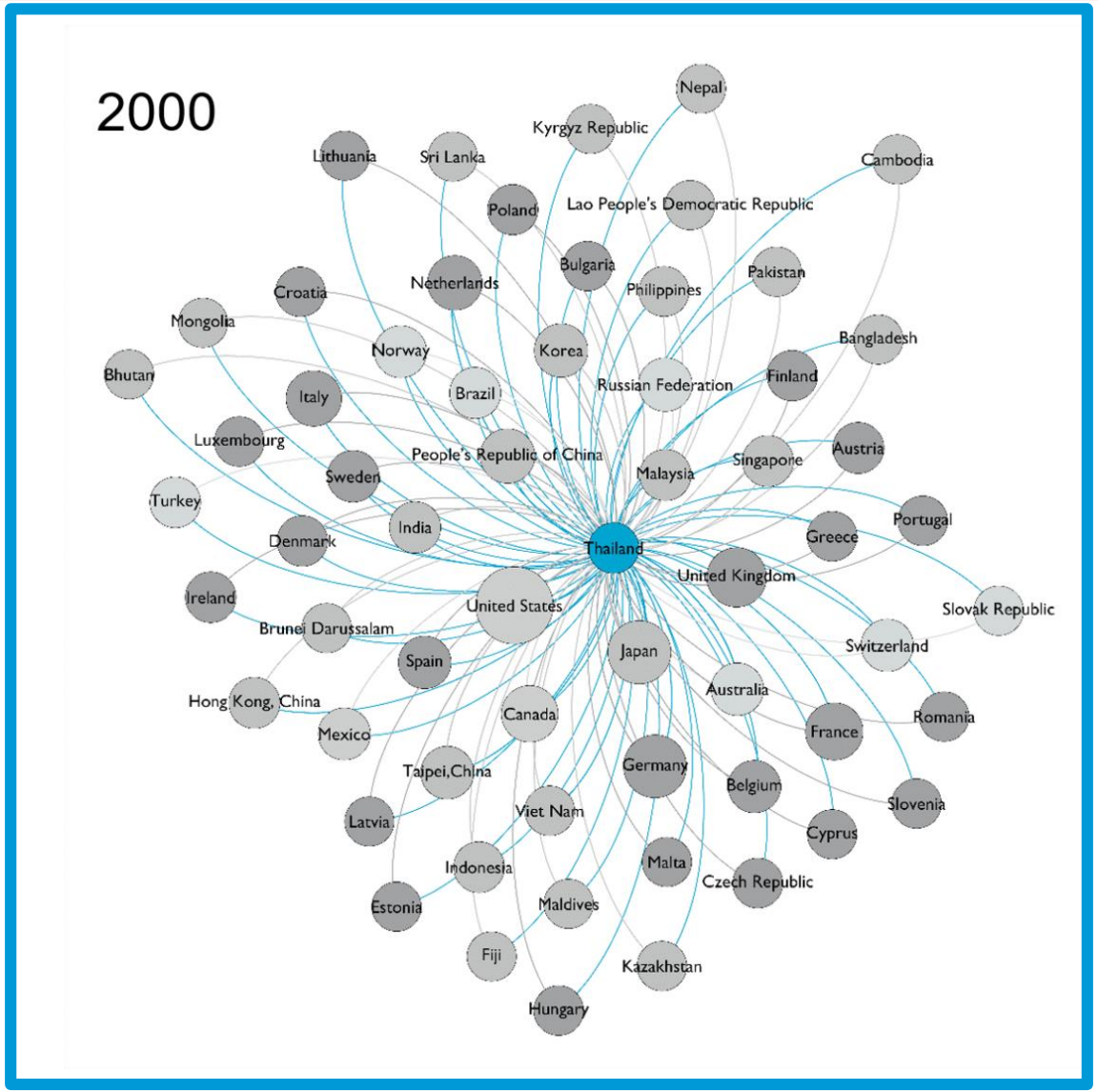


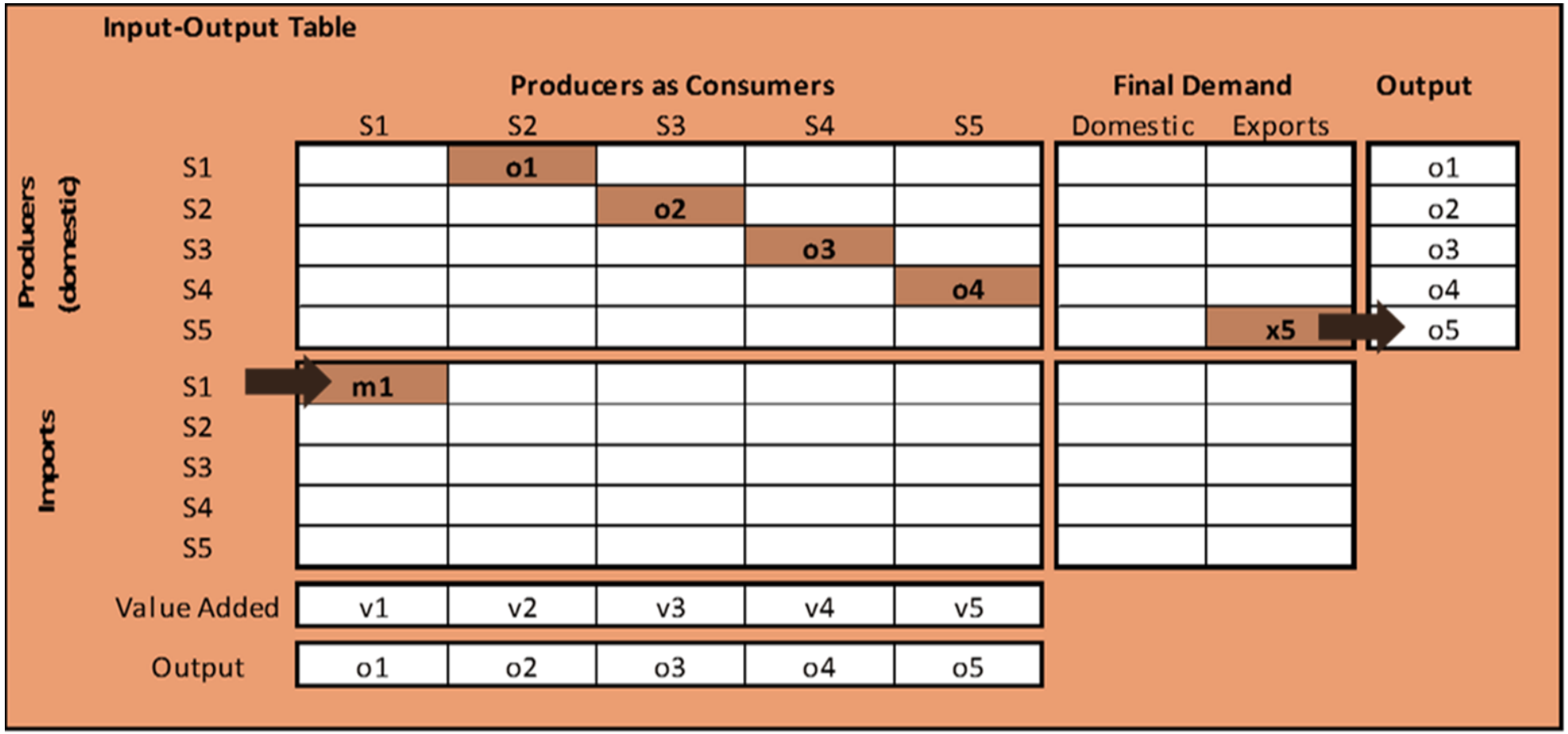
Illustration of uses of MRIO

- The Impact of Trade Conflict on Developing Asia (Abiad et al., 2018)
- Agglomeration Index (Mercer-Blackman et al., 2017)
- Jobs and Technology (Bertulfo et al., 2018)

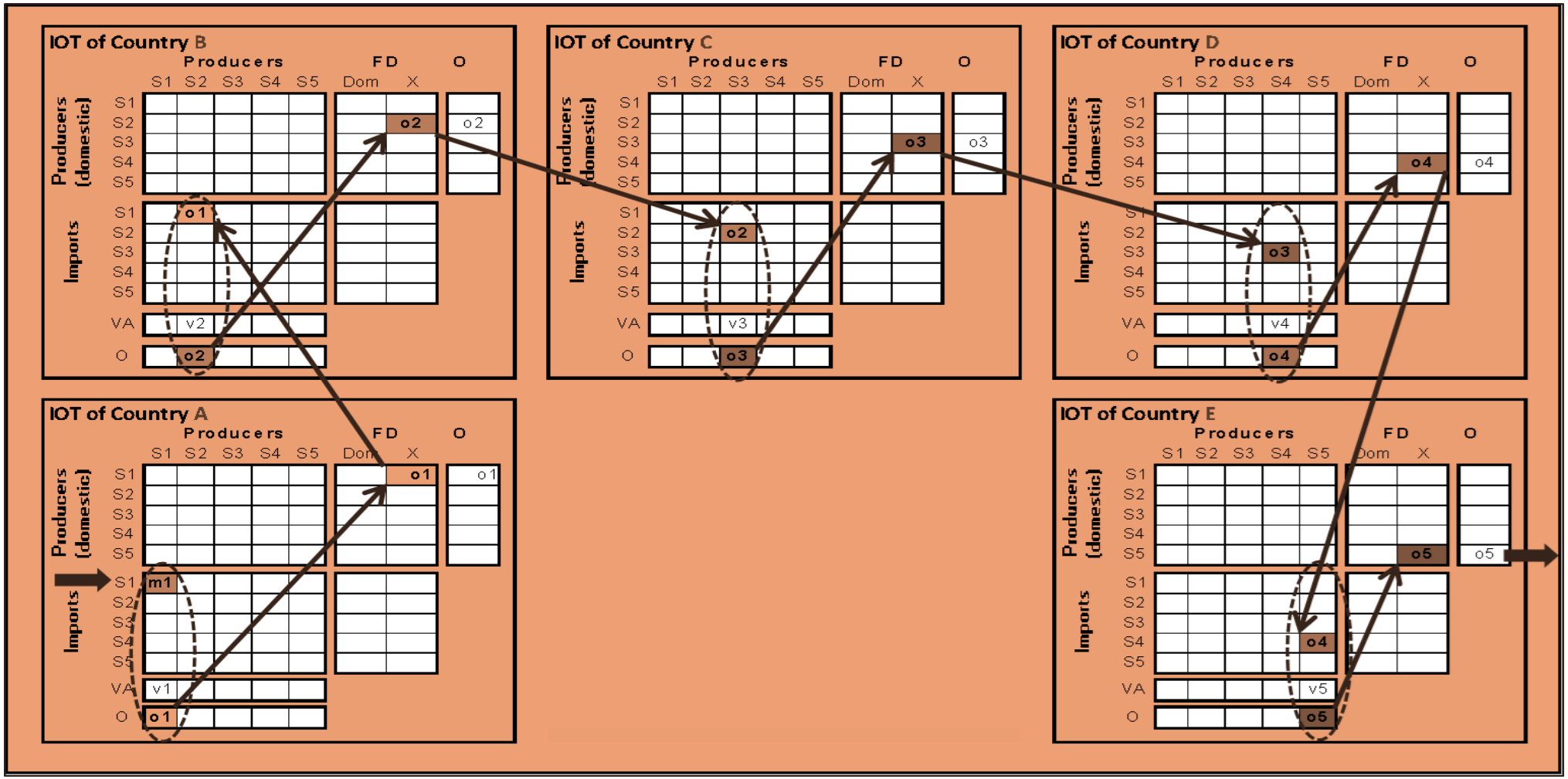
Overview of the main features of the various databases

Database	Number of countries	Number of products and industries	Years
AIIOT (IDE-JETRO)	10 (8 for 1975 table)	75 products (56 for 1975 table, 77 for 1985 table)	1975, 195, 1990, 1995, 2000, 2005
EORA MRIO	187 countries	Varying across countries; simplified version with 26 industries	1990-2013
EXIOBASE Versions 2 and 3 are more enhanced	43 countries; 5 world regions	220 products; 163 industries	2000, 2007
FIGARO	28 EU countries; USA; Rest of the World	64 industries; 64 products	2010; 2010-2017 in progress
Global MRIO LAB	220 countries	Flexible choice: 6357 products, industry root classification	1990-2015 (preliminary data)
GTAP-MRIO	140 GTAP regions	57 GTAP commodities	2004, 2007, 2011
OECD-ICIO	64 (including Rest of the World)	34 industries; 34 products	1995-2011 (ISIC 3; nowcasted 2012-2014); 2005-2011 (ISIC 4)
WIOD (2013 and 2016 release versions)	43 (including Rest of the World)	64 products; 56 industries	2000-2014
ADB MRIO	**63 (including Rest of the World)**	**Varying SUT dimensions; harmonized to 35 industries**	**2000; 2007-2018**

Stylized production chains in the Input-Output framework



Mapping production fragmentation in the IO framework



Schematic of multi-country / multi-regional input-output tables (MRIO)

		COUNTRY A	COUNTRY B	R.O.W.	COUNTRY A	COUNTRY B	R.O.W.	TOTAL
		Intermediate	Intermediate	Intermediate	Final	Final	Final	
		Industry	Industry	Industry	Industry	Industry	Industry	
COUNTRY A	Industry	Intermediate use of domestic output	Intermediate use by B of exports from A	Intermediate use by R.o.W. of exports from A	Final use of domestic output	Final use by B of exports from A	Final use by R.o.W. of exports from A	OUTPUT IN A
COUNTRY B	Industry	Intermediate use by A of exports from B	Intermediate use of domestic output	Intermediate use by R.o.W. of exports from B	Final use by A of exports from B	Final use of domestic output	Final use by R.o.W. of exports from B	OUTPUT IN B
Rest of the World	Industry	Intermediate use by A of exports from R.o.W.	Intermediate use by B of exports from R.o.W.	Intermediate use of domestic output	Final use by A of exports from R.o.W.	Final use by B of exports from R.o.W.	Final use of domestic output	OUTPUT IN R.O.W.
		Value Added	Value Added	Value Added				
		Output in A	Output in B	Output in R.O.W.				

Major compilation issues

ISSUES	SOLUTIONS
Harmonization of product and industry classification	Use of standard bridge tables; Disaggregation using alternative sources
Availability of national data (SUTs)	Non-survey methods Extrapolation / interpolation techniques
Bilateral trade matrices and the problem of trade asymmetries	Dual approach (OECD TiVA Expert Group) Alternative sources / data confrontation
Proportionality assumption	'Import use' ratios; BEC classification; modelled estimates from other sources
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Takeaways

Disaggregated view of the global economy

Ensuring data quality starts at the basic data, building upon the efforts and expertise of many statistical partners (both national and international)

Integration and reconciliation warrants multiple approaches: not all discrepancies can be treated mathematically, and not all mathematical solutions are absent of economic reasoning

Ways forward

More **countries** and **years**

Sectoral **disaggregation** (also updating ISIC)

Enhanced **balancing methods** (Möhr, Crown and Polenske, 1987; Ghanem, 2004)

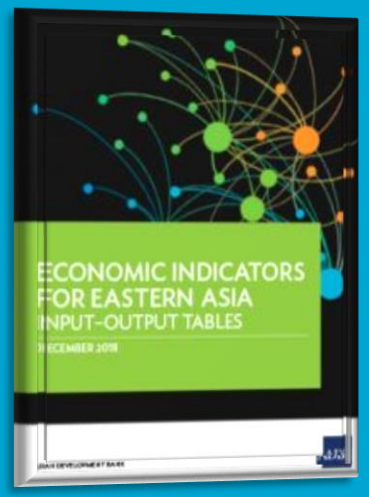
Extended input-output tables (e.g. employment, capital)

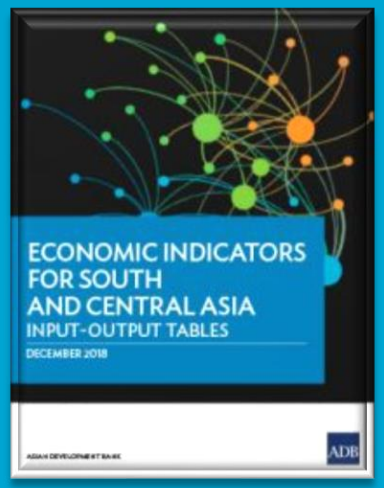
Satellite accounts

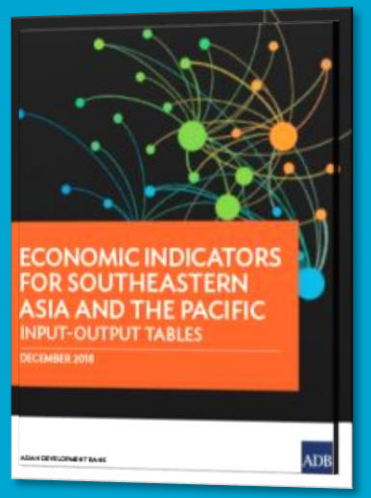
Constant prices

Social accounting matrices

Thank you very much for your attention!







ADB

Appendix

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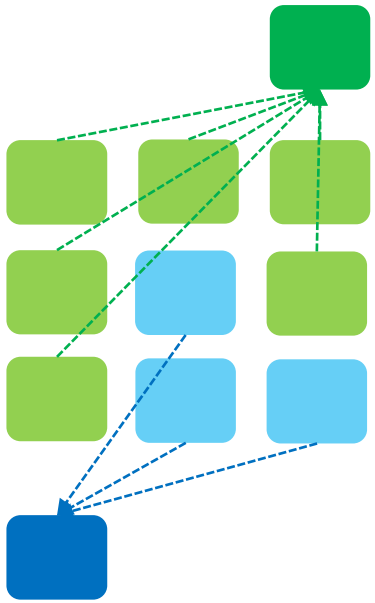
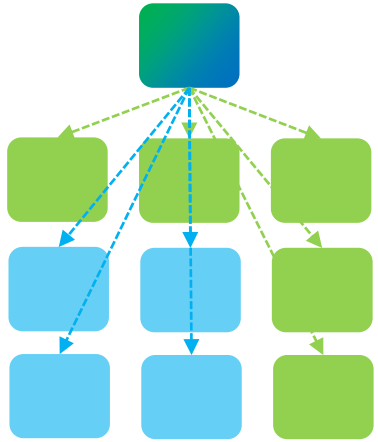
Diversity in classifications and dimensions of constituent national IOTs

- Objective: ***augment*** existing world input-output tables (Timmer et al., 2015) by expanding to include **19** participating economies under ADB's R-CDTA 8838
- Key publication: Compendium of Supply and Use Tables for Selected Economies in Asia and the Pacific (2017)
- Varying product dimensions, depending on the structure of the economy

"Aggregation"



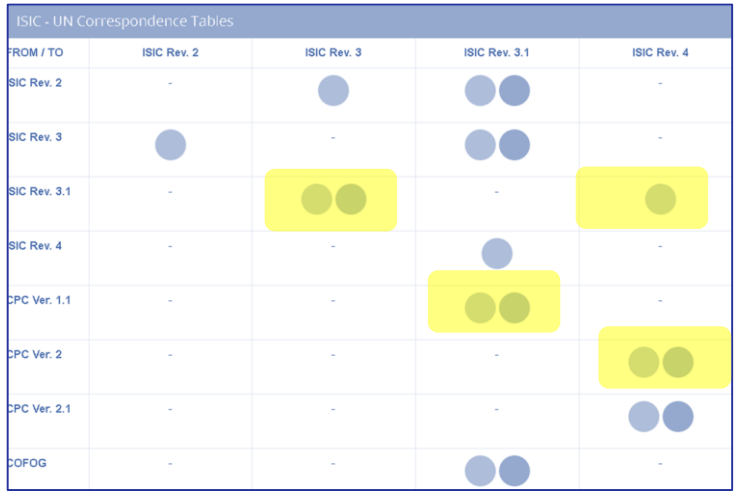
"Disaggregation"

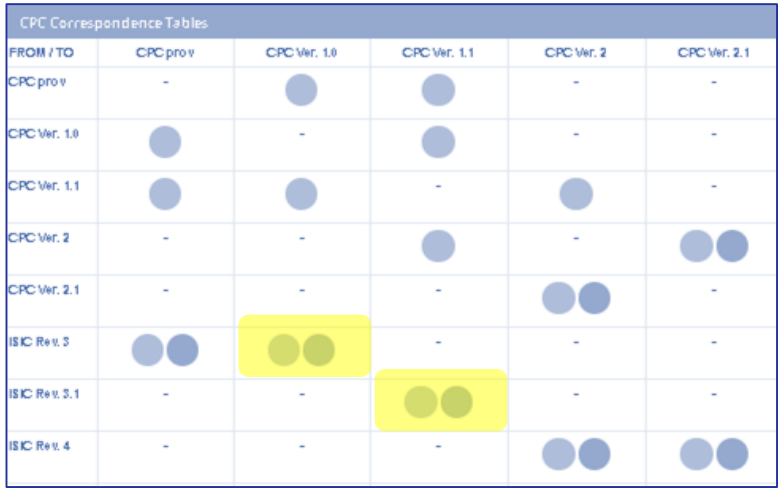


Diversity in classifications and dimensions of constituent national IOTs

AGGREGATION APPROACH

- Heavy use of correspondence tables published by UNSD
- Mainly **ISIC 3** for industries
- Trade-off between the level of uniformity and the level of information embedded in generating consistent multi-country SUTs and IOTs (UN SUT Handbook para 17.32)

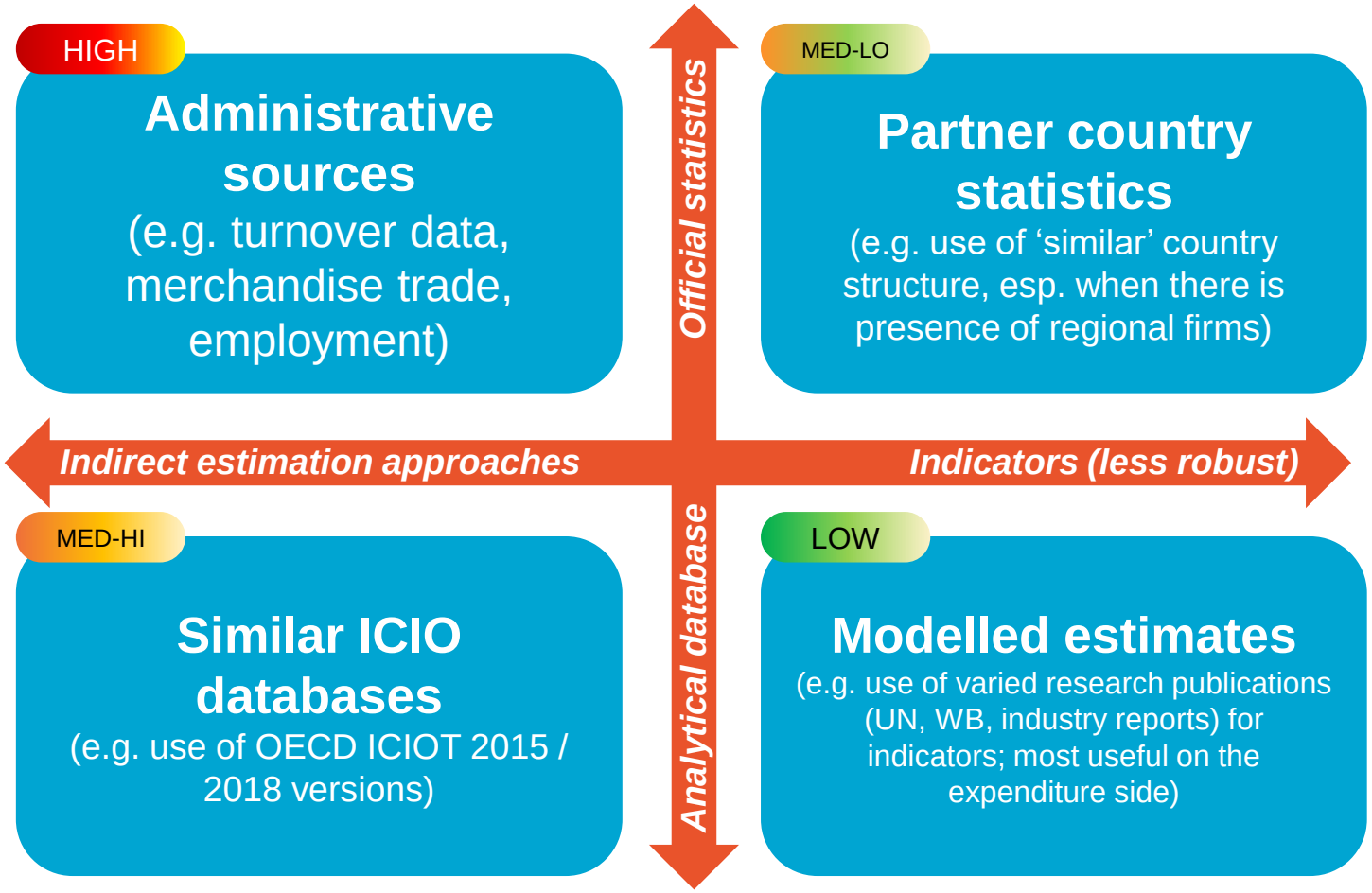




Diversity in classifications and dimensions of constituent national IOTs

DISAGGREGATION APPROACH

- Reliance on alternative sources



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Availability of timeseries national SUTs/IOTs for 63 economies

- **Option 1:** **Trends and extrapolation** anchored on annual national accounts statistics, direct input coefficients of benchmark year; normalized such that each element adds up to control figures (see for instance Timmer et al, 2013; Eurostat 2008); Back casting techniques using 'balanced' bilateral trade database of BACI
- **Option 2:** **Marginal inputs coefficients** (Miller & Blair, 2009) relate the *change* (from year *t* − *r* to year *t*) in the amount of input *i* purchased by industry *j* to the *change* (over the same period) in the total amount of *j* produced.

Marginal changes

$$a_{ij}^{*}(t) = \frac{z_{ij}(t) - z_{ij}(t-r)}{x_j(t) - x_j(t-r)} = \frac{\Delta z_{ij}}{\Delta x_j}$$

- **Option 3:** **G-RAS (Temurshoev 2013) and M-RAS algorithm (Paelinck and Waelbroeck 1963)**

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Construction of bilateral trade matrices: Problem of trade asymmetries

MAIN CAUSES (see Guo, Webb and Yamano (2009); Hamanaka (2011))

Factors	Causes	Change in Price and/or Quantity
Unavoidable factors	FOB–CIF difference • freight cost • insurance costs	Price
Structural differences between two customs offices	Coverage • differences in rules of origin (especially in the cases of re-export) • processing zone • returned goods	Quantity
	Time lag	Quantity
	Exchange rate	Price
Deliberate misreporting by traders and errors committed by customs offices	False declaration of value by traders	Quantity and Price
	False declaration of origin by traders	Quantity
	Commodity misclassification by customs	Quantity
	Direction misclassification by customs	Quantity

Construction of bilateral trade matrices: Preliminaries

- M**oving towards dual approach** (export / import) of the OECD Regional-Global TiVA Expert Group
- Important data sources:

1) UN Comtrade (by trade partner; HS-6 digit);
2) Data published by national statistics agencies (for missing years / countries (e.g. for splitting BEL-LUX economic union; Taipei,China));
3) IMF Direction of Trade Statistics (IMF-DOTS);
4) Other MRIOs
5) Observatory of Economic Complexity (OEC-MIT)

Construction of bilateral trade matrices: Broad algorithm sketch

Goods Import vector *(cif)*

Services import vector

Goods import vector (fob)

Services import vector

I_i^M F_i^M G_i^M

I_i^M F_i^M G_i^M

Intermediate uses | Final consumption | Capital goods

$I_{i,j}^M$ $F_{i,j}^M$ $G_{i,j}^M$

$I_{i,j}^M$ $F_{i,j}^M$ $G_{i,j}^M$

$= \boldsymbol{M_i}\ \forall \boldsymbol{i}$

Available from Balance of Payments;
Estimates from partner countries fob exports;
CIF-FOB bilateral margins

Various databases
BEC classification

Proportionality assumption (if no data);
Import use intensity from benchmark year t, e.g. :

$I(t)_{i,j}^M \,/\, I(t)_{i,j}^U * I(t+r)_{i,j}^M$

(and then normalized such that imported use of industries i… j…to n is equal to total imported intermediate goods and services)

Partner country A

Partner country B

Partner country C

$I_{i,j,k}^M$ $F_{i,j,k}^M$ $G_{i,j,k}^M$

By trade partner

UN Comtrade;
IMF-DOTS

By product *i*

UN COMTRADE;
Proportionality assumption

By industry *j*

Eora MRIO;
OECD ICIOT

Dual approach
Data confrontation

Export matrices by trade partner
(see 'dual approach' of OECD Regional-Global Expert TiVA Group)
Ideally M of c from k should be equal to the E of k to c

$I_{i,j,k}^e$ $F_{i,j,k}^e$ $G_{i,j,k}^e$

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Construction of bilateral trade matrices: Problem of trade asymmetries

SOME INVESTIGATIVE APPROACHES:

- **Which trade flow? Imports** are usually recorded with more accuracy than exports because imports generally generate tariff revenues while exports don't *(Based on WITS, echoed by Timmer et al 2012)*
- **Which reporter? Reliability indicators** (Guo, Webb, and Yamano (2009) and Gehlhar, Wang and Yao (2008), and more recently Fortanier & Sarrazin (2016; 2017) suggest indicators for reporter reliability based on discrepancies at the commodity-partner level. E.g. reported exports and imports are then reconciled using a "symmetry index" that gives more weight to those countries whose data more often agree with those of their trading partner

$$SI^{x}_{ikt} = \sum_{j} \frac{X^{r}_{ijkt}}{X_{ijkt}} \qquad and \qquad SI^{m}_{ikt} = \sum_{j} \frac{M^{r}_{ijkt}}{M_{ijkt}}$$

Where X^r and M^r reflect retained exports and retained imports, i.e. those bilateral flows that meet certain criterion (e.g. 30% in the case of OECD BATiS).

- **Top-down approach** is also used which checks highest levels of aggregation before looking at subcomponents; enables compiler to flag misdirected and misclassified trade.

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Moving away from proportionality assumption

CURRENT APPROACHES TO 'DISTURB' THE PROPORTIONALITY ASSUMPTION:

- **BEC / BTDIXE** (By end-use classification)
- **OECD Dual approach** (reconciliation of export matrix and import matrix by trade partner)
- **Import use estimates** (currently at the aggregate reporting country level; ratios by sourcing partners derived from bilateral trade databases)
- **Breakdown from BOP** (e.g. to split travel between IC and FC, see for instance para. 17.76 of the UN SUT Handbook)

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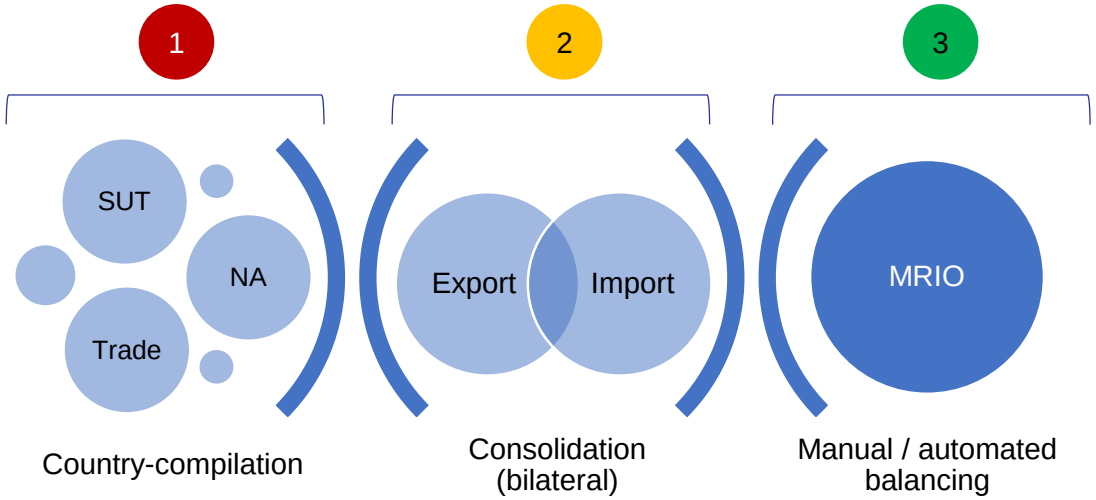
Reconciliation and balancing methods

- **Manual balancing: 35 sectors, 63 “economies”, 2000-2018***
  - Evaluation of underlying sources
  - Before and after comparison
  - Commodity flow approach for ‘rest of the world’
  - Timeseries analysis (checks for outliers)
- **Modified RAS approach** (separately for domestic and external trade matrices)



Examples of plausibility checks
GVA to output ratios
Changes in GVA weights
Changes in IC and IU ratios (consumption vs. use)
Changes in export-to-output ratios
Changes in import intensity
Movement of stocks / inventories
Fluctuations in exchange rates
Changes in final demand categories’ composition