OECD GLOBAL INPUT-OUTPUT DATABASES:

ICIO AND INDICATORS (TIVA -TECO2-TIM)

Joaquim J.M. Guilhoto

OECD
Directorate for Science, Technology and Innovation

NEREUS – IPE – FEA-USP
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BETTER POLICIES FOR BETTER LIVES

Agenda

- Introduction
  - Global models
  - OECDs databases
- ICIO
  - Estimation
  - Structure
- TiVA indicators
- TECO2 & TiM indicators
- Using the indicators
  - Exploring changes in world production and trade
- Concluding remarks

INTRODUCTION

Global Input-Output Models

- ICIO – Inter-Country Input-Output Database, OECD
- ECLAC - Input-Output Table for Latin America and the Caribbean
- EORA - Multi-Region Input-Output (MRIO) table of the world
- EXIOBASE - Multi-Regional Environmentally Extended Supply-Use Table (MR-SUT) and Input-Output Table (MR-IOT)
- FIGARO - EU-Inter Country Supply, Use and Input-Output Tables
- GTAP - Global Trade Analysis Project
- IDE-JETRO - International Input-Output Tables
- WIOD - World Input-Output Database

OECD Databases

- ICIO
  - – Inter-Country Input-Output Tables
- TiVA
  - – Trade in Value Added
- TECO2
  - – CO_2 Emissions Embodied in International Trade
- TiM
  - – Trade in Employment

ICIO

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ICIO 2018 Database

- System of National Accounts 2008 (SNA08)
- Industry list based on ISIC Rev.4
- Published for 36 industries and 64 economies + rest of the world
- ICIO estimation uses larger number of underlying industries and products (75)
- Improved estimates of "Rest of the World", with underlying data for +130 economies
- National account benchmarked
- Trade balances (goods and services)
- International comparability (VA at basic prices)
- Direct purchases by non-residents
- International trade and transport margins
- Long term project

Starting point: ICIO structure

Inter-country I-O ***at basic prices***		Intermediate demand						Final consumption and GFCF *(+ changes in inventories)*			Direct purchases by non-residents			Output (X)
		Cou A		Cou B		Cou C		Cou A	Cou B	Cou C	Cou A	Cou B	Cou C	
		Ind 1	Ind 2	Ind 1	Ind 2	Ind 1	Ind 2							
Cou A	Ind 1													X (A1)
	Ind 2													X (A2)
Cou B	Ind 1			Z						Y				X (B1)
	Ind 2													X (B2)
Cou C	Ind 1													X (C1)
	Ind 2													X (C2)
Taxes less subsidies ..		*... on intermediate products* NTZA1	NTZA2	NTZB1	NTZB2	NTZC1	NTZC2	*... on final products* NTYA	NTYB	NTYC	NTYA	NTYB	NTYC	Global GDP
Value-added (VA)		VA (A1)	VA (A2)	VA (B1)	VA (B2)	VA (C1)	VA (C2)							
Output (X)		X (A1)	X (A2)	X (B1)	X (B2)	X (C1)	X (C2)	Global GDP						

Key:

Cross-border flows of **intermediate** goods and services	**Cross-border** flows of **final** goods and services
Domestic flows of **intermediate** goods and services	**Domestic** flows of **final** goods and services

Country Coverage

OECD	All OECD countries
BRIICS	Brazil, China, India, Indonesia, Russian Federation, South Africa
Other EU28	Bulgaria, Croatia, Cyprus, Latvia, Lithuania, Malta, Romania
Other G20	Argentina, Saudi Arabia
Other South Eastern Asia	Brunei Darussalam, Cambodia, Malaysia, Philippines, Singapore, Thailand, Viet Nam
Other Eastern Asia	Chinese Taipei, Hong Kong China
Other	Columbia, Costa Rica, Tunisia, Kazakhstan, RoW
Region groups	OECD, Non-OECD, APEC, ASEAN, EasternAsia,EU28, Euro Area, North America, etc

TiVA 2018 Industry list

	Industry Code	Heading
1	D01T03	Agriculture, hunting, forestry and fishing
2	D05T06	Mining and extraction of energy producing products
3	D07T08	Mining and quarrying of non-energy producing products
4	D09	Services to mining and quarrying
5	D10T12	Food products, beverages and tobacco
6	D13T15	Textiles, textile products, leather and footwear
7	D16	Wood and products of wood and cork
8	D17T18	Paper products and printing
9	D19	Coke and refined petroleum products
10	D20T21	Chemicals and chemical products
11	D22	Rubber and plastics products
12	D23	Other non-metallic mineral products
13	D24	Basic metals
14	D25	Fabricated metal products
15	D26	Computer, electronic and optical equipment
16	D27	Electrical machinery and apparatus, nec
17	D28	Machinery and equipment, nec
18	D29	Motor vehicles, trailers and semi-trailers
19	D30	Other transport equipment
20	D31T33	Manufacturing nec; repair of machinery and equipment
21	D35T39	Electricity, gas, water supply, sewerage, waste and remediation services
22	D41T43	Construction
23	D45T47	Wholesale and retail trade; repair of motor vehicles
24	D49T53	Transportation and storage
25	D55T56	Accomodation and food services
26	D58T60	Publishing, audiovisual and broadcasting activities
27	D61	Telecommunications
28	D62T63	IT and other information services
29	D64T66	Financial and insurance activities
30	D68	Real estate activities
31	D69T82	Other business sector services
32	D84	Public admin. and defence; compulsory social security
33	D85	Education
34	D86T88	Health and social work
35	D90T96	Other community, social and personal services
36	D97T98	Private households with employed persons

TiVA 2018 Industry aggregates

	Industry Code	Heading
37	DTOTAL	TOTAL
38	D05T09	Mining and quarrying
39	D10T33	Total Manufacturing
40	D16T18	Wood and paper products and printing
41	D19T23	Chemicals and non-metallic mineral products
42	D24T25	Basic metals and fabricated metal products
43	D26T27	Computer, electronic and electrical equipment
44	D29T30	Transport equipment
45	D45T82	Total Business Sector Services
46	D45T56	Distributive trade, transport, accommodation and food services
47	D58T63	Information services
48	D84T98	Public admin, education, health and other personal services
49	D84T88	Public admin, defence; education and health
50	D90T98	Other social and personal services
51	D05T39	Industry (Mining, Manufactures and Utilities)
52	D45T98	Total Services
53	D58T82	Information, Finance, Real Estate and other business services
54	D41T98	Total Services (incl. construction)
55	DINFO	Information industries

Extended industry and product dimensions

- More detailed product list for better allocation of exports into importing industries and final expenditure items
- Margin industry output
  - trade
  - transport services
- Taxes and subsidies
  - Import duty
  - VAT/Consumption tax /sales tax
  - Other taxes
- Real estate: separation *of imputed rent of owner occupiers* (68A)
  - No trade
  - Approximately 20% of household final consumption
- Processing / manufacturing services (wholesale)

ICIO ESTIMATION

Brief summary of steps to build ICIO 2018

1. Create harmonized National Accounts constraints, and ..

2. … Sectoral output, VA, exports and imports constraints

3. Balance national Supply and Use tables (SUTs)

→ generate harmonized domestic IO tables @bp (a)

3b. Manufacturing heterogeneity within a country (Mexico and China)

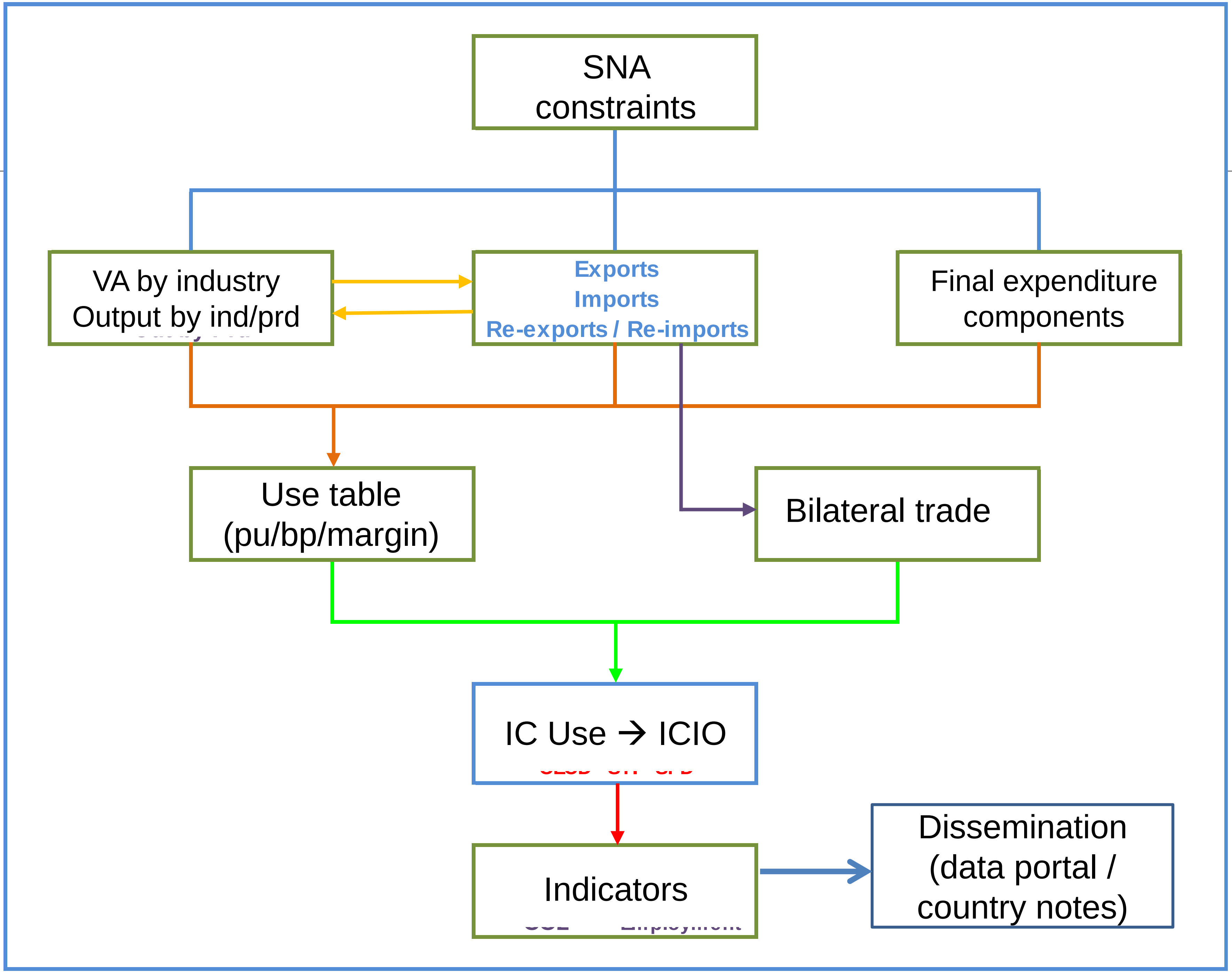
4. Bilateral trade in good and services by Use table harmonized products

4b. Heterogeneity split

5. Balance International Use table @pu;

→ conversion from purchasers (pu) to basic prices (bp) (b)

ICIO: combining (a) and (b)


SNA
constraints
VA by industry
Output by ind/prd
Exports
Imports
Re-exports / Re-imports
Final expenditure
components
Use table
(pu/bp/margin)
Bilateral trade
IC Use → ICIO
Indicators
Dissemination
(data portal /
country notes)

Data sources for
OECD Inter-country inter-industry model

Data sources (national / international data portals)

- National Accounts: official country data, main aggregate and satellite account
- Balance of Payments
- Supply-use and Input-Output tables (import, margins)
- Bilateral trade statistics for goods and services
- Employment
- Tourism satellite account
- Structural Business Statistics (OECD, EUROSTAT, UNIDO)
- Production and exports data from industry associations (oil, gas, steel, etc)

Data sources for
OECD Inter-country inter-industry model

Intermediate analytical data products at OECD

- Harmonised SUT / symmetric Input-Output tables (OECD I-O)
- Bilateral Trade Database by Industry and by End-use for goods (OECD BTDIxE)
- Bilateral Trade in Services (OECD-WTO)
- Sectoral Value-Added, Output, Employment(OECD STAN)
- Adjusted National Accounts (currency, non-resident expenditures and re-exports)

Official NA variables to adjusted SNA constraints for ICUT/ICIO

- VA at basic prices: shift taxes on products from VA (CHN, JPN, PHL, THA, MMR)
- Output at basic prices

- SNA exports of goods = X61.DOM + RXRM 61
- SNA exports of services = X62.CB + X34.DOM + M34.RX
- SNA household consumption by non-residents (P34) = X34.DOM + M34.RX

- SNA imports of goods = M71.DOM + RXRM61+ M34.RX
- SNA imports of services = M72.CB + M33
- Retained imports (M7CB) = M71.DOM + M72.CB

where

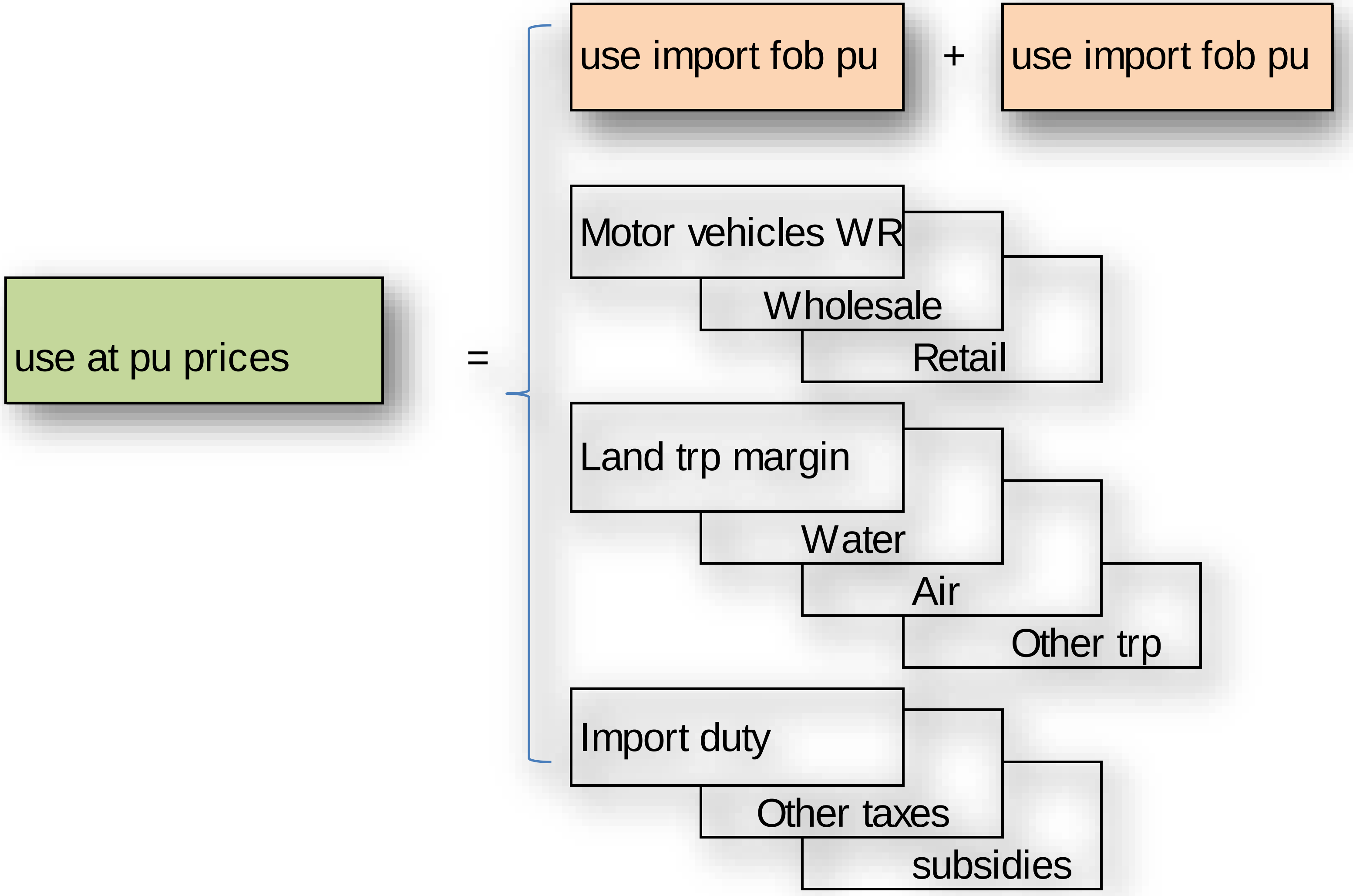
X61.DOM is Goods exports of domestic origin products, RXRM 61 is sum of re-imports and re-exports of goods, X62.CB is cross-border services exports, X34.DOM is direct purchases by non-residents of domestic products, M34.RX is direct purchases by non-residents of imported products, M71.DOM is imports of goods consumed in domestic territory, M72.CB is imports of cross-border services and, M33 is direct purchases abroad by residents.

Trade by product (partner world)

- Priority data source: SUT / IOT
- If not available, HS 6digit → hmz product list
  - Monetary gold, printing / publishing
- TiS EBOPS 2002 / 2010 → hmz product list
  - Some items are not used to match SNA trade: FISIM (SG2), government (SL)
  - manufacturing services (SA) to wholesale (I4-46)

- Re-exports/re-imports: Comtrade, Import tables (Eurostat), comparison with reported sum values from partners

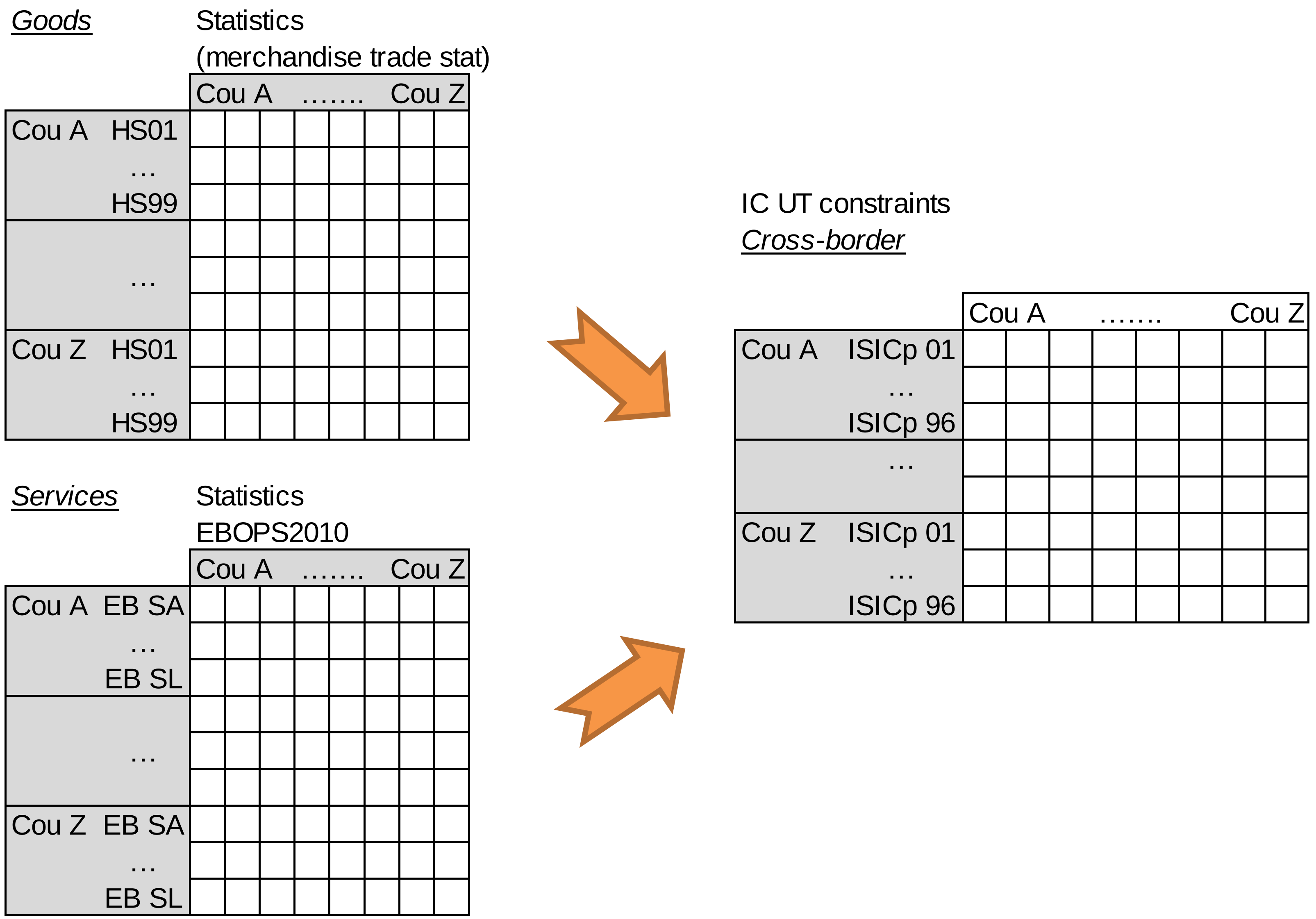
Use at purchasers' prices



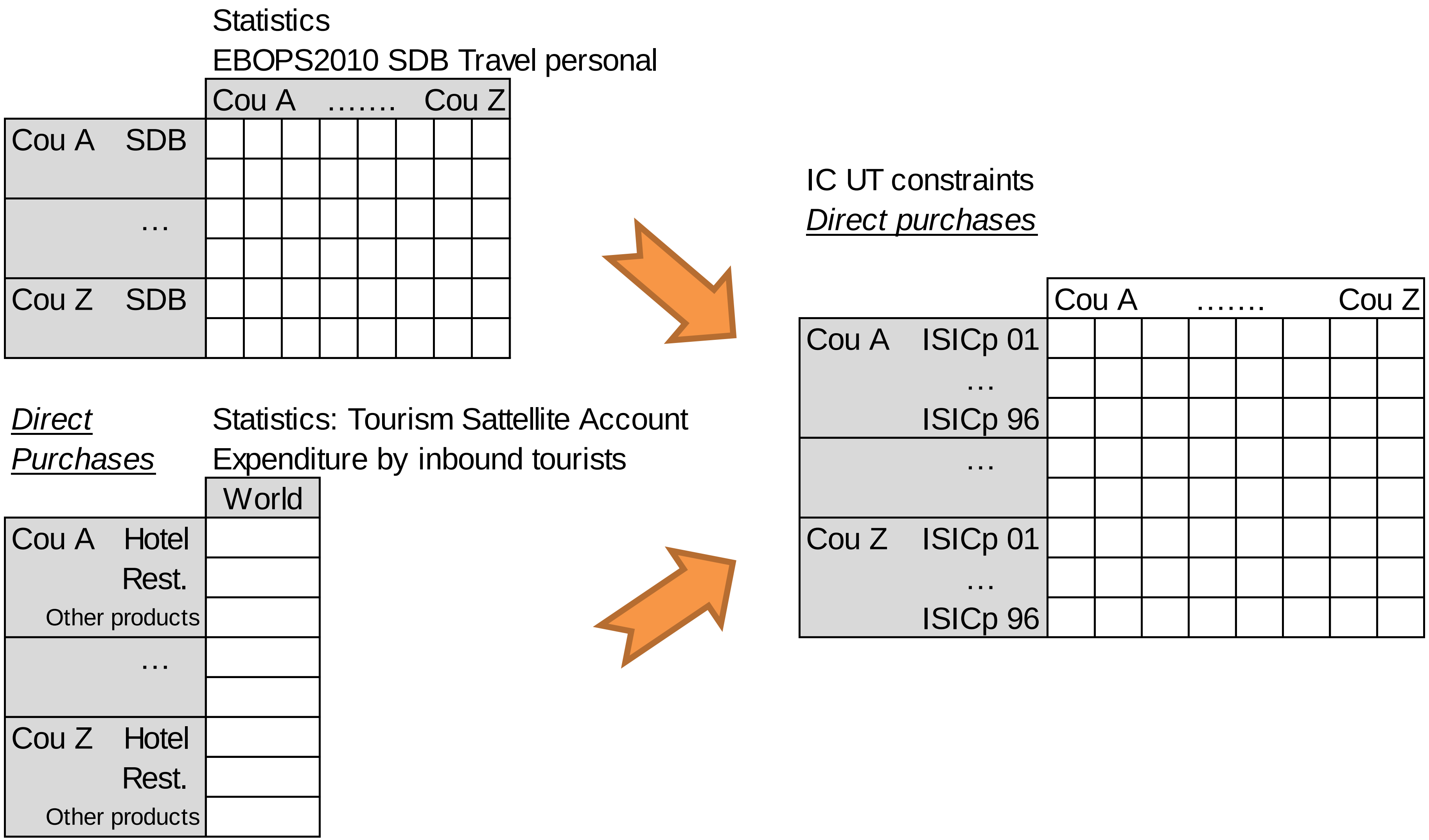
Margins

- Trade
  - Motor vehicles (I4-45)
  - Wholesale (I4-46)
  - Retail (I4-47)
- Transport
  - Land (I4 – 49)
  - Water (I4 – 50)
  - Air (I4 – 51)
  - Other (I4 – 52)
- Import duty
- Other taxes on products (VAT, Fuel, Alcohol)
- Subsidies on products (agriculture, land transport)

Trade by product (bilateral cross border)



Trade by product (bilateral direct purchases)



International use table

		Cou X
Cou A	ISICp 01	
	…	
	ISICp 96	
	…	
Cou Z	ISICp 01	
	…	
	ISICp 96	

		Cou X								
		ISIC 01	…	ISIC 98	HFCE	NPISH	GGFC	GFCF	INVNT	Direct Pur
TOTAL	ISICp 01									
Use	…									
Imports	ISICp 98									

		ISIC 01	…	ISIC 98	HFCE	NPISH	GGFC	GFCF	INVNT	DP
Use	Cou A									
for	…									
ISICp 01	Cou Z									

…….. ……..

BALANCE at purchasers' prices

		ISIC 01	…	ISIC 98	HFCE	NPISH	GGFC	GFCF	INVNT	DP
Use	Cou A									
for	…									
ISICp 98	Cou Z									

		Cou X								
		ISIC 01	…	ISIC 98	HFCE	NPISH	GGFC	GFCF	INVNT	DP
Cou A	ISICp 01									
	…									
	ISICp 98									
	…									
Cou Z	ISICp 01									
	…									
	ISICp 98									

TIVA INDICATORS - BASICS

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TiVA Indicators Basics

Basic Matrices in OECD's ICIO and TiVA Indicators

Matrix	Size of the matrix	Description
W	$1 \times (N * K)$	Value added, where w_i^r is the value added (at basic prices) by industry i (1 to K) in country r (1 to N) plus taxes less subsidies on intermediate products, so that total value added equals total final demand at basic prices.
X	$1 \times (N * K)$	Gross output (at basic prices), where x_i^r is the gross output from industry i in country r
V	$1 \times (N * K)$	Value added to output ratio, where $v_i^r = w_i^r / x_i^r$ is the ratio of value added to gross output by industry i in country r.
Z	$(N * K) \times (N * K)$	Intermediate consumption (at basic prices), where z_{ij}^{rs} is the flow of goods from producing industry i in country r to the purchasing industry j in country s.
Y	$(N * K) \times N$	Final demand, where the element $\boldsymbol{y_i^{rs}}$ represents final demand of country s for goods and services produced by industry i in country r. Final demand is separated into Household and Government Final Consumption, Gross Fixed Capital Formation (GFCF) and changes in inventories.
A	$(N * K) \times (N * K)$	Input coefficients, calculated as $a_{ij}^{rs} = z_{ij}^{rs} / x_j^s$
B	$(N * K) \times (N * K)$	Leontief inverse, or "output multipliers", $\mathbf{B} = (\mathbf{I} - \mathbf{A})^{-\mathbf{1}}$, where the element b_{ij}^{rs} shows the direct and indirect requirements of inputs from industry i in country r for the production of one unit of output for demand by industry j in country s.
GRTR **GRTR_INT** **GRTR_FNL**	$(N * K) \times N$	Bilateral gross trade matrices by exporting industry/country and importing country of intermediate (INT) and final (FNL) goods GRTR = GRTR_INT + GRTR_FNL

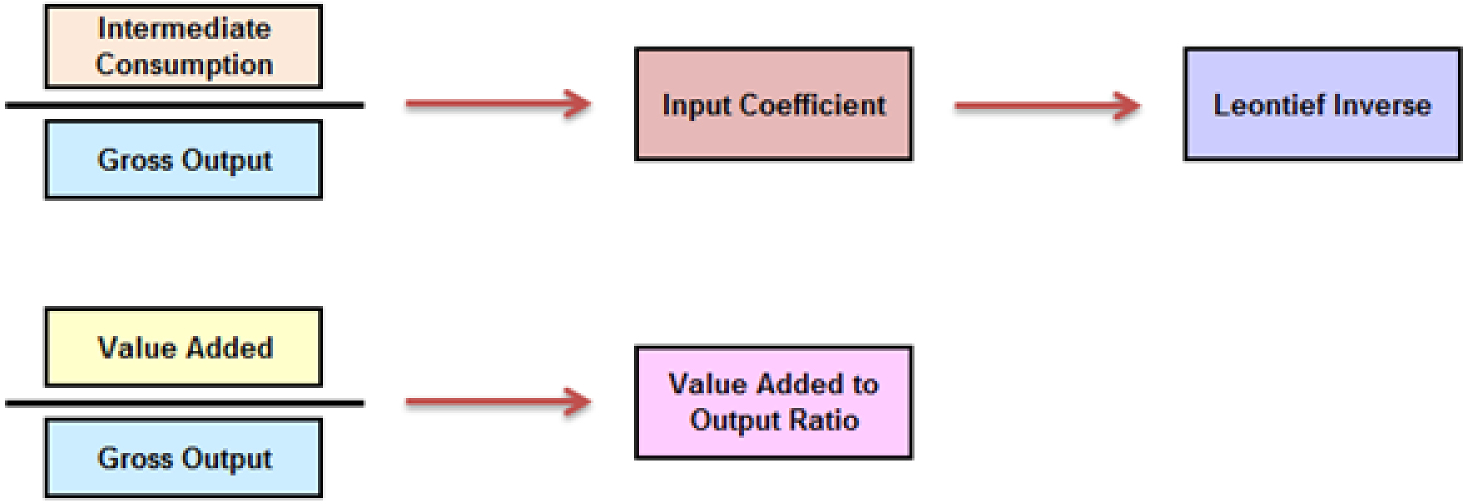
ICIO Basic Structure

OECD’s ICIO Basic Structure

		Intermediate Consumption			Final Demand			G.O.
		Country 1	. . .	Country N	Country 1	. . .	Country N	
		Ind. 1 ... Ind. K	. . .	Ind. 1 ... Ind. K	FD 1 ... FD F	. . .	FD 1 ... FD F	
Country 1	Ind. 1 ⋮ Ind. K	Z^{11}	. . .	Z^{1N}	Y^{11}	. . .	Y^{1N}	X^{1}
⋮	⋮	⋮	⋱	⋮	⋮	⋱	⋮	⋮
Country N	Ind. 1 ⋮ Ind. K	Z^{N1}	. . .	Z^{NN}	Y^{N1}	. . .	Y^{NN}	X^{N}
Value Added		W^{1}	. . .	W^{1}				
Gross Output		X^{1}	. . .	X^{N}				

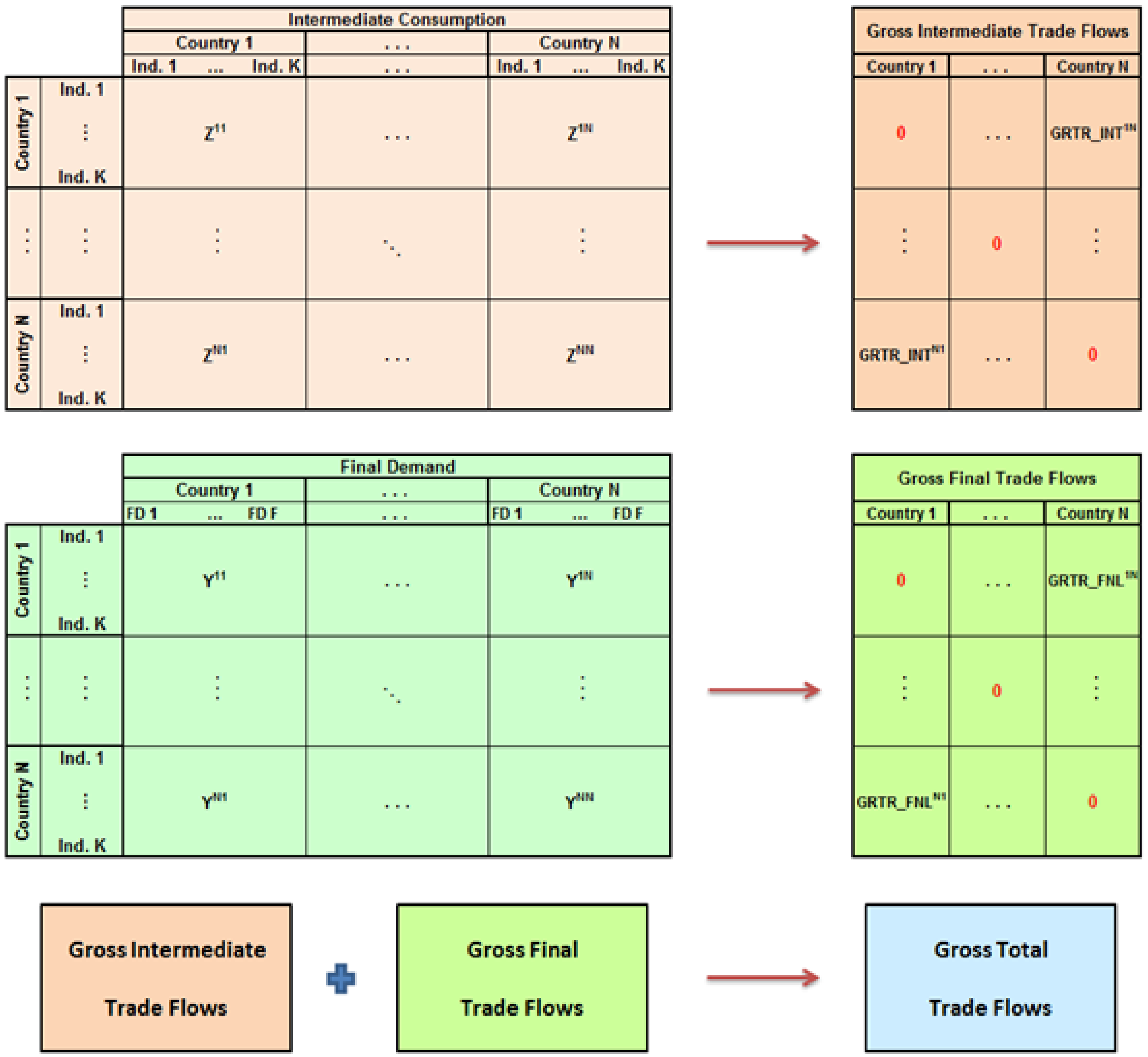
ICIO and TiVA Indicators

Obtaining the Leontief Inverse and the Value Added to Output Ratio



Bilateral Trade Flows

Obtaining the Bilateral Trade Flows



Trade Balance

- Gross trade balance = TiVA trade balance
- Gross trade balance
  - Gross Exports – Gross Imports
  - Includes intermediate and final products
- TiVA trade balance
  - FFD_DVA - DFD_FVA
- Reminding: Tax on intermediate inputs are included in the VA

TiVA Indicators List

- Revised and enlarged TiVA, Trade in Value Added, Indicators based on ICIO's database
  - Total of 50+ indicators
    - Structural indicators
    - Indicators linking VA and gross exports
    - Indicators linking VA and final demand
    - Detailed indicators for gross exports, gross imports and final demand

ICIO and TiVA Indicators

- ICIO and TiVA databases can be used, e.g.:
  - By themselves, to have a better understanding about the evolution of the World trade, and how the economies of the countries and regions are linked together;
  - Combined with other databases to understand the role and the importance of other variables, like the social economic indicators presented here, to go beyond the "pure" economic dimension!

TIVA INDICATORS - METHODOLOGY

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TiVA Definitions

- The USD million gross trade and output measures are in current prices with a basic price valuation .
- Changes in inventories for a given country are allocated to the respective country total final demand.

Results from ICIO Model

- Total gross exports and imports in the ICIO, and hence TiVA, differ from official National Accounts statistics due to removal of estimates of re-exports and re-imports, conversion to a Basic Price valuation and reconciliation of bilateral asymmetries via balancing under output constraints.

Trade Discrepancies Assumptions

- Discrepancies, which are residuals from inconsistencies in global trade data, were allocated to the total final demand of the Rest of World. As a result, discrepancies are only considered in the world total, not at partner level.

TiVA Country Dimensions

- For each indicator it is presented a specification of its dimension, where the abbreviations are as follow:
- Country / Region:
  - Prod cou = Production country
  - VA src cou = VA source country
  - Exp cou = Export country
  - Imp cou = Import country
  - FD cou = final demand / destination country
  - World = all countries includes domestic economy

TiVA Industry Definitions

- Industry:
  - Prod ind = Production source industry
  - VA src ind = VA source industry, production source industry
  - Exp ind = Export products producing industry
  - Imp ind = Import products producing industry
  - FD ind = final demand products producing industry
  - Tot ind = total industry
- Supply and Demand Dimensions:
  - Depending on the indicator, the supply and demand dimensions could refer to intermediate, final or total goods and services.

TiVA Groups

- OECD's TiVA Indicators can be classified into 4 subgroups according to their need of data and complexity of information:
  - Structural Indicators - based on the values presented in ICIO;
  - Indicators based on Value Added, Gross Exports and Imports;
  - Indicators based on Value Added and Final Demand;
  - Detailed Indicators, with 4 dimensions, revealing the origins of value added in gross exports, gross imports and final demand.

Treating Final Demand Matrices

Countries Demand

		Demand All Countries		
		Cou 1	. . .	Cou N
Country 1	Ind. 1 ⋮ Ind. K	E^{11}	. . .	E^{1N}
⋮	⋮	⋮	⋱	⋮
Country N	Ind. 1 ⋮ Ind. K	E^{N1}	. . .	E^{NN}

Total Demand

		Total Dem
Country 1	Ind. 1 ⋮ Ind. K	E^{1}
⋮	⋮	⋮
Country N	Ind. 1 ⋮ Ind. K	E^{N}

TIVA INDICATORS - UNDERSTANDING

TiVA indicators: meeting various needs

Experienced I-O practitioners / GVC analysts

- With appropriate IT skills and software tools, carry out a wide range of GVC-related analyses. Just need the ICIO "objects" i.e. vectors and matrices (http://oecd/icio)
- Understand and discuss indicators with equations (matrix algebra etc.)
- "*OECD produces too many indicators!*"

Researchers and policy analysts not familiar with I-O techniques

- Demand for easy-to-use, and understand, TiVA indicators
- Require 'simple' explanations of indicators and their use
- *"More indicators please!"*

Starting point: ICIO structure

Inter-country I-O		Intermediate demand						Final consumption and GFCF *(+ changes in inventories)*			Direct purchases by non-residents			Output (X)
at basic prices		Cou A		Cou B		Cou C		Cou A	Cou B	Cou C	Cou A	Cou B	Cou C	
		Ind 1	Ind 2	Ind 1	Ind 2	Ind 1	Ind 2							
Cou A	Ind 1													X (A1)
	Ind 2													X (A2)
Cou B	Ind 1			Z						Y				X (B1)
	Ind 2													X (B2)
Cou C	Ind 1													X (C1)
	Ind 2													X (C2)
Taxes less subsidies ..		*... on intermediate products*						*... on final products*						
		NTZA1	NTZA2	NTZB1	NTZB2	NTZC1	NTZC2	NTYA	NTYB	NTYC	NTYA	NTYB	NTYC	
Value-added (VA)		VA (A1)	VA (A2)	VA (B1)	VA (B2)	VA (C1)	VA (C2)							
Output (X)		X (A1)	X (A2)	X (B1)	X (B2)	X (C1)	X (C2)							

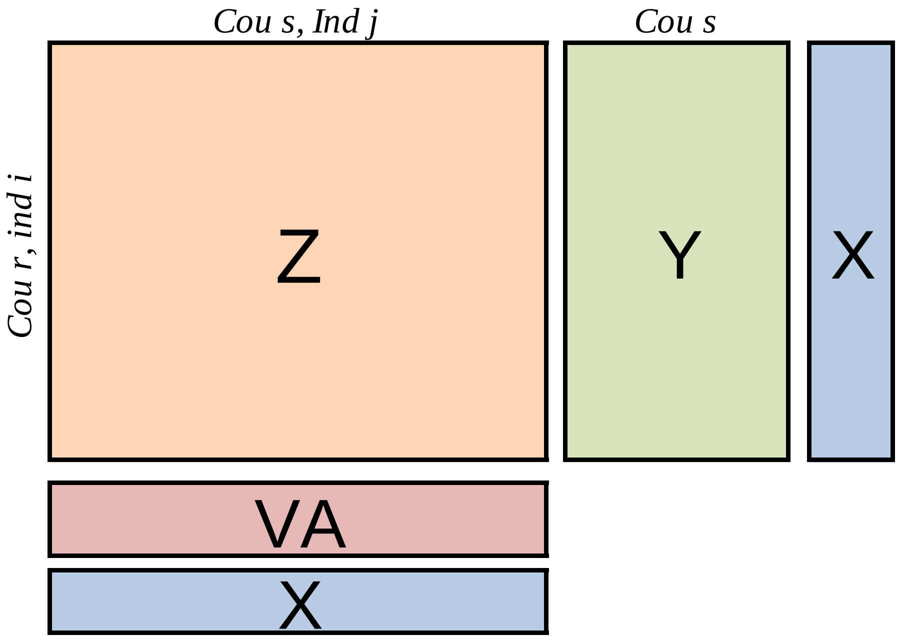
Global GDP

Global GDP

Key:

Cross-border flows of **intermediate** goods and services	**Cross-border** flows of **final** goods and services
Domestic flows of **intermediate** goods and services	**Domestic** flows of **final** goods and services

Basic equations



$$\text{VA} = \text{Y}$$

$$X = AX + Y$$

where A *is the input coefficient matrix:* $a_{ij}^{rs} = Z_{ij}^{rs} / x_j^s$

Leontief inverse:

$$B = (I\text{-}A)^{-1}$$

b_{ij}^{rs} *= direct and indirect inputs from industry i in country r for the production of one unit of output by industry j in country s.*

$$v\text{B}e$$

$v_j^s = va_j^s / x_j^s$ i.e. VA/output ratios

e is exports, final demand etc.

Global flows of goods and services

4 perspectives, 8 dimensions

VA origin	Exports	Imports	Final Demand
Country	Country	Country	Country
Industry	Industry	Industry	Industry

Direct flows of Intermediate and final goods and services.
Note: exports of final products meet final demand in importing country

From the country and industry of value added origin, *intermediate* goods and services may be processed by many firms in many countries before being processed by the exporting country. *Note: the exporting country is often the main origin of value added.*

Intermediate goods and services processed by an importing country may pass through many countries and industries before final demand goods and services reach the ultimate destination of demand. *Note: the importing country may be the country of final demand.*

Many combinations

In theory, could show indicators to reveal e.g.

- *value added from Chinese basic metals industry*
- *embodied in Japanese exports of ICT components*
- *imported by Mexican machinery industry*
- *ultimately meeting US final demand for motor vehicles*

But with 64 countries and 36 industries/product groups:

$$(64 \times 36)^4 \text{ combinations} \approx 28{,}000{,}000{,}000{,}000$$

This is without considering regional groups, industry aggregates, splitting FD into GFCF and HHFC, splitting exports into intermediates and final goods and services etc.

Challenge: to produce easy-to-use and easy-to-understand TiVA indicators for policy analysts and researchers

(i.e. reduce 8 dimensions to 2,3 or 4)

Indicators overview (published on OECD.STAT)

Core indicators (2 or 3 dimensions)

Gross exports based:
e.g. Domestic and foreign VA content of exports (EXGR_DVA and EXGR_FVA)

Final demand based:
e.g. DVA embodied in Foreign final demand, Foreign VA in domestic demand

Four cubes with 4 dimensions (for the more adventurous)

Value added origin of gross exports, Value added origin of gross imports

Value added origin of final demand.

Value added origin of gross exports by final demand destination

All accessible from http://oe.cd/tiva

Common confusion: what does industry refer to?

Value added origin industry? exporting industry? or final demand industry/product group?

Gross trade based indicators

Gross exports, EXGR

VA origin	Exports	Imports	Final Demand
all countries	Country **(c)**	Country (p)	
all industries	Industry (i)		

Gross imports, IMGR

VA origin	Exports	Imports	Final Demand
all countries	Country (p)	Country **(c)**	
all industries	Industry (i)		

Gross trade balance,
BALGR = EXGR (c,p) – IMGR(c,p)

VA origin	Exports	Imports	Final Demand
all countries	Country **(c)**	Country (p)	
	∑ all industries	∑ all industries	

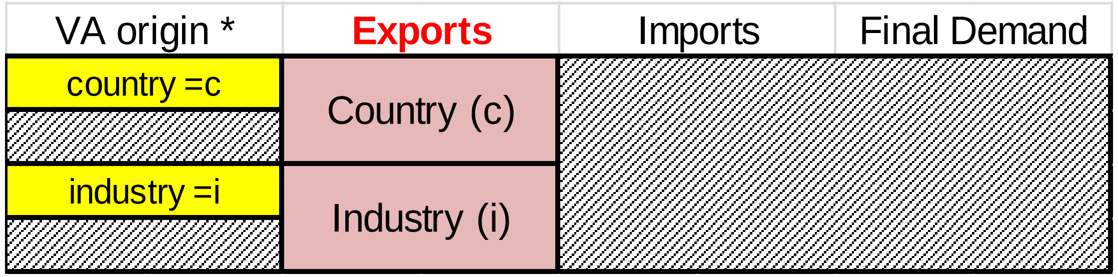
Domestic Value Added content of gross exports
EXGR_DVA

VA origin	Exports	Imports	Final Demand
country = c	Country **(c)**	Country (p)	
all industries	Industry (i)		

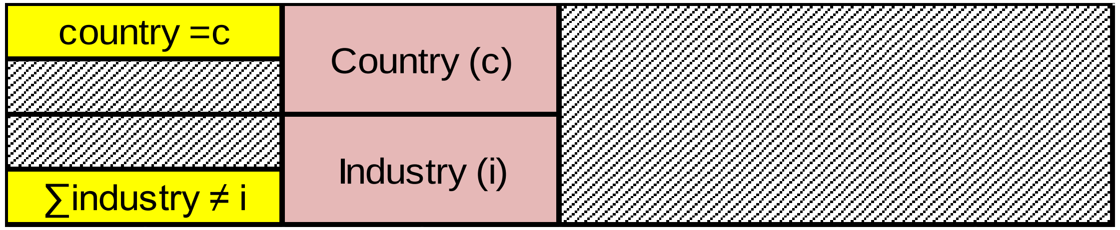
Indicator dimension	Measured attribute

Gross trade based indicators (cont)

Direct DVA content of Gross exports
EXGR_DDC

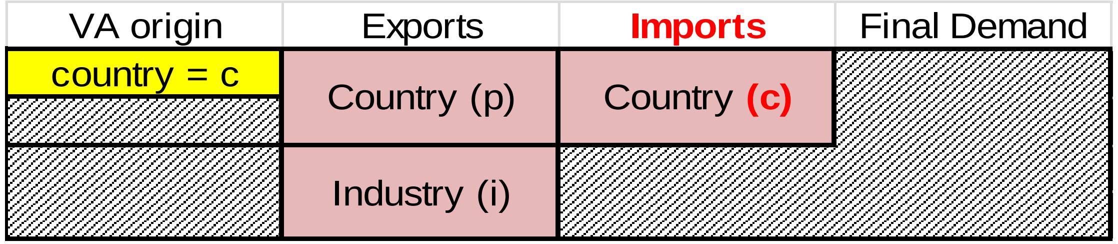


Indirect DVA content of Gross exports
EXGR_IDC



** does not include DVA that has returned, via imports, after previously being exported i.e. only the VA directly generated by the domestic exporting industry*

DVA content of gross imports
IMGR_DVA



DVA share of gross imports IMGR_DVASH = IMGR_DVA$_{(c,i,p)}$ / IMGR$_{(c,i,p)}$

Service content of Gross exports

Domestic Services VA content of Gross exports
EXGR_SERV_DVA

VA origin *	Exports	Imports	Final Demand
country =c	Country (c)		
	Industry (i)		
∑ services			

Foreign Services VA content of Gross exports
EXGR_SERV_FVA

VA origin *	Exports	Imports	Final Demand
	Country (c)		
∑country ≠ c			
	Industry (i)		
∑ services			

EXGR_SERV_DVASH= EXGR_SERV_DVA(c,i) / EXGR(c,i)

EXGR_SERV_FVASH= EXGR_SERV_FVA (c,i) / EXGR(c,i)

Using 4 dimensions

1. VA origin of gross exports EXGR_BSCI

VA origin	Exports	Imports	Final Demand
Country (p)	Country (c)		
Industry (h)	Industry (i)		

2. VA origin of gross imports IMGR_BSCI

VA origin	Exports	Imports	Final Demand
Country (s)	Country (p)	Country (c)	
	Industry (i)		

<u>Gross trade-based core TiVA indicators (2, 3 dims) can be derived from these cubes</u>

For example, from 1. above:

EXGR_DVA *(set source country s = "DXD: Domestic", source industry h = "CTOTAL")* hence EXGR_FVA, EXGR_DVASH, EXGR_FVASH, EXGR_TFVAIND

Also, EXGR_SERV_DVASH *(set source industry = "D41T98")*

and, EXGR_DVAFXSH.

Many other variations for users to play with …

Final demand based indicators

Domestic VA embodied in foreign final demand
FFD_DVA

VA origin	Exports	Imports	Final Demand
Country (c)			Country ≠ c
Industry (i)			

Share of Domestic VA embodied in foreign final demand
VALU_FFDDVA =FFD_DVA(c,i) / Value Added (c,i)

VA origin	Exports	Imports	Final Demand
Country (c)			
Industry (i)			

Foreign VA embodied in domestic final demand
DFD_FVA

VA origin	Exports	Imports	Final Demand
Country ≠ c			Country (c)
Industry (i)			

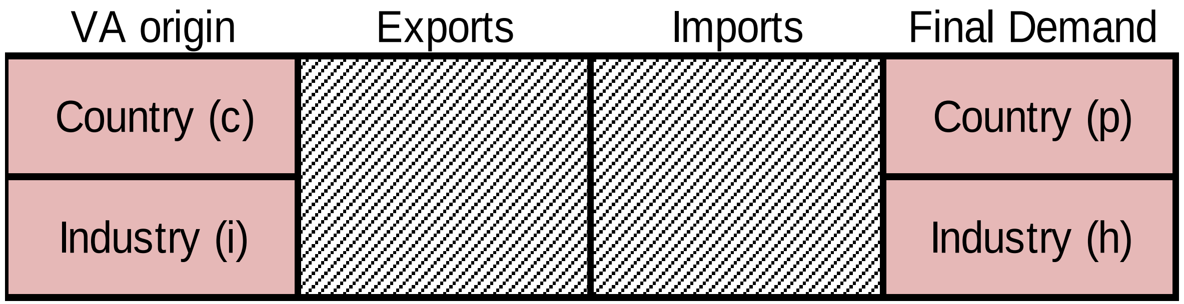
Value added balance, BALVAFD = FFD_DVA – DFD_FVA

Note: at the total economy level BALVAFD = BALGR

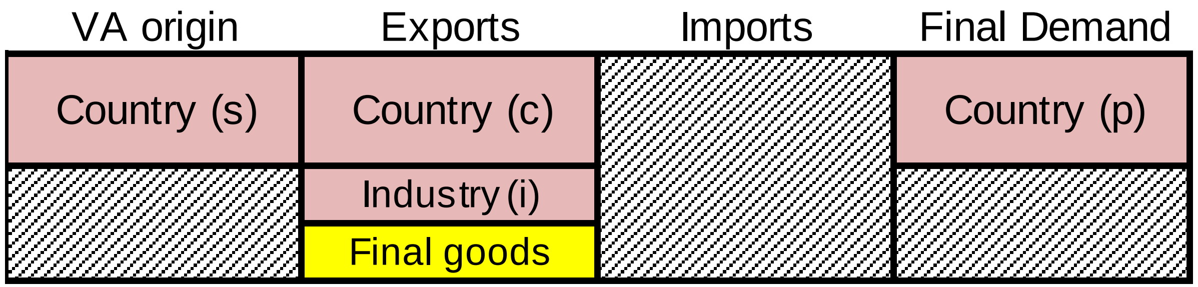
i.e. Gross trade balance = VA trade balance: differences for bilateral relations

Using 4 dimensions

VA origin of
Final Demand
FDVA_BSCI



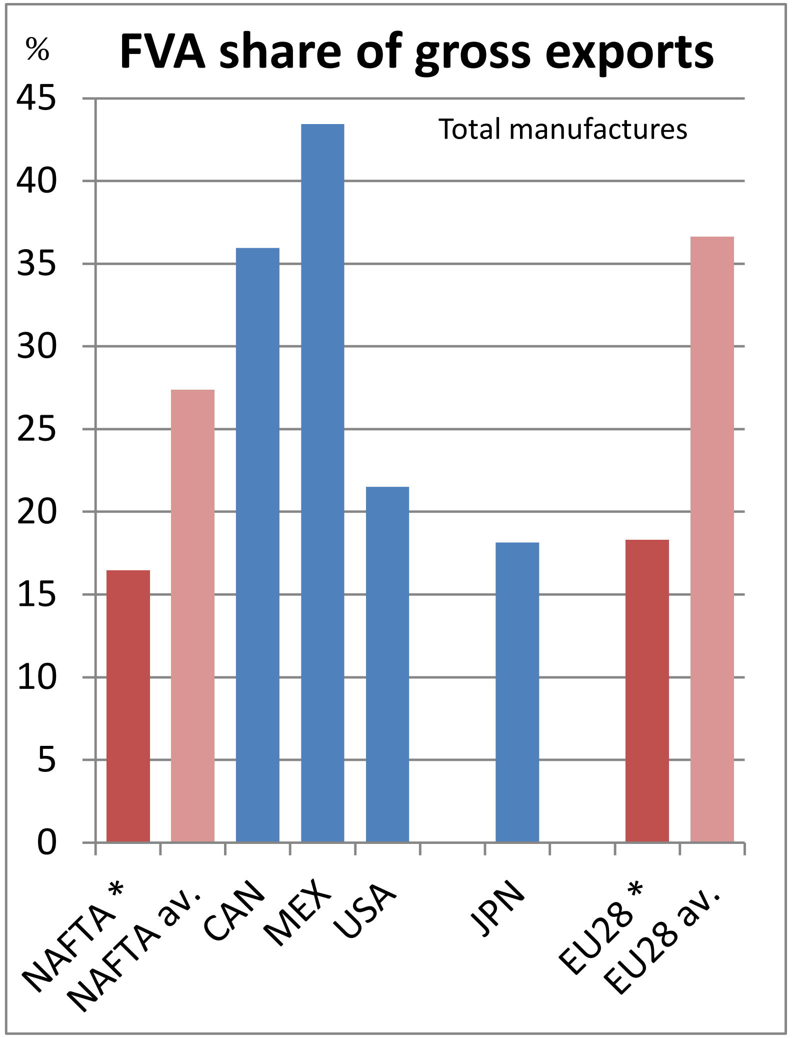
Gross exports by origin of value added and final destination
FD_EXGR_VA



Final Demand-based core TiVA indicators (2, 3 dims) can be derived from these cubes e.g. FFD_DVA and DFD_FVA but also many other variations

Indicators for regions

- Regions = country groups e.g. EU
- For indicators such as EXGR_FVA, can include or exclude intra-region trade flows and/or VA flows.
- Including is equivalent to showing average of countries e.g. intra-region VA flows treated as FVA
- Excluding is treating the region as a single economy e.g. intra-region VA flows treated as DVA
- EXGR_FVA: excl. intra-region VA
- VA origin of EXGR (4 dims): excl. intra-region VA flows



* excl. intra-region VA and trade flows

Caveats:
Average industry production functions [from *vBe*]

- At the <u>detailed level of industry</u>:

  DVA (FVA) share (%) of exports =

  DVA (FVA) share in output for domestic consumption

  (*except for China and Mexico*)

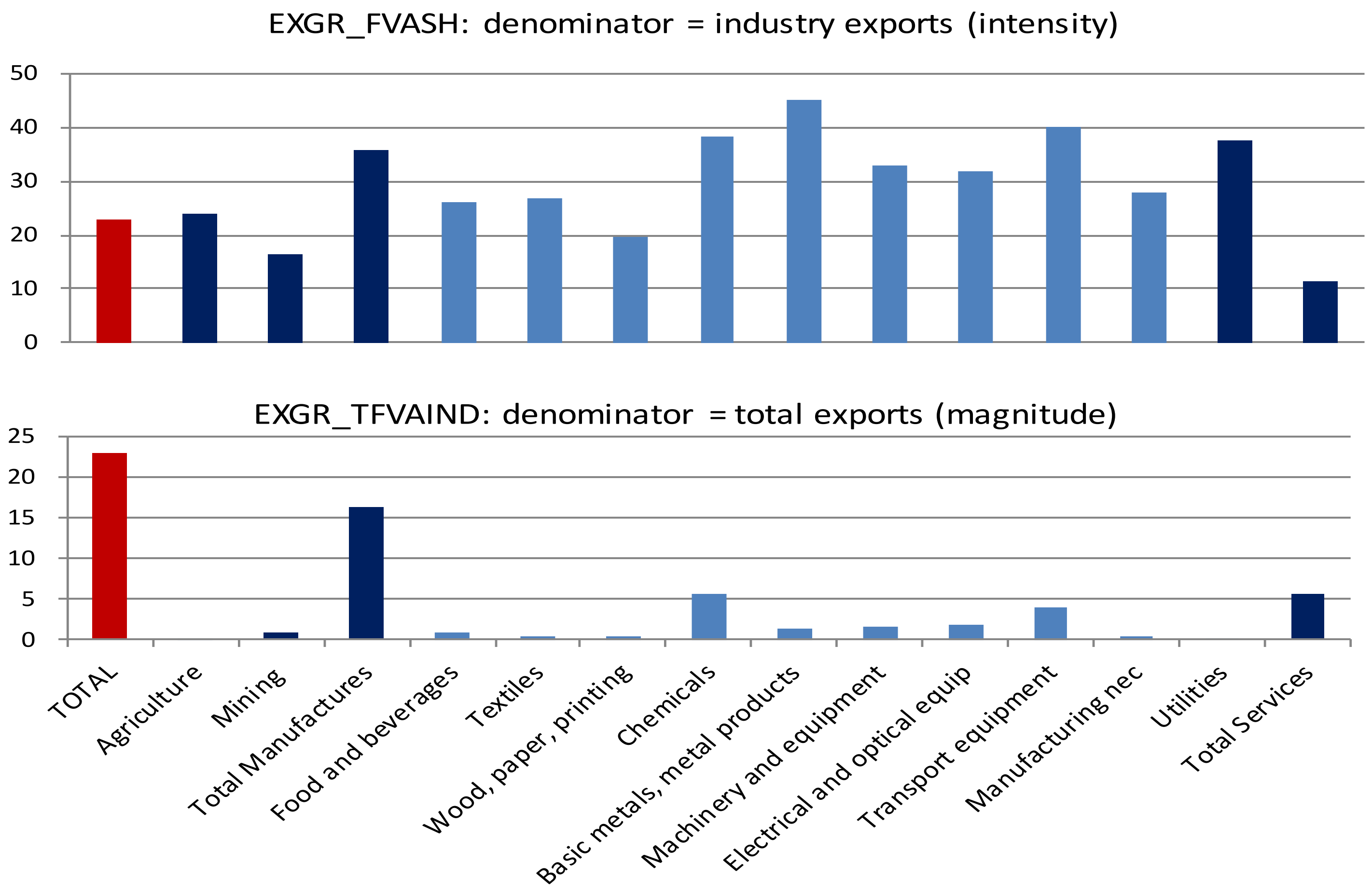
- Also, the same for each importing partner country
- Differences at the aggregate level (e.g. total manufactures) reflect differing industry compositions of exports to each partner
- Using a more detailed industry list would result in changes in indicators at aggregate levels (e.g. total manufactures, total services)
- Also, dividing industries to account for firm heterogeneity, e.g. exporters v. non-exporters, also changes indicators:

  This is what we do for China and Mexico in the ICIO

Caveats: “double counting”

- Presence of double-counting in EXGR-based indicators when comparing across countries
- Double counted value-added comes in different flavours in gross exports:
  - The foreign value-added in exports can already be regarded as ‘double counting’ because it is domestic value added in the exports of another country
    - At the world level, this is ‘double counting’
    - But not when measured for a given exporting economy
    - Also, the same FVA can be included in the gross exports of different countries
  - An additional source of double counting comes from intermediate inputs that come back to the exporting economy
    - Domestic inputs can return back home and the domestic value-added embodied in them is counted twice (as well as any foreign value-added embodied in them)
    - Foreign inputs can also return back to the exporting economy (and they have foreign value-added or domestic value-added that will also be counted several times)
    - Therefore, a full decomposition of gross exports should also include domestic double counted VA and foreign double counted VA.
- Does it matter?
  - Double counting is generally small but at the industry level and in specific countries, it is non negligible.
  - It matters when the domestic value-added has to be consistent with GDP (e.g. jobs embodied in exports).

Example of EXGR_FVASH versus EXGR_TFVAIND



TIVA INDICATORS - LIST

Structural Indicators

		Structural Indicators - based on the values in the ICIO tables	
1	4.1	PROD	Production (gross output)
2	4.2	VALU	Value added
10	4.3	PROD_VASH	Value added as a % of production
3	4.4	EXGR	Gross exports
4	4.4	EXGR_INT	Gross exports of intermediate products
5	4.4	EXGR_FNL	Gross exports of final products
6	4.5	IMGR	Gross imports
7	4.5	IMGR_INT	Gross imports of intermediate products
8	4.5	IMGR_FNL	Gross imports of final products
9	4.6	BALGR	Gross trade balance
11	4.7	EXGRpSH	Gross exports, partner shares
12	4.7	IMGRpSH	Gross imports, partner shares

Structural Indicators

- Production, gross output, USD million
  - $\boldsymbol{PROD_{c,i} = X_{c,i}}$
  - $Prod\ cou \mid Prod\ ind \mid World$
- Value added, USD million
  - $\boldsymbol{VALU_{c,i} = W_{c,i}}$
  - $Prod\ cou \mid Prod\ ind \mid World$
- *Gross exports, by industry and by partner country, USD million (f.o.b.)*
  - $\boldsymbol{EXGR_{c,i} = \sum_p EXGR_{c,i,p} = \sum_p (EXGR\_INT_{c,i,p} + EXGR\_FNL_{c,i,p})}$
  - $\boldsymbol{EXGR\_INT_{c,i,p} = GRTR\_INT_{(c-1)*N+i,p}}$
  - $\boldsymbol{EXGR\_FNL_{c,p,i} = GRTR\_FNL_{(c-1)*N+i,p}}$
  - $Exp\ cou \mid Exp\ ind \mid Imp\ cou$

Structural Indicators

- Gross imports, by industry and by partner country, USD million (f.o.b.)
  - $\boldsymbol{IMGR_{c,i} = \sum_p IMGR_{c,p,i}}$
  - $\boldsymbol{IMGR\_INT_{c,i,p} = GRTR\_INT_{(p-1)*N+i,c}}$
  - $\boldsymbol{IMGR\_FNL_{c,i,p} = GRTR\_FNL_{(p-1)*N+i,c}}$
  - *Imp cou | Exp ind | Exp cou*

- Gross trade balance, by partner country, USD million (f.o.b.)
  - $\boldsymbol{BALGR_{c,p} = EXGR_{c,p} - IMGR_{c,p}}$
  - *Exp cou | Tot ind | Imp cou*

- Value added as a share of Gross Output, by industry, percentage
  - $\boldsymbol{PROD\_VASH_{c,i} = \frac{VALU_{c,i}}{PROD_{c,i}}}$
  - *Prod cou | Prod ind | World*

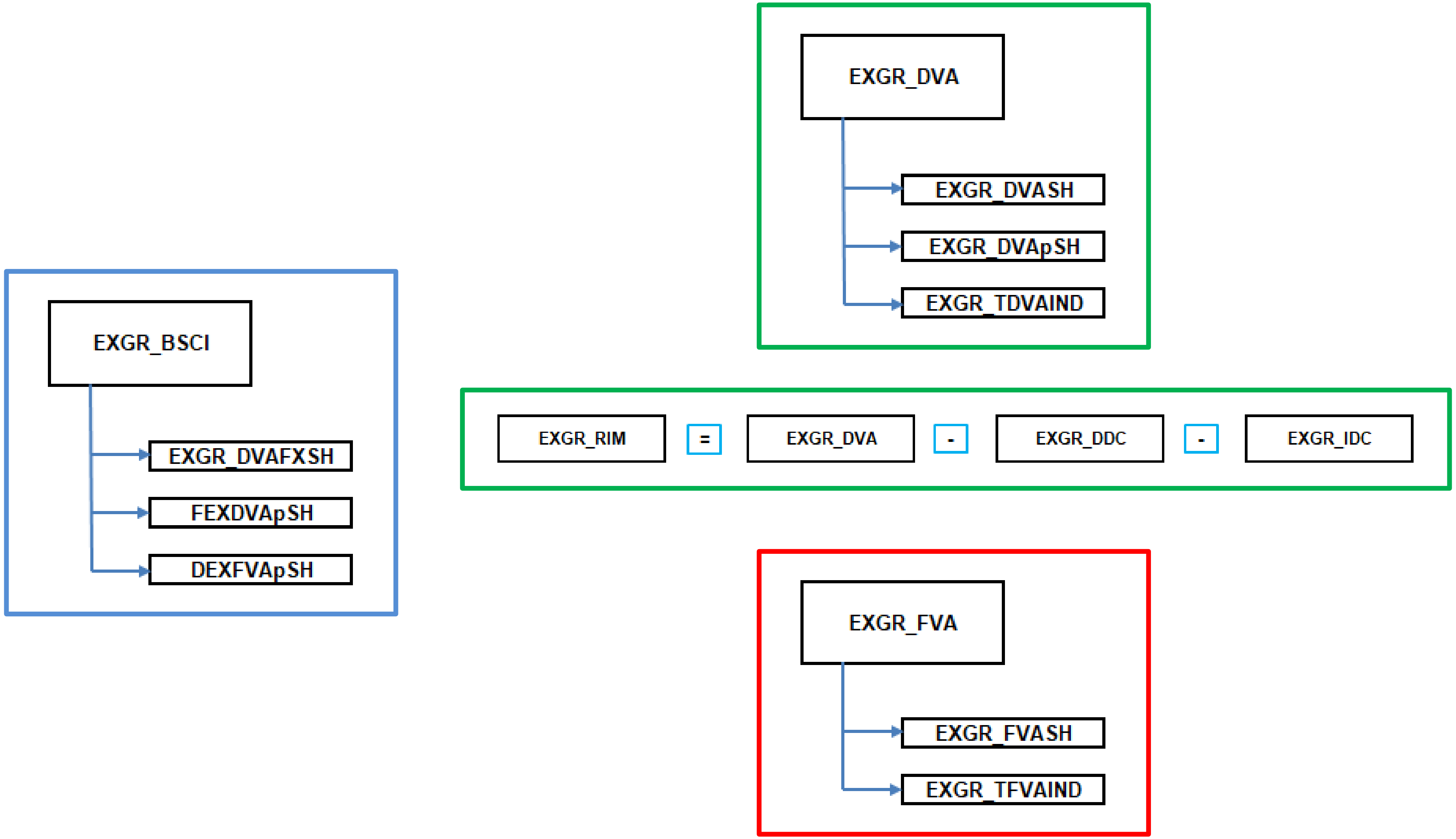
Structural Indicators

- Gross exports, partner shares %, by industry, percentage
  - $\boldsymbol{EXGRpSH_{c,i,p}} = \frac{\boldsymbol{EXGR_{c,i,p}}}{\sum_p \boldsymbol{EXGR_{c,i,p}}} \times \mathbf{100}$
  - *Exp cou | Exp ind | Imp cou*
- Gross imports, partner shares %, by industry, percentage
  - $\boldsymbol{IMGRpSH_{c,i,p}} = \frac{\boldsymbol{IMGR_{c,i,p}}}{\sum_p \boldsymbol{IMGR_{c,i,p}}} \times \mathbf{100}$
  - *Imp cou | Exp ind | Exp cou*

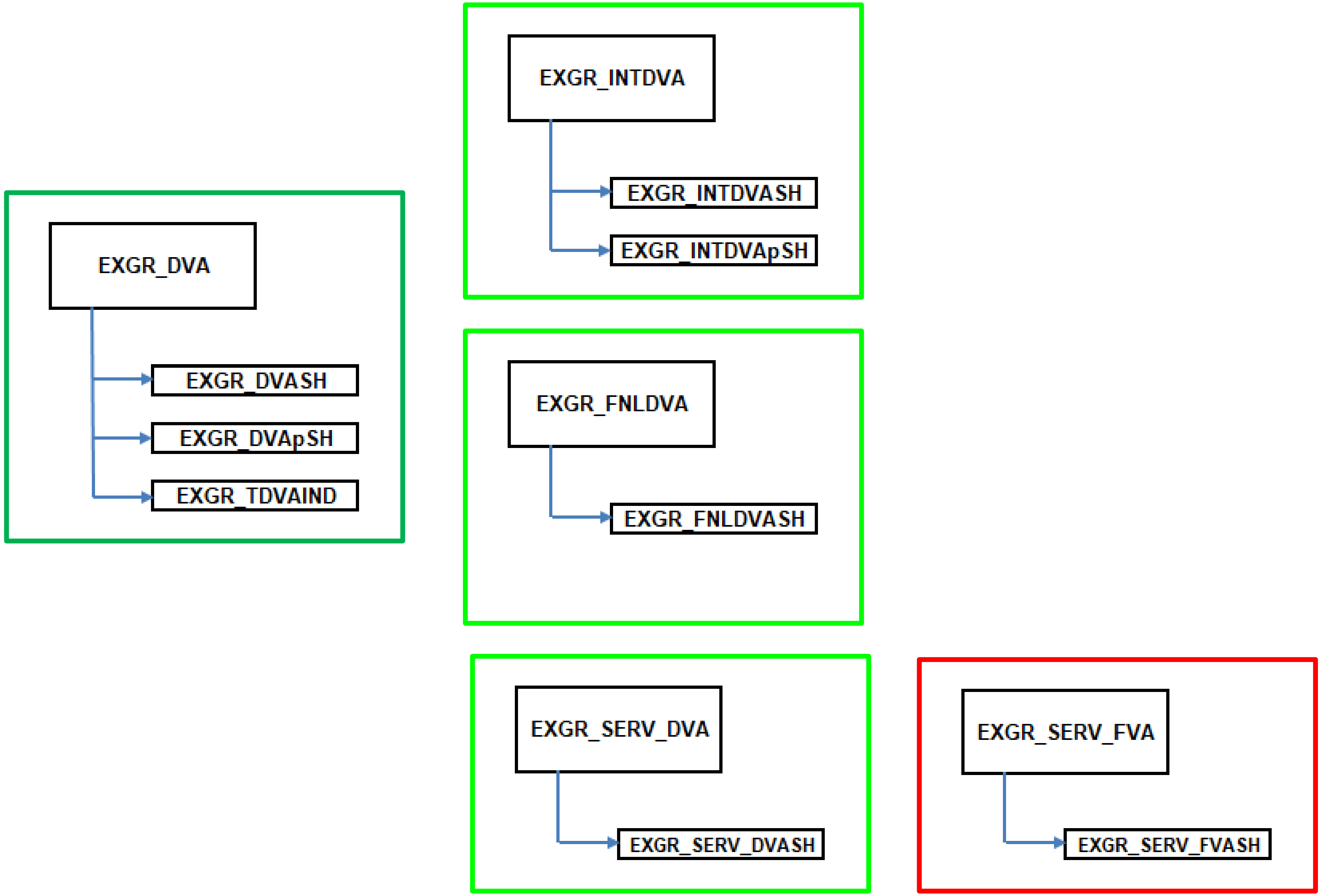
Indicators based on Value Added, Gross Exports and Imports

		Indicators based on the origins of value added in gross exports and imports	
		Domestic value added content of gross exports	
13	5.1	EXGR_DVA	Domestic value added content of gross exports
20	5.2	EXGR_DVASH	Domestic value added share of gross exports
29	5.3	EXGR_TDVAIND	Industry domestic value added contribution to gross exports
25	5.4	EXGR_DVApSH	Domestic value added in gross exports, partner shares
		Decomposition of domestic value added content of gross exports	
14	5.5	EXGR_DDC	Direct domestic value added content of gross exports
15	5.6	EXGR_IDC	Indirect domestic value added content of gross exports
16	5.7	EXGR_RIM	Re-imported domestic value added content of gross exports
		Foreign value added content of gross exports (backward participation in GVCs)	
17	5.8	EXGR_FVA	Foreign value added content of gross exports
27	5.9	EXGR_FVASH	Foreign value added share of gross exports
30	5.10	EXGR_TFVAIND	Industry foreign value added contribution to gross exports
33	5.11	DEXFVApSH	Foreign value added share of gross exports, by value added origin country
		Domestic value added content of foreign gross exports (forward participation in GVCs)	
24	5.12	EXGR_DVAFXSH	Domestic value added embodied in foreign exports as share of gross exports
34	5.13	FEXDVApSH	Domestic value added in foreign exports as a share of gross exports, by foreign exporting country
		Domestic value added content of intermediate and final gross exports	
21	5.14	EXGR_INTDVASH	Domestic value added in exports of intermediate products, as a share of total gross exports
22	5.15	EXGR_FNLDVASH	Domestic value added in exports of final products, as a share of total gross exports
26	5.16	EXGR_INTDVApSH	Domestic value added in exports of intermediate products, partner shares
		Services value added content of gross exports	
23	5.17	EXGR_SERV_DVASH	Domestic services value added share of gross exports
28	5.18	EXGR_SERV_FVASH	Foreign services value added share of gross exports
		Domestic value added in imports	
18	5.19	IMGR_DVA	Domestic value added content of gross imports
31	5.20	IMGR_DVASH	Domestic value added share of gross imports
		Re-exported intermediate imports	
19	5.21	REII	Re-exported intermediate imports
32	5.22	IMGRINT_REII	Re-exported intermediate imports as % of intermediate imports

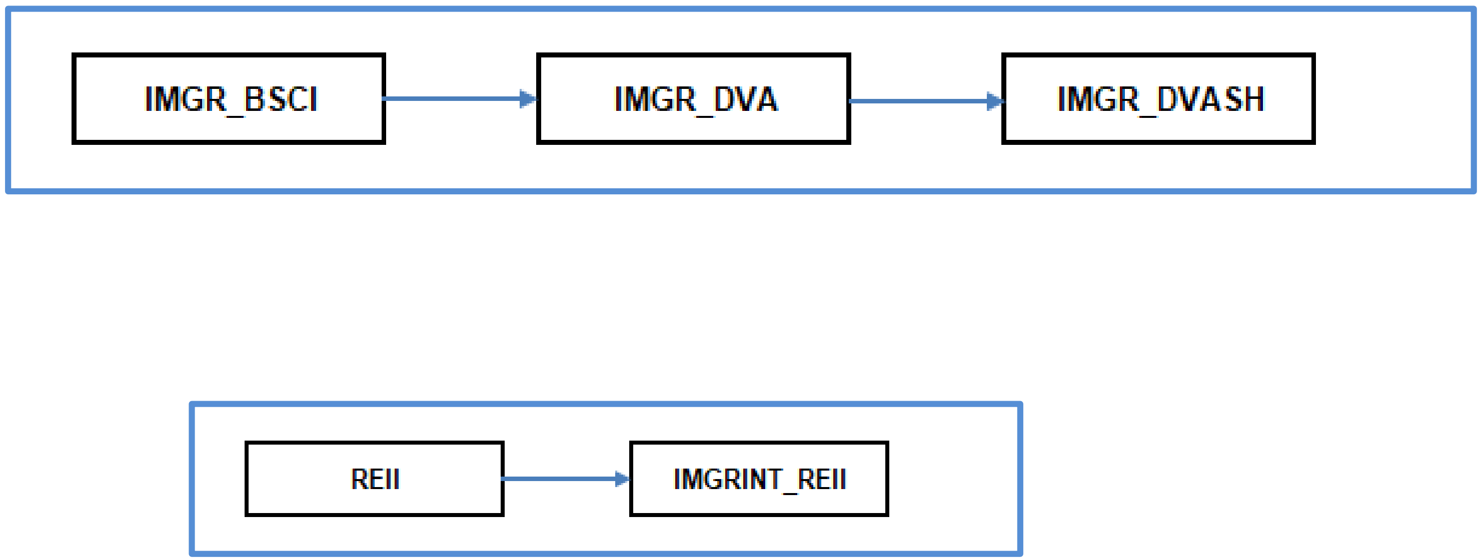
Overview Indicators Estimation



Overview Indicators Estimation



Overview Indicators Estimation



Indicators based on Value Added, Gross Exports and Imports

- Domestic value added embodied in gross exports, by industry and by partner country, USD million
  - $\mathbf{EXGR\_DVA_{c,i,p} = V_c B_{c,c} EXGR_{c,i,p}}$
  - *Exp cou | Exp ind | Imp cou*

- Direct domestic industry value added content of gross exports, USD million
  - $EXGR\_DDC_c = \widehat{V_c} diagB_c EXGR_c$
  - *Exp cou | Exp ind | World*

- Indirect domestic content of gross exports (originating from domestic intermediates), USD million
  - $EXGR\_IDC_c = \widehat{V_c} offdiagB_c EXGR_c - EXGR\_DDC_c$
  - *Exp cou | Exp ind | World*

Indicators based on Value Added, Gross Exports and Imports

- Re-imported domestic value added content of gross exports, USD million
  - $\boldsymbol{EXGR\_RIM_c = \widehat{V_c}B_{c,c}EXGR_c - EXGR\_DDC_c - EXGR\_IDC_c}$
  - *Exp cou | Exp ind | World*

- Foreign value added content of gross exports, by industry, USD million
  - $\boldsymbol{EXGR\_FVA_c = V_cB_cEXGR_{c,i}}$
  - *Exp cou | Exp ind | World*

- Domestic value added embodied in gross imports, by exporting industry and exporting country, USD million
  - $\boldsymbol{IMGR\_DVA_{c,i,p} = \widehat{V}_cB_{c,i,p}IMGR_{c,i,p}}$
  - *Imp cou | Exp ind | Exp cou*

Indicators based on Value Added, Gross Exports and Imports

- Re-exported intermediate imports, USD million
  - $REII_{c,i} = \left(\sum_p A_{p,c} B_{c,c} EXGR_c\right)_i$
  - *Exp cou | Prod ind | World*
- Domestic value added share of gross exports, percentage
  - $EXGR\_DVASH_{c,i} = \frac{\sum_p EXGR\_DVA_{c,i,p}}{\sum_p EXGR_{c,i,p}} \times 100$
  - *Exp cou | Exp ind | World*
- Domestic value added in exports of intermediate products as a share of total gross exports, percentage
  - $EXGR\_INTDVASH_{c,i} = \frac{\sum_p EXGR\_INTDVA_{c,i,p}}{\sum_p EXGR_{c,i,p}} \times 100$
  - *Exp cou | Exp ind | World*

Indicators based on Value Added, Gross Exports and Imports

- Domestic value added in exports of final products as a share of total gross exports, percentage
  - $\boldsymbol{EXGR\_FNLDVASH_{c,i}} = \frac{\sum_p EXGR\_FNLDVA_{c,i,p}}{\sum_p EXGR_{c,i,p}} \times 100$
  - *Exp cou | Exp ind | World*
- Domestic services value added share in gross exports, percentage
  - $\boldsymbol{EXGR\_SERV\_DVASH_{c,i}} = \frac{EXGR\_SERV\_DVA_{c,i}}{EXGR_{c,i}} \times 100$
  - where: $EXGR\_SERV\_DVA_{c,i} = \sum_{j \in S} \widehat{V_{c,j}} \left(B_{c,c}\right)_{ji} EXGR_{c,i}$
  - *Exp cou | Exp ind | World*
- Domestic value added embodied in foreign exports as share of gross exports, percentage
  - $\boldsymbol{EXGR\_DVAFXSH_{c,i}} = \frac{\sum_p EXGR\_BSCI_{c,i,p}}{EXGR_c} \times 100$
  - *VA src cou | Exp ind |World*

Indicators based on Value Added, Gross Exports and Imports

- Domestic value added in gross exports, partner shares, percentage
  - $EXGR\_DVApSH_{c,i,p} = \frac{EXGR\_DVA_{c,i,p}}{\sum_p EXGR\_DVA_{c,i,p}} \times 100$
  - *Exp cou | Exp ind | Imp cou*

- Domestic value added in exports of intermediate products, partner shares, percentage
  - $EXGR\_INTDVApSH_{c,i,p} = \frac{EXGR\_INTDVA_{c,i,p}}{\sum_p EXGR\_INTDVA_{c,i,p}} \times 100$
  - *Exp cou | Exp ind | Imp cou*

- Foreign value added share of gross exports, percentage
  - $EXGR\_FVASH_{c,i} = \frac{\sum_p EXGR\_FVA_{c,i,p}}{\sum_p EXGR_{c,i,p}} \times 100$
  - *Exp cou | Exp ind | World*

Indicators based on Value Added, Gross Exports and Imports

- Foreign services value added share in gross exports, percentage
  - $EXGR\_SERV\_FVASH_{c,i} = \frac{EXGR\_SERV\_FVA_{c,i}}{EXGR_{c,i}} \times 100$
  - where: $EXGR\_SERV\_FVA_{c,i} = \sum_p \sum_{j \in S} \widehat{V_{p,j}} \left(B_{p,c}\right)_{ji} EXGR_{c,i,p}$
  - *Exp cou* | *Exp ind* | *World*

- Industry domestic value added contribution to gross exports, as a percentage of total gross exports
  - $EXGR\_TDVAIND_{c,i} = \frac{\sum_p EXGR\_DVA_{c,i,p}}{\sum_{p,i} EXGR_{c,i,p}} \times 100$
  - *Exp cou* | *Exp ind* | *World*

- Industry foreign value added contribution to gross exports, as a percentage of total gross exports
  - $EXGR\_TFVAIND_{c,i} = \frac{\sum_p EXGR\_FVA_{c,i,p}}{\sum_{p,i} EXGR_{c,i,p}} \times 100$
  - *Exp cou* | *Exp ind* | *World*

Indicators based on Value Added, Gross Exports and Imports

- Domestic value added share of gross imports, percentage
  - $\boldsymbol{IMGR\_DVASH_{c,i,p} = \frac{IMGR\_DVA_{c,i,p}}{\sum_p IMGR_{c,i,p}} \times 100}$
  - *Imp cou | Exp ind | Exp cou*

- Re-exported intermediate imports as a % of total intermediate imports, percentage
  - $\boldsymbol{IMGRINT\_REII_{c,i} = REII_{c,i} / \sum_p IMGR\_INT_{c,i,p}}$
  - *Exp cou | Prod ind | World*

- Backward participation in GVCs, percentage
  - $\boldsymbol{DEXFVApSH_{c,p} = \frac{EXGR\_BSCI_{c,p}}{EXGR_c} \times 100}$
  - *Exp cou | Tot ind | VA src cou*

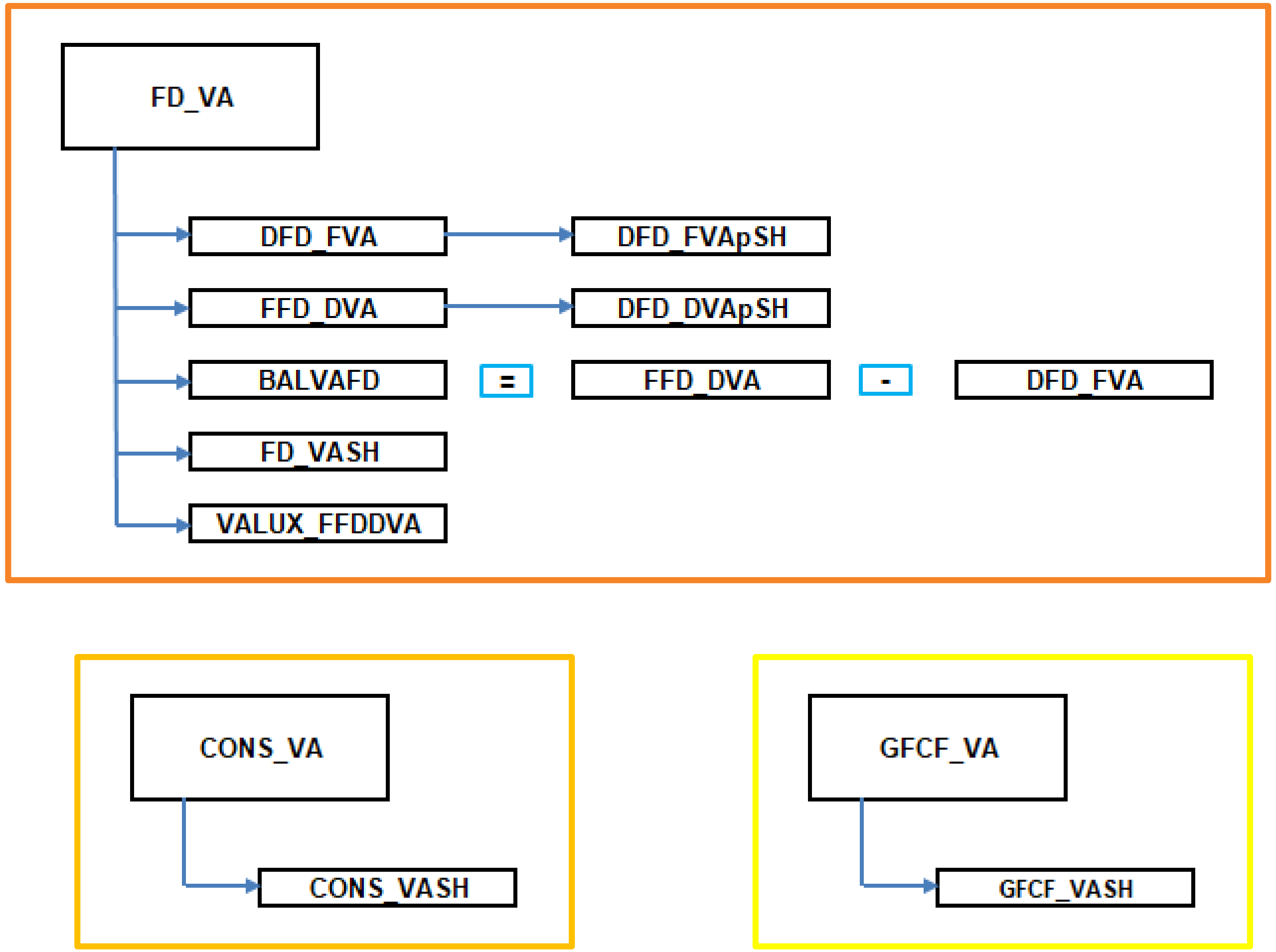
Indicators based on Value Added, Gross Exports and Imports

- Forward participation in GVCs, percentage
  - $\boldsymbol{FEXDVApSH_{cp} = \frac{EXGR\_BSCI_{cp}}{EXGR_c} \times 100}$
  - $VA\ src\ cou \mid Tot\ ind \mid Exp\ cou$

Indicators based on Value Added and Final Demand

		Indicators based the origins of value added origin in final demand	
38	6.1	FFD_DVA	Domestic value added embodied in foreign final demand
44	6.2	FFD_DVApSH	Domestic value added in foreign final demand, partner shares
46	6.3	VALU_FFDDVA	Share of domestic value added embodied in foreign final demand
39	6.4	DFD_FVA	Foreign value added embodied in domestic final demand
45	6.5	DFD_FVApSH	Foreign value added in domestic final demand, partner shares
40	6.6	BALVAFD	Value added embodied in final demand, balance
		Sources of value added in final demand	
35	6.7	FD_VA	Value added content of final demand, by source country and industry
36	6.7	CONS_VA	Value added content of total consumption, by source country and industry
37	6.7	GFCF_VA	Value added content of gross fixed capital formation, by source country and industry
41	6.8	FD_VASH	Value added share of total final demand, by source country and industry
42	6.8	CONS_VASH	Value added share of total consumption, by source country and industry
43	6.8	GFCF_VASH	Value added share of gross fixed capital formation, by source country and industry

Overview Indicators Estimation



Indicators based on Value Added and Final Demand

- Value added embodied in final demand, consumption and GFCF, USD million
  - $\boldsymbol{FD\_VA_{c,p} = \left(\hat{V}\ B\ FD\right)_{p,c}}$
  - $\boldsymbol{CONS\_VA_{c,p} = \left(\hat{V}\ B\ CONS\right)_{p,c}}$
  - $\boldsymbol{GFCF\_VA_{c,p} = \left(\hat{V}\ B\ GFCF\right)_{p,c}}$
  - $FD\ cou \mid VA\ src\ ind \mid VA\ src\ cou$
- Domestic value added embodied in foreign final demand, USD million
  - $\boldsymbol{FFD\_DVA_{c,p} = \left(\hat{V}\ B\ FD\right)_{c,p}}$
  - $VA\ src\ cou \mid VA\ src\ ind \mid Dem\ cou$
- Foreign value added embodied in domestic final demand, USD million
  - $\boldsymbol{DFD\_FVA_{c,p} = \left(\hat{V}\ B\ FD\right)_{p,c}}$
  - $FD\ cou \mid VA\ src\ ind \mid VA\ src\ cou$

Indicators based on Value Added and Final Demand

- Value added embodied in final demand, balance, USD million
  - $\boldsymbol{BALVAFD_{c,i,p} = FFD\_DVA_{c,i,p} - DFD\_FVA_{c,i,p}}$
  - *VA src cou | VA src ind | FD cou*
- Value added shares in final demand, consumption and GFCF , by source country and industry, percentage
  - $\boldsymbol{FD\_VASH_{c,i,p} = \frac{FD\_VA_{c,i,p}}{\sum_p FD\_VA_{c,i,p}}\ x\ 100}$
  - $\boldsymbol{CONS\_VASH_{c,i,p} = \frac{CONS\_VA_{c,i,p}}{\sum_p CONS\_VA_{c,i,p}}\ x\ 100}$
  - $\boldsymbol{GFCF\_VASH_{c,i,p} = \frac{GFCF\_VA_{c,i,p}}{\sum_p GFCF\_VA_{c,i,p}} x100}$
  - *FD cou | VA src ind | VA src cou*

Indicators based on Value Added and Final Demand

- Domestic value added embodied in foreign final demand, partner shares, percentage
  - $\boldsymbol{FFD\_DVApSH_{c,i,p}} = \frac{\boldsymbol{FFD\_DVA_{c,i,p}}}{\sum_p \boldsymbol{FFD\_DVA_{c,i,p}}} \times \mathbf{100}$
  - *VA src cou | VA src ind | FD cou*
- Foreign value added embodied in domestic final demand, partner shares, percentage
  - $\boldsymbol{DFD\_FVApSH_{c,i,p}} = \frac{\boldsymbol{DFD\_FVA_{c,i,p}}}{\sum_p \boldsymbol{DFD\_FVA_{c,i,p}}} \times \mathbf{100}$
  - *FD cou | VA src ind | VA src cou*
- Domestic value added embodied in foreign final demand as a % of total value added, percentage
  - $\boldsymbol{VALUX\_FFDDVA_{c,i}} = \frac{\sum_p \boldsymbol{FFD\_DVA_{c,i,p}}}{\boldsymbol{VALUx_{c,i}}} \times \mathbf{100}$
  - *VA src cou | VA src ind | World*

Indicators with four dimensions

		Indicators with four dimensions	
		Origins of value added By Source Country and Industry (BSCI)	
47	7.1	EXGR_BSCI	Origin of value added in gross exports
48	7.2	IMGR_BSCI	Origin of value added in gross imports
49	7.3	FDVA_BSCI	Origin of value added in final demand
		Gross exports with 3 country dimensions: exporter, value added origin and final destination	
50	7.4	FD_EXGRINT_VA	Gross exports of intermediate products by origin of value added and final destination
51	7.4	FD_EXGRFNL_VA	Gross exports of final products by origin of value added and final destination
52	7.4	FD_EXGR_VA	Gross exports by origin of value added and final destination

Indicators with four dimensions

- Origin of value added in gross exports, USD million
  - $EXGR\_BSCI_{p,h,c,i} = \left(\widehat{V}B\ EXGR_{c,i}\right)_{p,h}$
  - *VA src ind | VA src ind | Exp cou | Exp ind*
- Origin of value added in gross imports, USD million
  - $IMGR\_BSCI_{p,c,i,s} = \widehat{V}BIMGR_{p,c}$
  - *Imp cou | VA src cou | Exp ind | Exp cou*
- Origin of value added in final demand, USD million
  - $FDVA\_BSCI_{c,i,p,h} = \left(\widehat{V}B\ FD_{p,h}\right)_{c,i}$
  - *VA src cou | VA src ind | FD cou | FD ind*

Indicators with four dimensions

- Value added embodied in intermediate products exports by final destination, USD million
  - $FD\_EXGRINT\_VA_{s,c,i,p} = V_{s,j} * B_{s,j,c,i} * F_{c,i,p}$
  - Where: $F = diag\{[\gamma \circ A * diag(B * FD)] * i\}$
  - *VA src cou | Exp cou | Exp ind | FD cou*
- Value added embodied in final products exports by final destination, USD million
  - $FD\_EXGRFNL\_VA_{s,c,i,p} = V_{s,j} * B_{s,j,c,i} * EXGR\_FNL_{c,i,p}$
  - *VA src cou | Exp cou | Exp ind | FD cou*
- Value added embodied in total gross exports by final destination, USD million
  - $FD\_EXGR\_VA_{s,c,i,p} = FD\_EXGRINT\_VA_{s,j,c,i} + FD\_EXGRFNL\_VA_{c,i,p}$
  - *VA src cou | Exp cou | Exp ind | FD cou*

TECO2 AND TIM INDICATORS

BETTER POLICIES FOR BETTER LIVES

$TECO_2$ and TiM Indicators

- TECO2 and TiM indicators are estimated according to the methodology presented for the estimation of the TiVA indicators.
- They make use of CO_2 emissions and employment coefficients in the place of value added coefficients.
- The discussion of the coefficients estimation of these databases is presented in the respective working papers published by OECD and on the dedicated internet webpages (http://oe.cd/io-co2 and http://oe.cd/io-emp)

EXPLORING CHANGES IN WORLD PRODUCTION AND TRADE

INSIGHTS FROM THE 2018 UPDATE OF OECD’S ICIO/TIVA DATABASE

BETTER POLICIES FOR BETTER LIVES

World Production and Trade

by ICIO and TiVA Databases

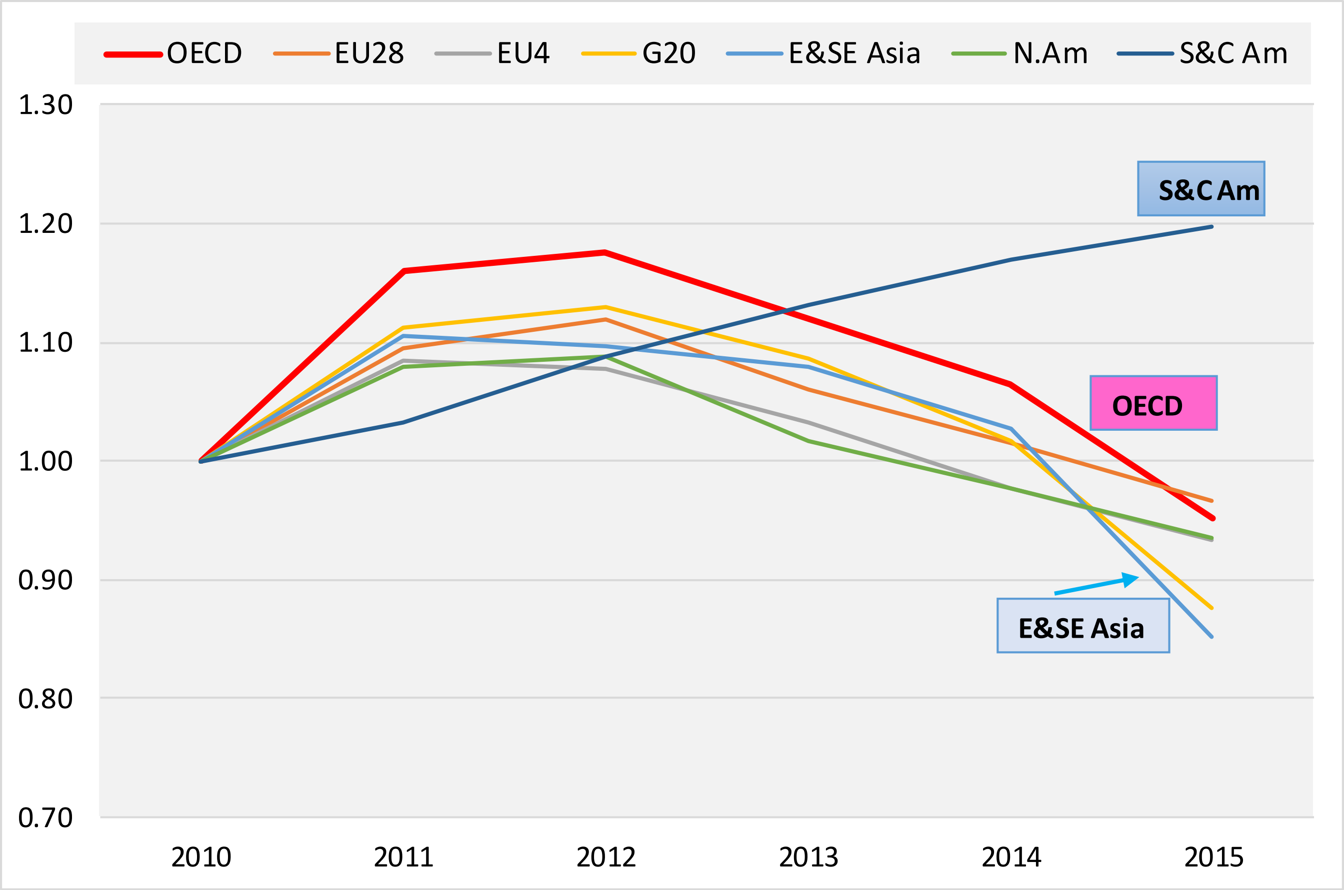
- Has the structure of world production and trade really changed from 2005 to 2015?
- If so, how do these changes affect (and are affected by) changes in the structure of value added, employment, and emissions generation?
- Who are the main players?
- A portrait by OECD's ICIO and TiVA!

- For a Brazilian perspective using OECD databases:
  - IEDI (2019). *Cadeias de Valor e a Globalização Produtiva*. Carta IED N. 960. https://iedi.org.br/cartas/carta_iedi_n_960.html

De-globalisation?

- For major blocs of countries, in recent years, the general trend in foreign contents of exports has been downward.
- The notable exception is South and Central America.
- At the country level the patterns of change can be very different within the same trading bloc.

Foreign value added shares of total exports, 2010 = 1.00

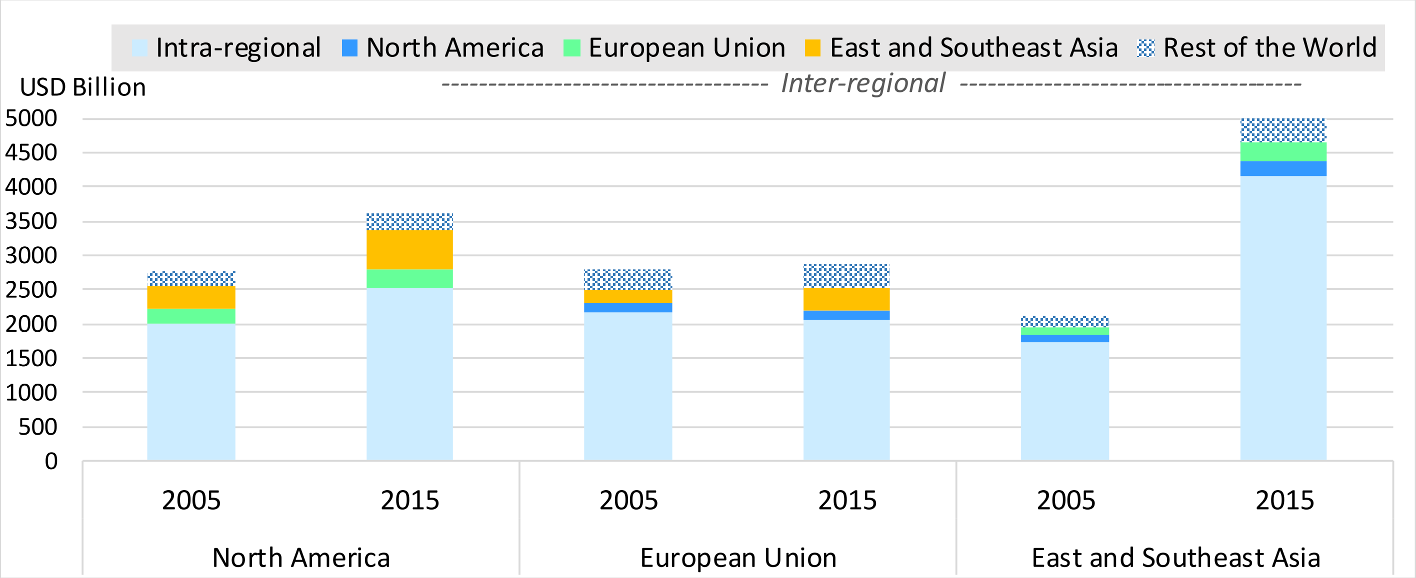


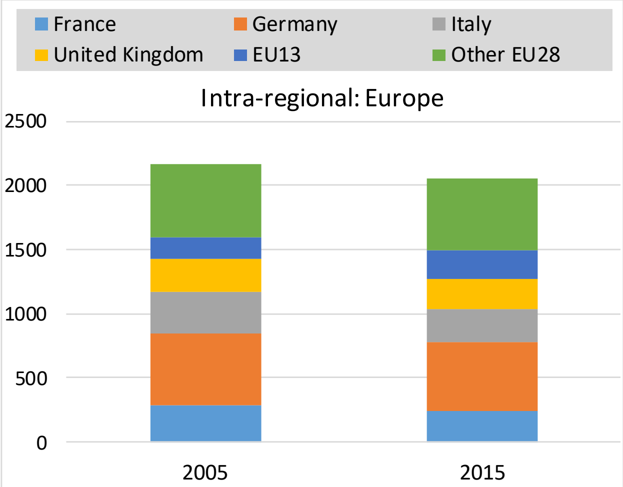
Source: Estimation based on OECD's Inter-Country Input-Output (ICIO) Database, 2018

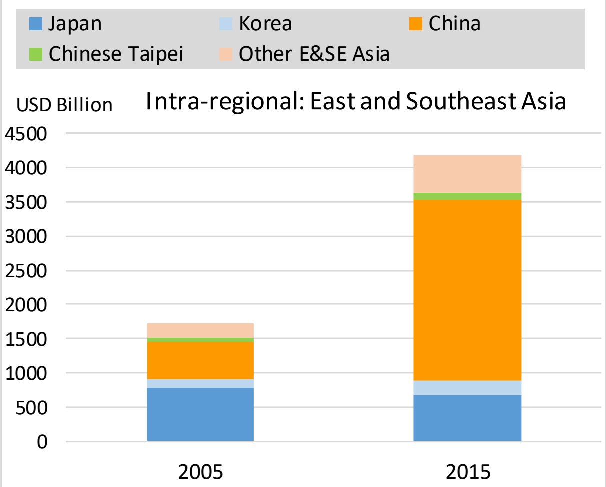
Globalisation or regionalisation?

- Inter x Intra regional trade
- Main trading blocs: North America, European Union (EU28), East and Southeast (E&SE) Asia
- Overall increase in the trade of manufactured goods, in value added terms, from 2005 to 2015, especially for E&SE Asia
- As a whole, there are declines in intra-regional trade in North America and EU28, while for E&SE Asia there is an clear increase in the intra-regional trade, in great part due to China.

Inter- and Intra-regional demand for manufactured goods





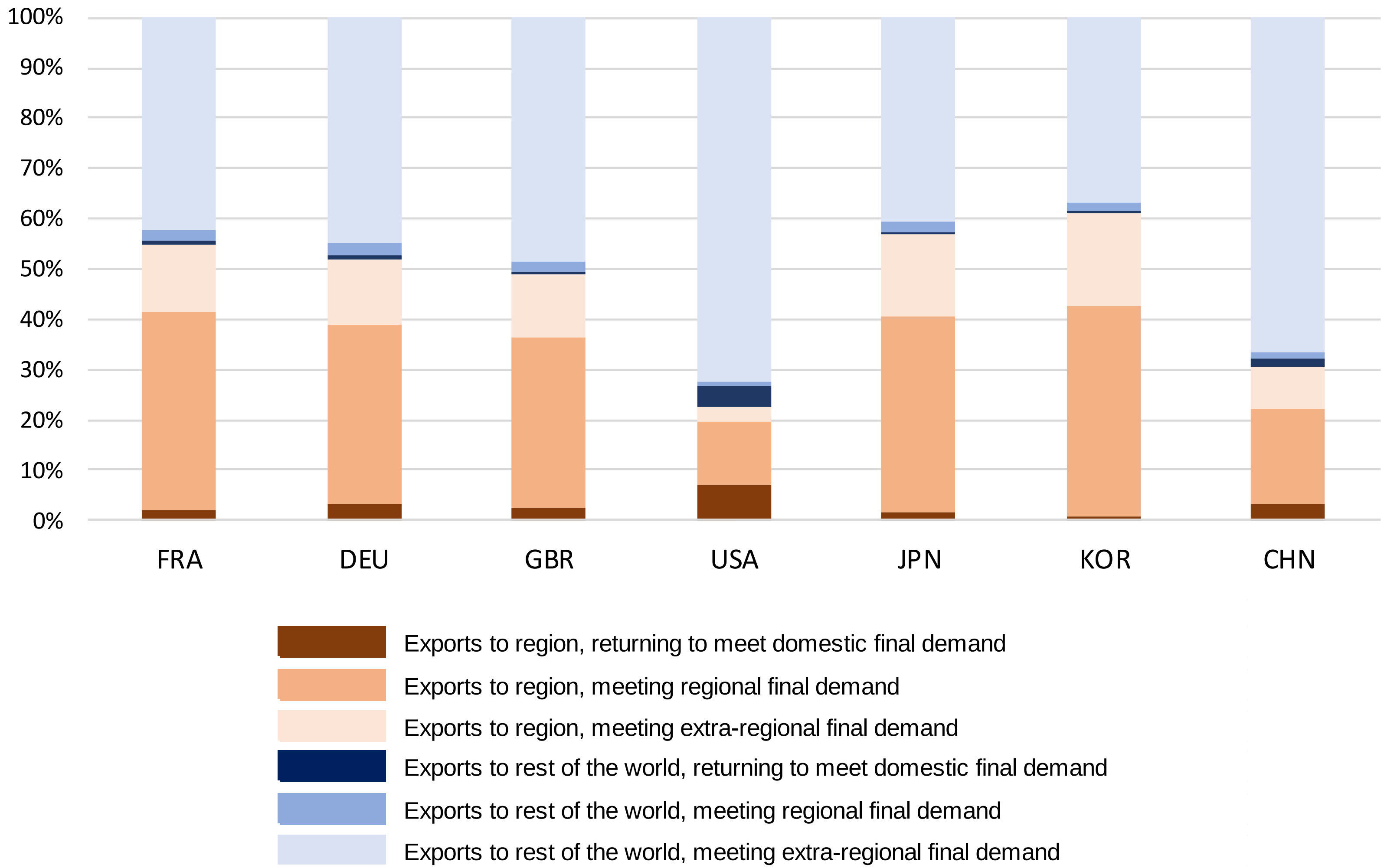


Source: OECD, Trade in Value Added database, http://oe.cd/tiva, 2018, *Origin of value added in final demand*

Globalisation or regionalisation?

- Analysis of the final destination of intermediate exports, for select countries, shows where these goods actually end-up.
  - For USA and, to a lesser extent, for China, there is a return of exports to meet demand in the originating countries;
  - For the selected Asian countries (Japan, Korea, China) around one-third of the intra-regional exports are subsequently embodied in exports to the rest of the world.
- The increased dependence and integration among E&SE Asian economies is a result of organisation within the region to produce goods and services to fulfil the growing extra-regional demand and Chinese domestic demand.

Final destination of intermediate exports by final demand region, 2015



Source: Estimation based on OECD's Inter-Country Input-Output (ICIO) Database, 2018

Industry perspective

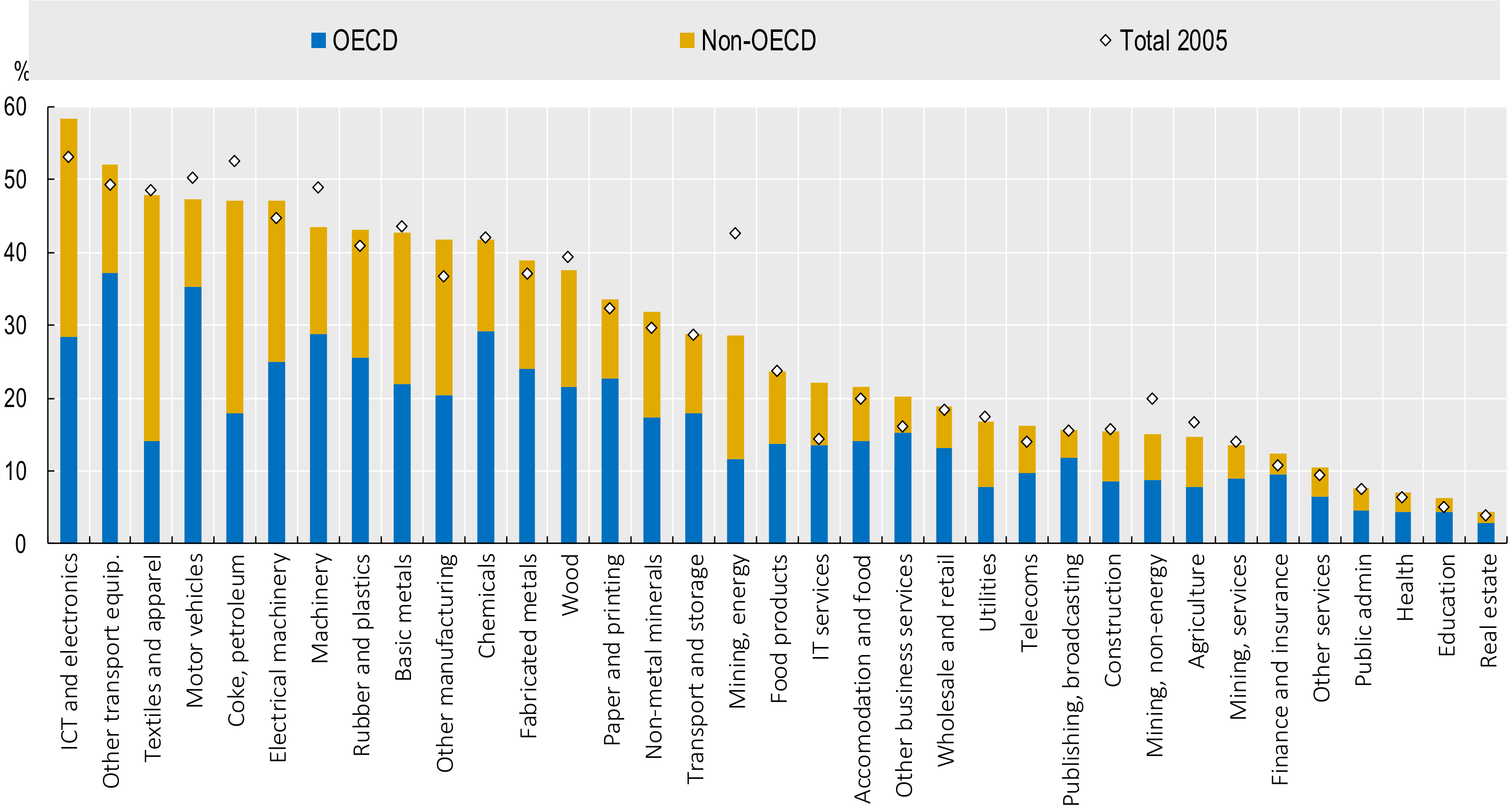
Four highly fragmented sectors are:

- Textiles and apparel;
- Chemicals and pharmaceuticals;
- Computer, electronic and optical products (or “ICT and electronics”); and,
- Motor vehicles

OECD countries are more integrated in production chains of ICT and electronics and motor vehicles

Foreign value added embodied in domestic final demand by sector, global average, 2015

As a percentage of total domestic demand



Source: OECD, Trade in Value Added database, http://oe.cd/tiva, 2018, *Origin of value added in final demand*

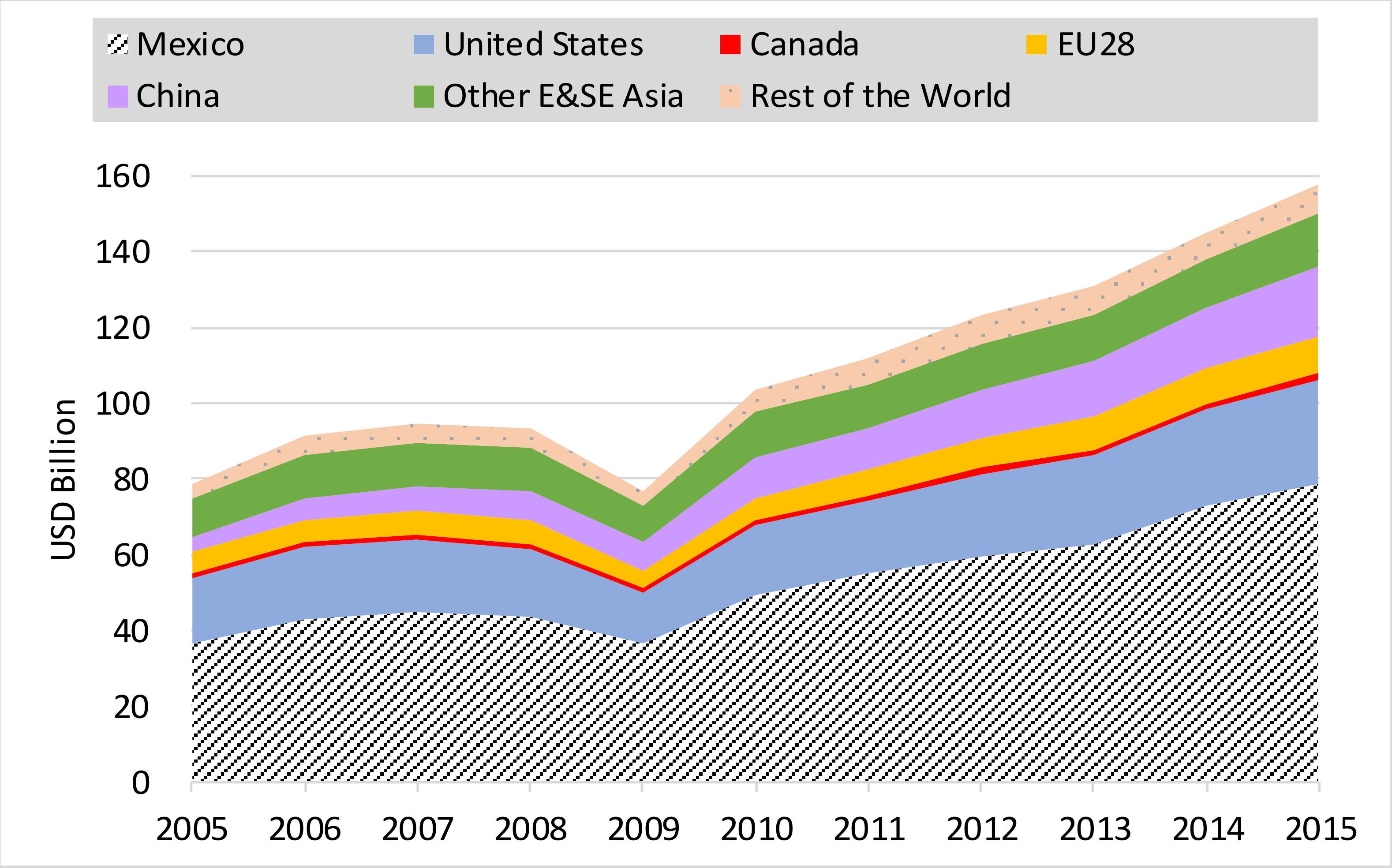
Industry perspective

Origin of value added in US imports of "*electronics, machinery and transport equipment*" from Mexico, 2005-2015:

while US value added content fell (22% to 18%), China's increased from 5% to 12% and Mexico's from 46% to 50%

US imports of "*electronics, machinery and transport equipment*" from Mexico, 2005 to 2015

by country or region of value added origin



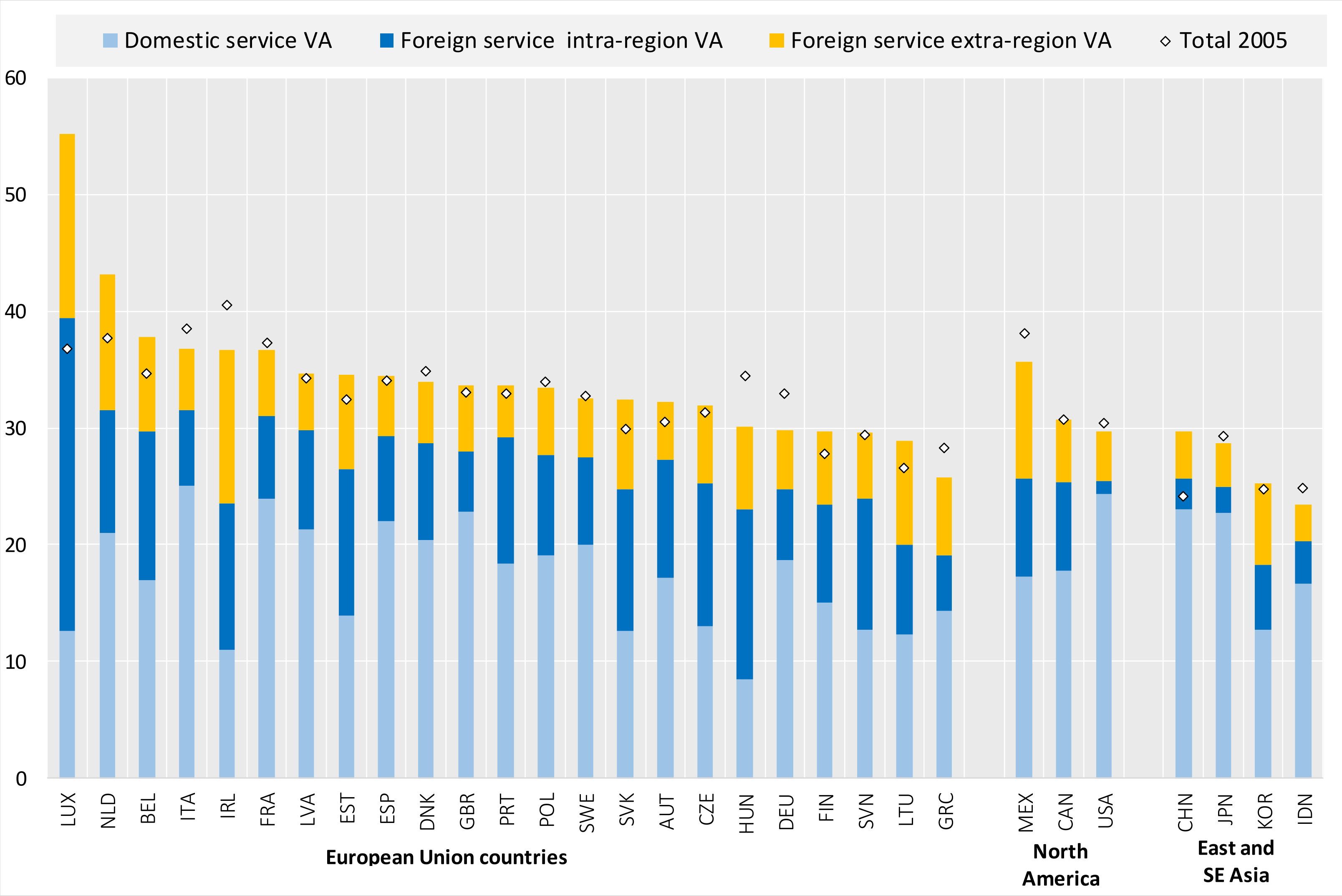
Source: OECD, Trade in Value Added database, http://oe.cd/tiva, 2018, *Origin of value added in gross imports*

Services

- For most OECD and G20 countries, the total service value added content of manufactured exports ranges between 25% and 40%, with many experiencing an increase over the period from 2005 to 2015. There is a wide variation in the mix of domestic and foreign contributions.
- Splitting foreign services content of manufactured exports into intra-regional and extra-regional origin, reveals that in the European Union, on average, about 58% of the foreign value added is intra-regional.

Services value added embodied in manufactured exports, by domestic and foreign origin, 2015

as a percentage of total manufacturing exports



Source: OECD, Trade in Value Added database, http://oe.cd/tiva, 2018, *Origin of value added in gross exports*

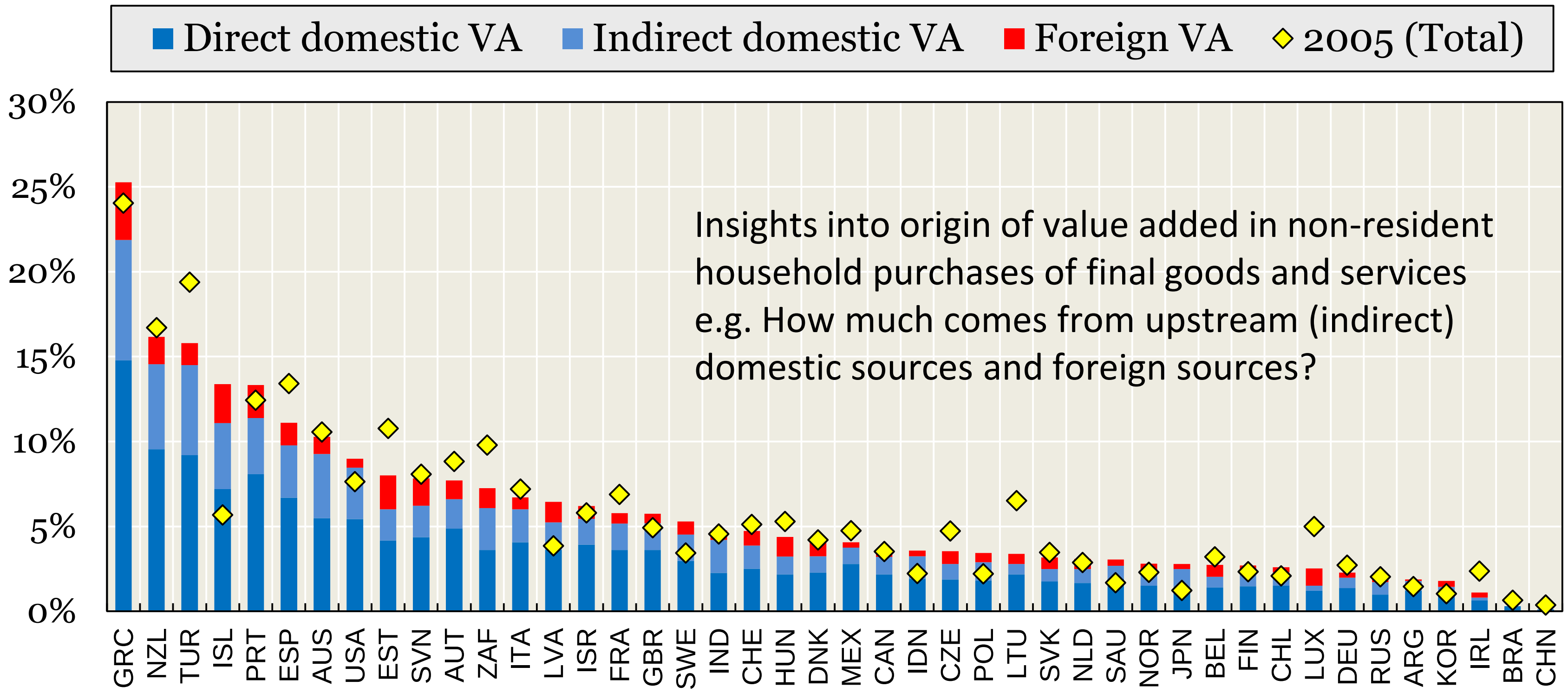
Non-residents' household consumption

- Spending on final goods and services by non-resident households (e.g. accommodation and food services) has a notable indirect impact on the activities of upstream suppliers. On average, indirect domestic value added content accounted for about a third of spending by non-resident households in 2015

Non-resident household expenditure and tourism

In OECD ICIO tables: cross-border trade and non-resident household expenditure are separated → insights into international tourism and GVCs

Contribution of non-resident household expenditure to total exports, 2015, %



Relative to GDP:

Greece and Iceland > 5%

Chile, Finland, Japan and Korea < 0.75%

Canada and USA ≈ 1%

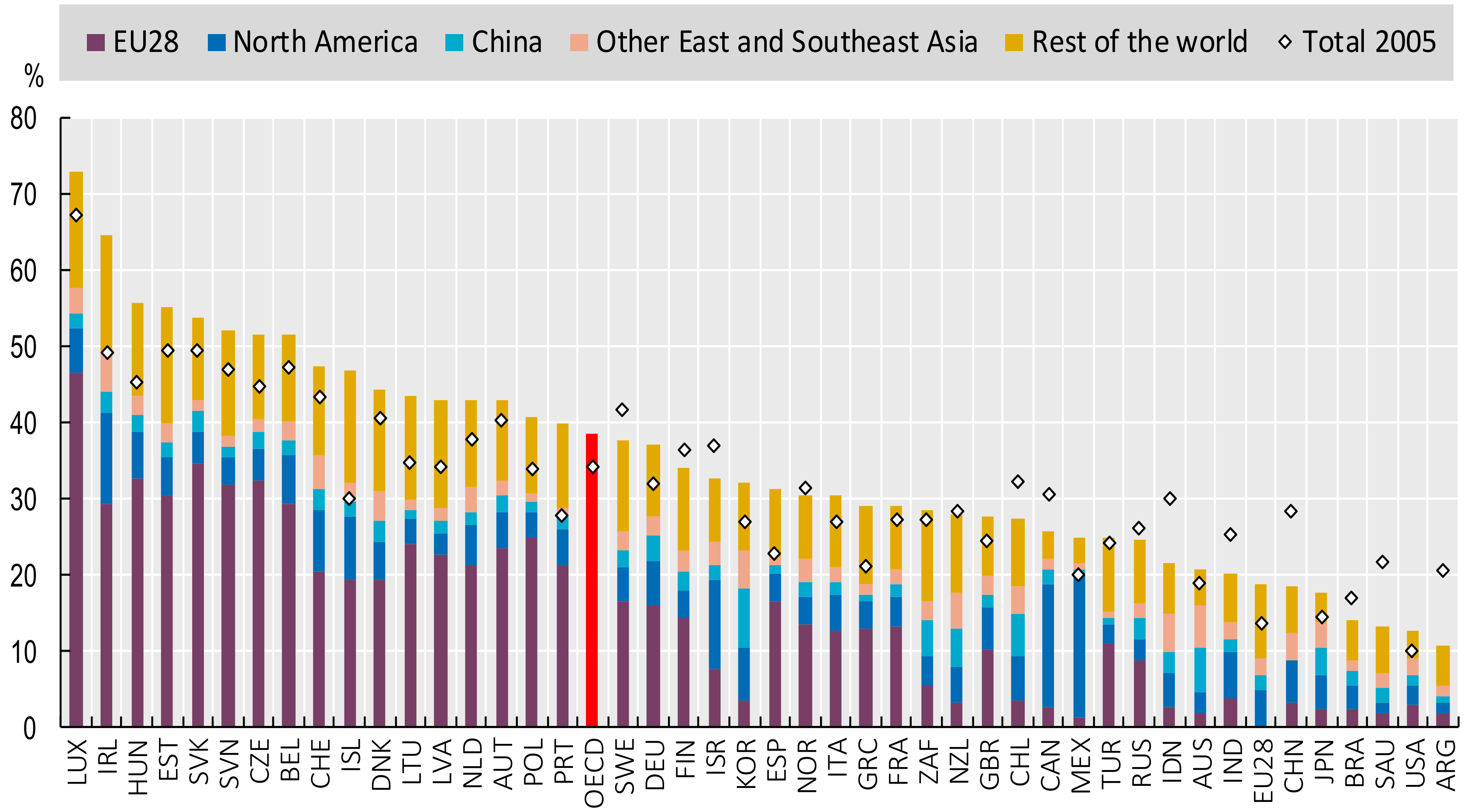
OECD Tourism working paper: "*Providing new OECD evidence on tourism trade in value added*" (2019)

Employment

- Using the OECD ICIO tables, it is possible to estimate employment and labour compensation *sustained by foreign final demand*, disaggregated by region of demand
- On average in OECD countries, there was an increase in business sector employment sustained by foreign final demand between 2005 and 2015
- There are some important variations by country with Chile and China reducing their external dependence while for most European Union (EU28) countries and the United States, the dependence increased, although not dramatically (1-3 percentage points in most cases)

Employment in the business sector sustained by foreign demand, by region of demand, 2015

as a percentage of total business sector employment

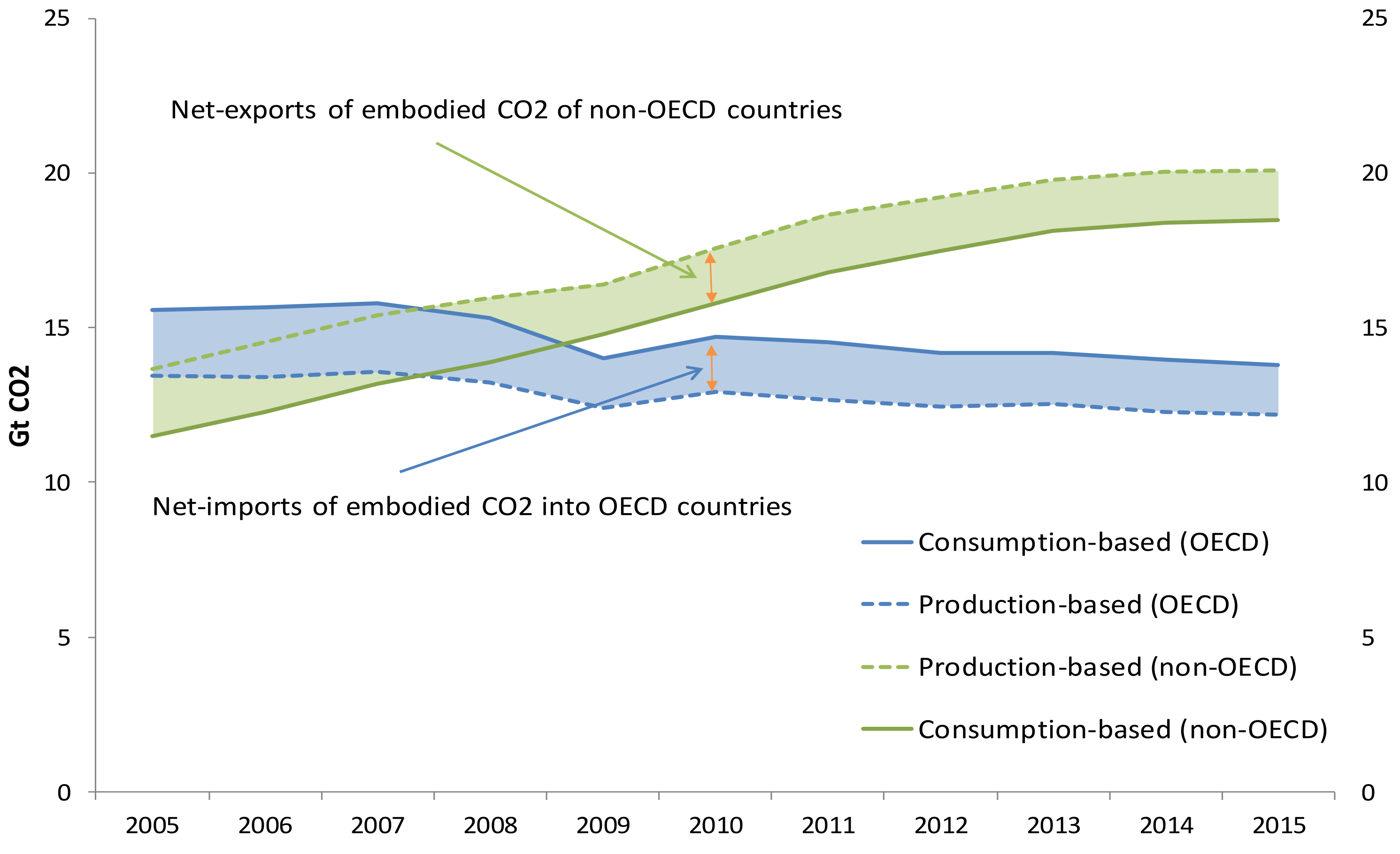


Source: OECD, Trade in Employment database, http://oe.cd/io-emp, 2019

CO_2 emissions

- The OECD ICIO tables can also be used to provide insights into environmental impacts of global production networks; e.g. going beyond the origin of CO2 emissions to estimate emissions embodied in final demand
- The difference between production-based and demand-based carbon emissions is highlighted by comparing the OECD and non-OECD groups.
- In total, the OECD is a net-importer of embodied carbon while non-OECD economies, as a whole, are net-exporters. Net-imports by the OECD countries have gradually been falling since 2005.

CO2 emissions from fuel combustion (OECD and non-OECD countries), demand-based and production-based

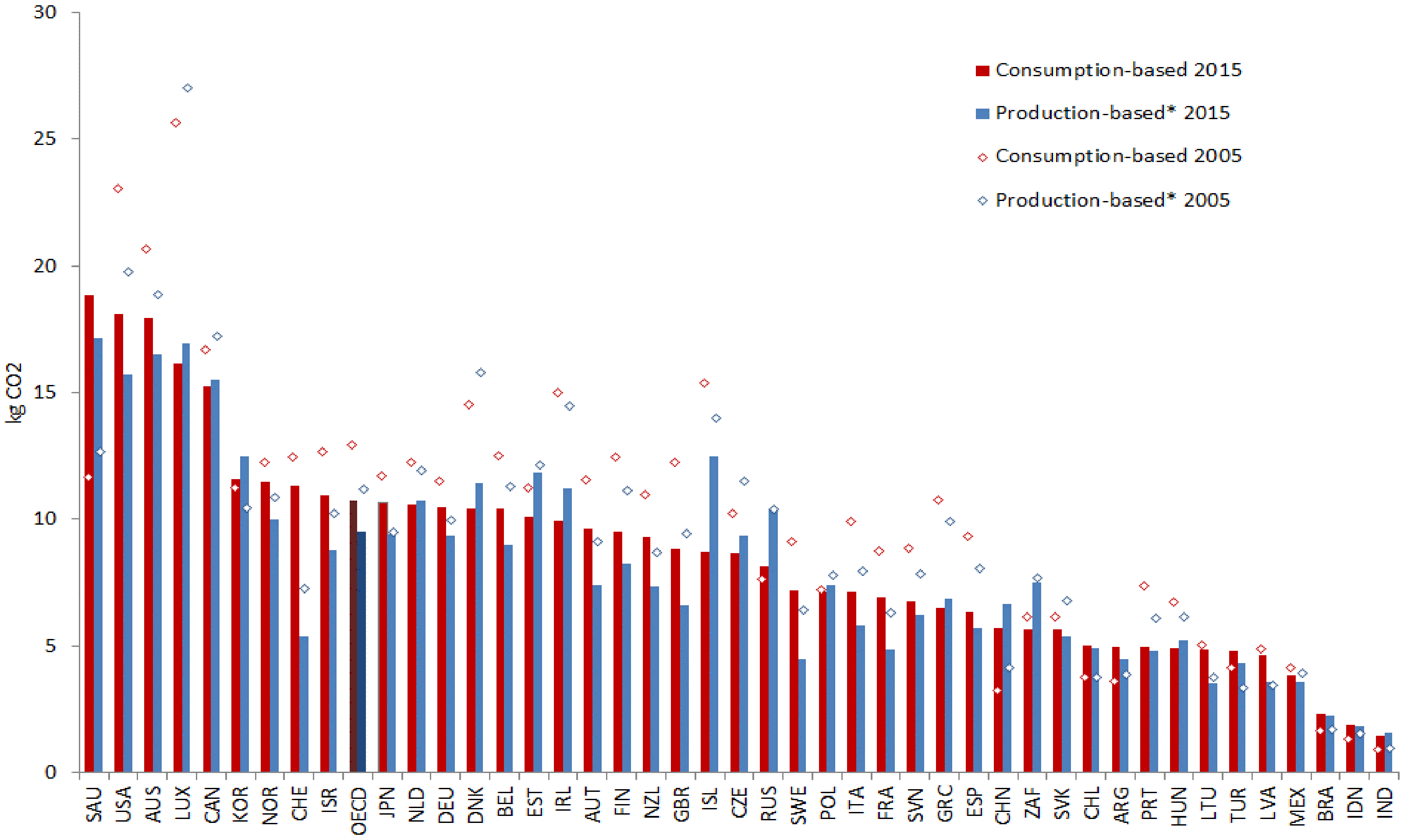


Source: Estimation based on OECD's Inter-Country Input-Output (ICIO) Database (2018) and IEA (2018)

CO_2 emissions

- Not all OECD countries are net-importers of carbon and similarly, not all non-OECD countries are net-exporters.
- Among OECD and G20 countries, the average of the three countries with highest per capita demand-based emissions (Australia, Saudi Arabia and United States, 18.3 tonnes CO2) is nearly ten times higher than that of the three countries with lowest per capita emissions (Brazil, Indonesia and India, 1.9)

Per capita CO_2 emissions from fuel combustion demand-based and production-based



Source: Estimation based on OECD's Inter-Country Input-Output (ICIO) Database (2018), IEA (2018), and UN (2017)

CO_2 emissions

- Developed nations: a) are emitting less: b) have high intensity of emissions per-capita; and c) are net importers of emissions.
- Developing nations: a) are emitting more; b) have low intensity of emissions per-capita; and c) are net-exporters of emissions.
- Challenge 1: Better quality of life in developing countries with less emissions.
- Challenge 2: Political willingness of the nations to effectively engage in the decarbonisation process, as Nordhaus (2015) pointed out, when he introduces the notion of "Climate Clubs".

World production and trade

- Evidence of recent falls in the foreign value added (FVA) content of exports in many economies
- Regional integration remains strong. Especially in East and Southeast Asia– where there is significant growth in intra-regional flows (a large share of production being directed to exports ending up to meet Chinese and extra-regional demand)
- Using ICIO, it is possible to reveal the importance of international trade (cross-border and non-resident purchases) for the generation of value added and employment in non-exporting service industries
- OECD’s ICIO and TiVA infrastructure has proved to be an important tool for revealing new insights into the role of the international trade and GVCs as a source of growth and development for the world economies

FINAL COMMENTS

BETTER POLICIES FOR BETTER LIVES

OECD’s ICIO and Indicators

- The OECD estimation of a time series of ICIO tables and related indicators - TiVA, TECO2, TiM, etc. – provide an important source of information for academics, researchers and policy makers.
- These databases are regularly updated and freely available in the internet.
- It is a continuous work which aims not only on the update of the information, but also on bringing novelties in terms of indicators and methodological estimation.

ICIO tables and TiVA indicators – next release

- Estimates up to 2018 + earlier years (1995 to 2000)
- Expected release: Q4 2020 *(other indicator sets thereafter)*
- 2020 and beyond
  - More countries (*subject to sufficient coverage and quality of national statistics and resources*) i.e. Africa, South and central Asia and, Central and South America
  - Improved metadata and documentation + new online visualisation tools to help users.
  - New ICIO extensions and indicator collections

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THANK YOU

joaquim.guilhoto@oecd.org

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