



OECD ICIO

GLOBAL INTER-COUNTRY INPUT-OUTPUT TABLES

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Agenda

- Introduction
- ICIO Estimation
 - Overview
 - Data requirement
- OECD indicators based on ICIO
 - TiVA - TECO_2 – TiM
- Release 2021
 - Launch 17/11/2021
- Concluding remarks



ICIO ESTIMATION & STRUCTURE



A brief history of Input-Output databases at OECD

- From harmonized national Input-Output tables to global ICIO tables

OECD

Main new applications

1990s	<ul style="list-style-type: none">Harmonized national IOTs and capital matrices10 countries	Technology diffusion (embodied R&D) CO ₂ embodied in trade
2000s	<ul style="list-style-type: none">Domestic and import tablesIOT industry x industry (SNA 1993 / ISIC Rev.3)	CO ₂ embodied in trade, Vertical specialization, Jobs in foreign demand
2013 - 2017	<ul style="list-style-type: none">ICIO (SNA 1993 / ISIC Rev.3)Time series ICIOs	Trade in Value Added (TiVA) indicators Trade in Employment, Carbon footprints
2018	<ul style="list-style-type: none">ICIO (SNA 2008 / ISIC Rev.4)64 countries – 36 industries	Projection models Multi-National Enterprises (MNE) activities in trade
From 2021	<ul style="list-style-type: none">ICIO (SNA 2008 / ISIC Rev.4)67 countries – 45 industries	Tourism indicators Energy indicators

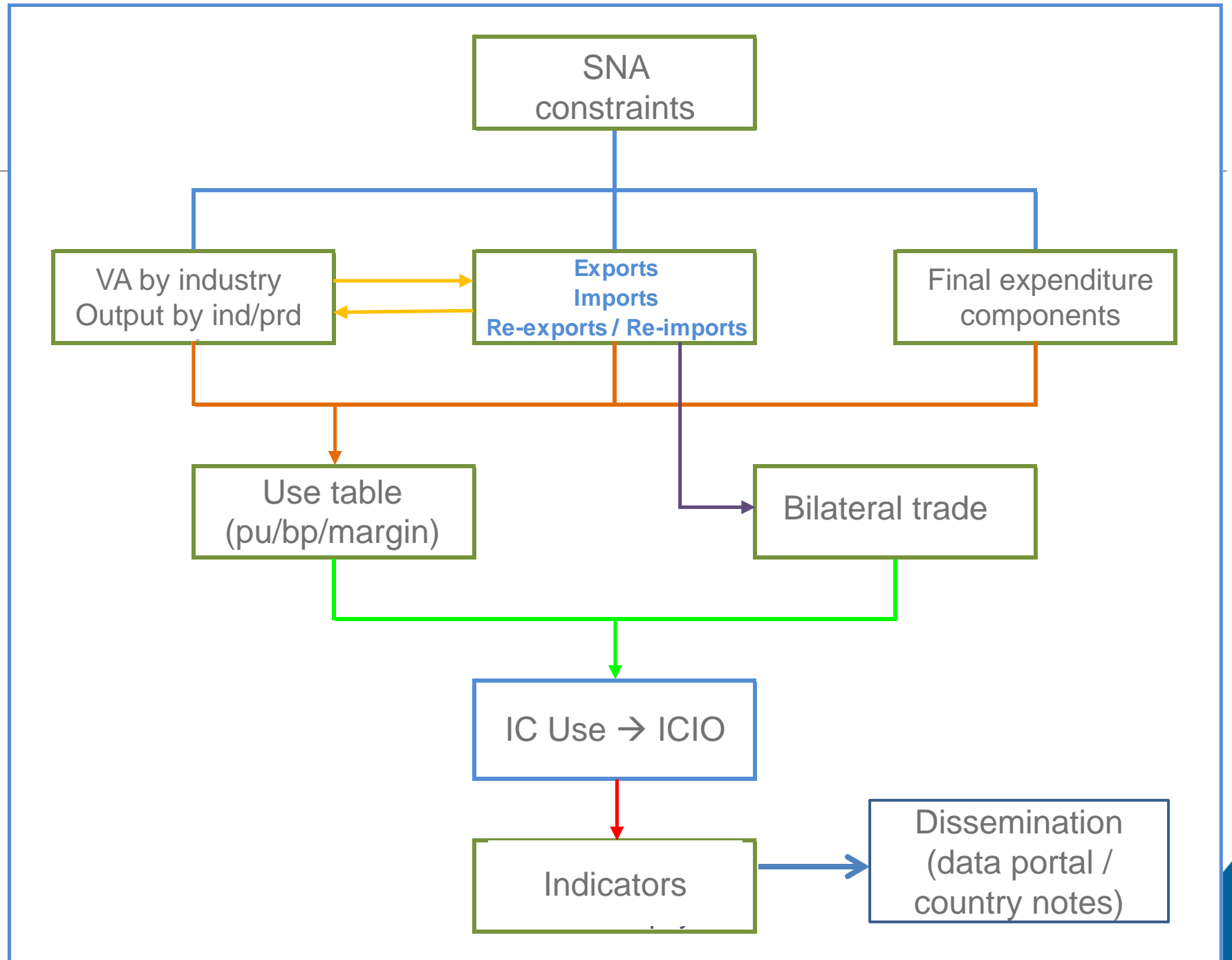


Characteristics of the OECD ICIO model

- Institutional, long-term project
- Underlying official Supply, Use and I-O tables
- Benchmarked to National Accounts (exports, imports and value-added) and Balance of Payments
- Re-imports / Re-exports adjustment
- Rest of the World (closed model)
- Explicit linkage between goods and distribution
- Direct purchases expenditures (tourism & education)
- Firm heterogeneity within manufacturing industry (China and Mexico)



Development Flow of ICIO





Characteristics of main data sources

Features

Caveats

National accounts

- 200+ countries
- Harmonised across countries

- Mixed SNA System(68,93,08), price valuation (bp/pr), calendar v. fiscal years, Missing detail (p61, p34, i.e., missing exports and imports of goods v. services split and non-residents expenditure)

Merchandise trade

- Timely, high frequency, 160+ countries
- very detailed product-level, Bilateral

- Confidentiality, Asymmetries in reported bilateral trade flows, second-hand goods, cif or fob? Re-imports, re-exports n/a, different practices (origin, consignment, final destination)

Balance of Payments

- 200+ countries
- Very detailed services, processing trade

- No details for goods, Few countries report detailed bilateral trade in services flows

National SUTs/ IOTs

- Detailed product-by-industry relationship

- Few annual tables and historical updates, large differences in sectoral detail (industry/product), less timely, 80+ countries

Labour Force Surveys

- Employment by characteristics (age, gender, occupation, education)

- 100+ countries, detailed characteristics not reported by many countries

Global Inter-Country IO (ICIO)

- Symmetric trade flows
- Harmonised in basic prices

- Only 25 to 70 sectors, 40 to 70 countries



Development flow of ICIO

1. Collection of data sources (National Accounts, national IOTs / SUTs, trade)
2. SNA Main aggregates
 - ✓ Final demand expenditure categories
3. Estimation of harmonised constraints
 - ✓ Output, value added by industry
 - ✓ exports and imports by product (partner world)
4. Estimation of harmonized SUTs (filling gaps)
 - ✓ Domestic and import tables
5. Bilateral trade data in goods and services
6. Domestic Input-Output (IO) flows (symmetric industry-by-industry)
7. International use table (product-by-industry)
8. Inter-Country Input-Output (industry-by-industry)



Ideal SUTs and IOTs data sources

Use table

- Intermediates at both purchasers' prices and basic prices
- Value added and output at basic prices
- Total, domestic and import tables
- Household consumption by product
 - Domestic territory by residents
 - Domestic territory by non-residents
 - DP abroad by residents
- Exports by product
 - Domestic exports and re-exports
 - Consumption by non-residents in domestic territory
 - Cif/fob adjustments

- **Supply table**
 - Output at basic prices
 - Valuation columns : taxes, subsidies, import duty, wholesale and retail, transport margin by mode
 - Retained imports and re-exports
- **Symmetric Input-Output table**
 - Industry-by-industry / product-by-product
 - Total, domestic and import tables
 - Basic prices
- **Sufficient industry details & Annual data & 2008 SNA/BPM6 format**
- **Ideally time-series of SUTs (or IOTs)**
 - Hardly met!



ICIIO working structure

- 75 industries
- 75 commodities
- 198 economies (197 countries + rest of the world)



ICIO structure

3-country, 2-industry example

ICIO at basic prices (industry-by-industry)		Intermediate demand						Final consumption (P3) and Gross capital formation (P5)			Direct purchases abroad by residents (P33)			Output at bp	
		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								
Country A	Industry 1	Orange	Orange												
Country A	Industry 2	Orange	Orange				Green								
Country B	Industry 1			Orange	Orange			Green			Pink	Pink			
Country B	Industry 2														
Country C	Industry 1					Orange									
Country C	Industry 2					Orange									
Net taxes on products paid by	Country A	Yellow	Yellow				Yellow								
	Country B			Yellow	Yellow			Yellow							
	Country C					Yellow	Yellow								
Value added at bp (B1G)		Red	Red	Red	Red	Red									
Output at bp (P1)		Blue	Blue	Blue	Blue	Blue									

Global GDP (B1G_P)	= VA + NTZ + NTF
Global GDP (B1G_E)	= Y + DP + NTF

(i) SNA codes

	intermediate	final expenditure	net taxes on products	direct purchases
KEY				
Domestic	Orange	Green	Yellow	
Inter-country	Orange	Green	Yellow	Pink

- The goal:
- A globally balanced view of inter-country inter-industry flows of intermediate and final goods and services
- A table for each year to track evolution of global production networks over time
- To understand the nature, and impact, of regional and global value chains (GVCs) e.g. TiVA indicators



INDICATORS



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!

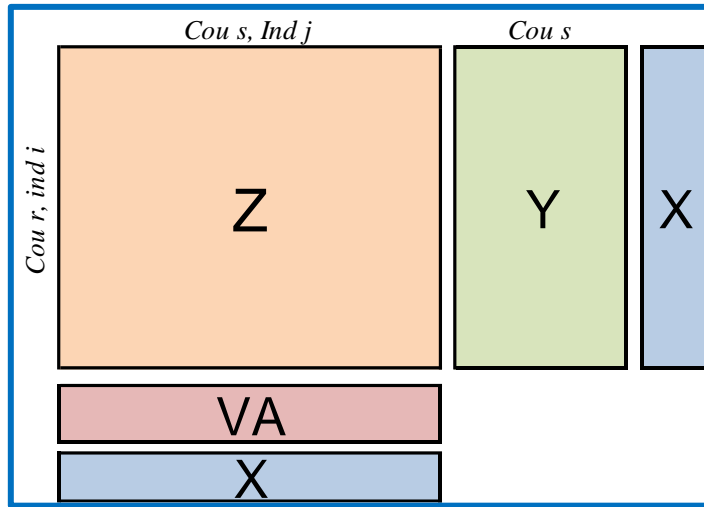


TiVA Indicators

- Trade in value added (TiVA) is a statistical approach that estimates the origin (by country and industry) of value added in the exports of goods and services and, the origin of value added in final demand for goods and services
- The TiVA approach leads to a better understanding of the economic interconnections among countries by accounting for global production networks and their Global Value Chains (GVCs) and, the relations that international trade has with the generation and consumption of value added by countries.
- TiVA thus refers to a family of indicators generated from Inter-Country Input-Output (ICIO) tables. TiVA does not refer to a single indicator. In the OECD TIVA database, indicators are assigned codes and labels to reflect their definition.
- Similar structure applies to $TECO_2$ and TiM indicators



Basic equation



$$VA = Y$$

$X = AX + Y$

where A is the input coefficient matrix:

$$a_{ij}^{rs} = Z_{ij}^{rs} / x_j^s$$

Leontief inverse *Output and Final Demand*

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

$$X = BY$$

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 .

$$Va_y = vBY$$

$$Va_e = vBe$$

Where Y is final demand, e are exports and v is the VA/output ratios

$$v_j^s = va_j^s / x_j^s$$

- Note: Please note that this is a simplified version of ICIO and:
- Value added (W) includes taxes less subsidies on intermediate products;
 - Final demand includes direct purchases abroad by residents;



TiVA indicators

- TiVA 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



TECO₂ – Trade in embodied CO₂

TiM – Trade in Employment

- TECO₂ (Trade in embodied CO₂) and TiM (Trade in Employment) indicators are estimated according to the methodology presented for the estimation of the TiVA indicators.
- They make use of CO₂ 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>)



ICIO 2021 RELEASE



ICIO 2021 Launch

- **Measuring interconnected economies**
 - Launch of the 2021 OECD ICIO and TiVA databases
- **Virtual event on 17 November, 13h00 (Paris-CET)**
 - The agenda and registration details can be found in:
<https://www.oecd.org/industry/ind/measuring-interconnected-economies-2021.htm>





ICIO 21 Main Features

- Wide coverage of the global economy, 67 economies;
- Detail for 45 industries
- Tables covering all years from 1995 to 2018
- Benchmarking to latest official annual National Accounts statistics
- Distinction between cross-border trade and direct purchases by non-residents
- Extensions to account for firm heterogeneity in China and Mexico



ICIO 2021

Countries

N.	Code	Country	N.	Code	Country
1	AUS	Australia	39	ARG	Argentina
2	AUT	Austria	40	BRA	Brazil
3	BEL	Belgium	41	BRN	Brunei Darussalam
4	CAN	Canada	42	BGR	Bulgaria
5	CHL	Chile	43	KHM	Cambodia
6	COL	Colombia	44	CHN	China (People's Republic of)
7	CRI	Costa Rica	45	HRV	Croatia
8	CZE	Czech Republic	46	CYP	Cyprus ²
9	DNK	Denmark	47	IND	India
10	EST	Estonia	48	IDN	Indonesia
11	FIN	Finland	49	HKG	Hong Kong, China
12	FRA	France	50	KAZ	Kazakhstan
13	DEU	Germany	51	LAO	Lao People's Democratic Rep.
14	GRC	Greece	52	MYS	Malaysia
15	HUN	Hungary	53	MLT	Malta
16	ISL	Iceland	54	MAR	Morocco
17	IRL	Ireland	55	MMR	Myanmar
18	ISR	Israel ¹	56	PER	Peru
19	ITA	Italy	57	PHL	Philippines
20	JPN	Japan	58	ROU	Romania
21	KOR	Korea	59	RUS	Russian Federation
22	LVA	Latvia	60	SAU	Saudi Arabia
23	LTU	Lithuania	61	SGP	Singapore
24	LUX	Luxembourg	62	ZAF	South Africa
25	MEX	Mexico	63	TWN	Chinese Taipei
26	NLD	Netherlands	64	THA	Thailand
27	NZL	New Zealand	65	TUN	Tunisia
28	NOR	Norway	66	VNM	Viet Nam
29	POL	Poland	67	ROW	Rest of the World
30	PRT	Portugal			
31	SVK	Slovak Republic			
32	SVN	Slovenia			
33	ESP	Spain			
34	SWE	Sweden			
35	CHE	Switzerland			
36	TUR	Turkey			
37	GBR	United Kingdom			
38	USA	United States			
OECD countries (as of 25 May 2021)					



The OECD ICIO 2021 – Geographical coverage

OECD	All 38 OECD countries
Other G20	Argentina, Brazil, China PR, India, Indonesia, Russian Federation, Saudi Arabia, South Africa
Other EU28	Bulgaria, Croatia, Cyprus, Malta, Romania
Other South Eastern Asia	Brunei Darussalam, Cambodia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, Viet Nam
Other Eastern Asia	Chinese Taipei, Hong Kong China
LAC Countries	Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru
Other	Kazakhstan, Morocco, Tunisia, Rest of the World
Region groups	OECD, Non-OECD, APEC, ASEAN, Eastern Asia, European Union, Euro Area, North America, etc.

- **2021 Edition**
- Published ICIO tables include 66 economies + “Rest of the World” + split of Mexico and China
- The shares* of sum of the 66 economies in the world economy in 2018 are:
 - GDP: 93%
 - Exports: 92%
 - Imports: 90%
- * National Accounts, current prices



Heterogeneity for Mexico and China

- In addition to the country coverage, ICIO considers heterogeneity of production in Mexico and China by splitting their IO tables into 2 different structures of production:
 - Processing industries
 - Non-processing industries



The OECD ICIO 2021 - Industry coverage

N.	Code	Industry	ISIC Rev.4
1	D01T02	Agriculture, hunting, forestry	01, 02
2	D03	Fishing and aquaculture	03
3	D05T06	Mining and quarrying, energy producing products	05, 06
4	D07T08	Mining and quarrying, non-energy producing products	07, 08
5	D09	Mining support service activities	09
6	D10T12	Food products, beverages and tobacco	10, 11, 12
7	D13T15	Textiles, textile products, leather and footwear	13, 14, 15
8	D16	Wood and products of wood and cork	16
9	D17T18	Paper products and printing	17, 18
10	D19	Coke and refined petroleum products	19
11	D20	Chemical and chemical products	20
12	D21	Pharmaceuticals, medicinal chemical and botanical products	21
13	D22	Rubber and plastics products	22
14	D23	Other non-metallic mineral products	23
15	D24	Basic metals	24
16	D25	Fabricated metal products	25
17	D26	Computer, electronic and optical equipment	26
18	D27	Electrical equipment	27
19	D28	Machinery and equipment, nec	28
20	D29	Motor vehicles, trailers and semi-trailers	29
21	D30	Other transport equipment	30
22	D31T33	Manufacturing nec; repair and installation of machinery and equipment	31, 32, 33

N.	Code	Industry	ISIC Rev.4
23	D35	Electricity, gas, steam and air conditioning supply	35
24	D36T39	Water supply; sewerage, waste management and remediation activities	36, 37, 38, 39
25	D41T43	Construction	41, 42, 43
26	D45T47	Wholesale and retail trade; repair of motor vehicles	45, 46, 47
27	D49	Land transport and transport via pipelines	49
28	D50	Water transport	50
29	D51	Air transport	51
30	D52	Warehousing and support activities for transportation	52
31	D53	Postal and courier activities	53
32	D55T56	Accommodation and food service activities	55, 56
33	D58T60	Publishing, audiovisual and broadcasting activities	58, 59, 60
34	D61	Telecommunications	61
35	D62T63	IT and other information services	62, 63
36	D64T66	Financial and insurance activities	64, 65, 66
37	D68	Real estate activities	68
38	D69T75	Professional, scientific and technical activities	69 to 75
39	D77T82	Administrative and support services	77 to 82
40	D84	Public administration and defence; compulsory social security	84
41	D85	Education	85
42	D86T88	Human health and social work activities	86, 87, 88
43	D90T93	Arts, entertainment and recreation	90, 91, 92, 93
44	D94T96	Other service activities	94, 95, 96
45	D97T98	Activities of households as employers; undifferentiated goods- and service	97, 98

- **2021 Edition**
- **45 industries based on ISIC Rev.4**
- **17 manufacturing sectors**
- **20 services sectors**



TiVA 2021 industry aggregates

N.	Code	Industry Aggregate	ISIC Rev 4 Code
1	D01T03	Agriculture, hunting, forestry and fishing	01, 02, 03
2	D05T09	Mining and quarrying	05 to 09
3	D10T33	Total Manufacturing	10 to 33
4	D16T18	Wood and paper products and printing	16 to 18
5	D19T23	Chemicals and non-metallic mineral products	19 to 23
6	D20T21	Chemicals and pharmaceutical products	20, 21
7	D24T25	Basic metals and fabricated metal products	24, 25
8	D26T27	Computer, electronic and electrical equipment	26, 27
9	D29T30	Transport equipment	29, 30
10	D35T39	Electricity, gas, water supply, sewerage, waste and remediation services	35 to 39
11	D45T82	Total Business Sector Services	45 to 82
12	D45T56	Distributive trade, transport, accommodation and food services	45 to 56
13	D49T53	Transportation and storage	49 to 53
14	D58T63	Information and communication	58 to 63
15	D69T82	Other business sector services	69 to 82
16	D84T98	Public admin, education, health and other personal services	84 to 98
17	D84T88	Public admin, defence; education and health	84 to 88
18	D90T98	Other social and personal services	90 to 98
19	D90T96	Other community, social and personal services	90 to 96
20	D05T39	Industry (Mining, Manufactures and Utilities)	05 to 39
21	D45T98	Total Services (excl. construction)	45 to 98
22	D58T82	Information, Finance, Real Estate and other business services	58 to 82
23	D41T98	Total Services (incl. construction)	41 to 98
24	DINFO	Information industries	26, 58 to 63
25	DTOTAL	TOTAL	All industries



OECD TiVA related databases

- ICIO
 - Inter-Country Input-Output Tables (<http://oe.cd/icio>)
- TiVA
 - Trade in Value Added (<http://oe.cd/tiva>)
- TECO₂
 - CO₂ Emissions Embodied in International Trade (<http://oe.cd/io-co2>)
- TiM
 - Trade in Employment (<http://oe.cd/io-emp>)



CONCLUDING REMARKS



Concluding Remarks

- Only 7 LAC countries are currently included in published ICIO/TiVA databases and we would like to add more. Hoping for further cooperation with ECLAC team working on LAC IOTs to achieve this in the longer term.
- Current project with WTO and UNECA to add more African countries
 - Cameroon, Ivory Coast, Nigeria, Senegal, Egypt



Concluding Remarks

- 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.



**Questions or
comments?**





THANK YOU!

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More information at

<http://oe.cd/icio>

<http://oe.cd/tiva>

<http://oe.cd/io-co2>

<http://oe.cd/io-emp>



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ANNEX



The expanding ICIO

Published editions of TiVA indicators

Release date	# countries	#industries	years	underlying standards
January 2013	40	18	2005, 2008, 2009	SNA93, ISIC Rev.3
May 2013	56	18	1995, 2000, 2005, 2008, 2009	SNA93, ISIC Rev.3
October 2015	61	34	1995, 2000, 2005, 2008-2011	SNA93, ISIC Rev.3
December 2016	63	34	1995-2011	SNA93, ISIC Rev.3
December 2018	64	36	2005-2015*	SNA08, ISIC Rev.4
forthcoming 2021	66	45	1995-2018	SNA08, ISIC Rev.4 (2015 SNA benchmark)

Size of published ICIO tables

Number of cells per year (1)	#years	Number of cells for all years
522,720	3	1,568,160
1,022,112	5	5,110,560
4,313,920	7	30,197,440
4,601,016	17	78,217,272
5,322,240	11	58,544,640
8,838,720	24	212,129,280

} x 3.6

Notes: Number of TiVA indicators and number of TiVA cubes on OECD.STAT have increased over time
 #countries excludes "Rest of World" and various regional aggregates (e.g. EU, N. America, G20, ASEAN)
 #industries show unique industries only, excludes aggregates in an industry hierarchy
 * including "nowcasts" to 2016 for selected indicators

The underlying 'internal' harmonised SUTs and ICIO tables have 198 countries and 75 industries / products

internal version of ICIO
 220,611,600 24 5,294,678,400

(1) roughly = [(#cou x #ind) x (#cou x #ind)] + [(#cou x #ind) x 6] i.e. [intermediate matrix]+ [final demand columns]

excludes country = "Rest of the World", and the fact that there are split tables for China and Mexico from the 2015 edition of ICIO onwards



New industries to be published in TiVA database

TiVA 2021			TiVA 2018	
	ISIC4 Code	Section	ISIC4 Code	Description
Agriculture, hunting, forestry	D01T02	A	D01T03	Agriculture, hunting, forestry and fishing
Fishing	D03			
Chemical and chemical products	D20	CE	D20T21	Chemicals and pharmaceutical products
Pharmaceuticals	D21	CF		
Electricity, gas, steam and air conditioning supply	D35	D	D35T39	Electricity, gas, water supply, sewerage, waste and remediation services
Water supply; sewerage, waste management and remediation activities	D36T39	E		
Land transport and transport via pipelines	D49	H	D49T53	Transportation and storage
Water transport	D50			
Air transport	D51			
Warehousing and support activities for transportation	D52			
Postal and courier activities	D53			
Professional, scientific and technical activities	D69T75	M	D69T82	Other business sector services
Administrative and support services	D77T82	N		
Arts, entertainment and recreation	D90T93	R	D90T96	Arts, entertainment, recreation and other service activities
Other service activities	D94T96	S		

e.g. STI Ocean satellite account project

Monitor international flows of pharmaceuticals in GVCs

Split energy supply from other utilities: improved indicators related to embodied GHG emissions

Better links to information on transport margins. Also COVID impact analysis

“Other business services” covers many activities. Split to ISIC sections M and N.

Split ISIC sections R and S. COVID impact analysis

TiVA 2018 industry aggregates maintained in published database for continuity