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FIGARO methodology

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FIGARO methodology

The methodology described in the statistical working paper was used to produce the experimental FIGARO tables published in 2018 for the reference year 2010.

With the May 2021 release of the FIGARO tables, some improvements have been made in the methodology.

They are described in the following paragraphs. However, the methodology is not fully closed yet. Further improvements are being made and will be discussed at international level under the OECD Regional-Global TiVA initiative.

Balanced bilateral trade data

Balanced bilateral trade data rarely align with the total exports and imports (listed by product) of national supply and use tables (SUTs). These differences are due to: (i) the balancing process of trade asymmetries; (ii) the alignment of trade statistics principles to National Accounts principles; (iii) conversion from trade statistics categories to CPA categories of goods and services; (iv) and the misclassification of products. We have adopted a new method to resolve discrepancies due to products possibly being misclassified. This method is transparent for users seeking to understand how national data is adjusted to fit into inter-country input-output (ICIO) tables. A detailed description of the methodology can be found in the FIGARO statistical working paper. Ultimately, we have implemented GRAS-variants (3D) to remove all remaining discrepancies, bearing in mind bilateral trade constraints (country-partner only) and otherwise, across all the elements of the statistical variant of the inter-country use table.

Fully-fledged FIGARO tables

Given the potential use of the FIGARO tables for global economic analyses, we have constructed fully-fledged FIGARO tables with 27 EU Member States, the United States (US) and the United Kingdom. To complete the remaining non-EU countries, we have used the underlying data from the latest OECD TiVA database for Australia, Argentina, Brazil, Canada, China, Switzerland, India, Indonesia, Japan, Korea, Mexico, Norway, Russia, Saudi Arabia, South Africa, Turkey and a rest-of-the-world (RoW) region. This makes 45 countries, including the G20. To incorporate the OECD data into the FIGARO tables, we designed a three-stage process that can be summarised as follows:

a) Split the column of exports to non-EU countries (excluding UK and US) across all trading partners using the same (row) shares as in the OECD data.
b) Split the row of imports from non-EU countries (excluding UK and US) across all countries of origin using the same (column) shares as in the OECD data.

For the EU, this approach guarantees identical results as long as extra-EU imports and extra-EU exports between the FIGARO tables and the OECD tables coincide.

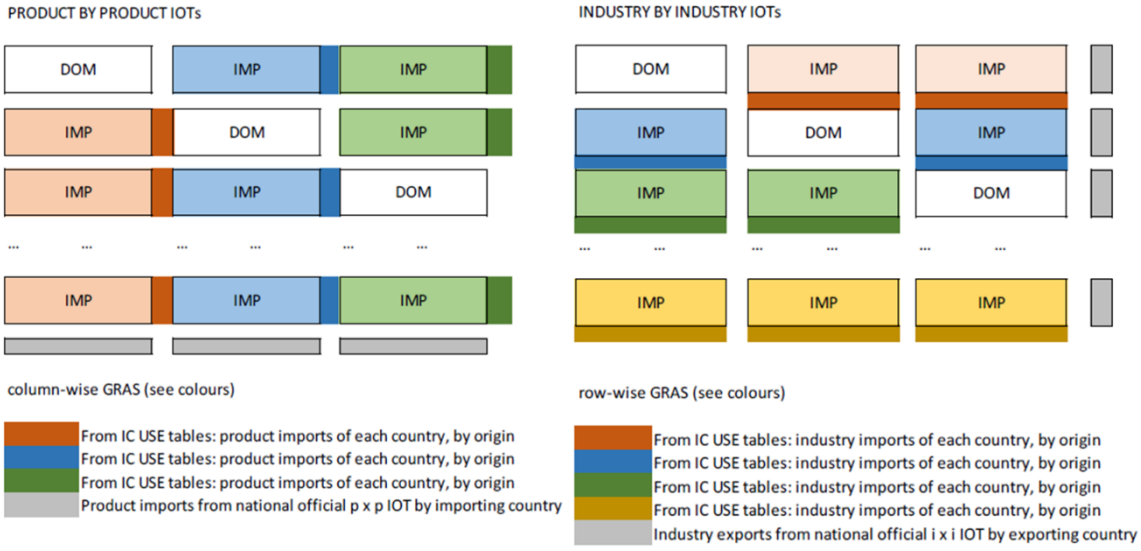
c) In order to balance the remainder, we used GRAS-variants with specific constraints:

- Total product and industry outputs of the non-EU countries and RoW (excl. UK and US) must match those of the OECD data.
- Totals of the final demand components of the non-EU countries and RoW (excl. UK and US) must match those of OECD data.
- Gross value added by industries and taxes less subsidies on products by users must match those of the OECD for non-EU countries and RoW (excl. UK and US).
- Distribution of trade flows between intermediate and final exports by product must match those of the OECD data for non-EU countries and RoW (excl. UK and US).
- Domestic use and supply matrices of the non-EU countries and RoW (excl. UK and US) must match those of the OECD data.
- If needed, we use the RoW part of the FIGARO tables as balancing item wherever convergence problems may arise.

National input-output tables in FIGARO tables

We developed a methodology to fit national input-output tables (IOTs) into the inter-country IOTs produced based on the industry technology assumption (model B – product by product) or the fixed product sales structure assumption (model D – industry by industry).

Figure 1: Fitting national IOTs



For product-by-product IOTs, we run GRAS for each trading partner, setting constraints from the FIGARO inter-country use table (rows) and the national IOTs product by product (columns). The domestic parts replace those of model B for product-by-product IOTs. Oppositely, for industry-by-industry IOTs, we run GRAS for each exporter country where row constraints are given by the national industry-by-industry IOTs (if available) of the exporter country and the column constraints correspond to the FIGARO inter-country use table (industry imports by origin). The domestic parts replace those of model D for industry-by-industry IOTs[1].

Benchmark to latest main macroeconomic aggregates

We have developed a benchmark process for the national supply, use and input-output tables (SUIOTs) on the latest main macroeconomic aggregates (usually from January of the dissemination year), wherever these are available. Moreover, we have developed a methodology for nowcasting in order to produce the necessary national SUIOTs to nowcast the FIGARO tables. From the ESA2010 transmission programme, national data are available 3 years after the end of the reference period. Therefore, in December 2020, national data up to 2017 (as long as countries are compliant with the data transmission deadlines) are available. Therefore, we nowcast data for 2018 and 2019. For more details, see below.

Quality validation of the FIGARO tables

We have developed a series of quality validation tests, looking into: (i) the changes made to the raw data in each stage of the production process; (ii) the consistency of the basic accounting identities; (iii) the assessment of time consistencies of technical coefficients, including import intensities; (iv) the assessment of discrepancies between national accounts trade data and trade statistics; and (v) the compilation of the non-EU part (excluding UK and US) using OECD data.

We have also implemented, in liaison with the affected EU countries, a process to avoid disclosing national confidential data (both in the domestic production and value added components). The process takes an average structure of the available EU Member States to replace the confidential data.

[1] Please note that for the May 2021 release, national industry-by-industry IOTs were not integrated in the FIGARO tables.

Annex: Processes used to nowcast and benchmark national supply, use and input-output tables

To benchmark the national SUTs, we need the gross value added (B1G) and the total output (P1) by industries (see Figures 1 and 2).

Figure 1 shows supply and use tables incorporated into one single framework to be used for computation. The symbols in Figures 1 and 2 are notations that can be found in the Eurostat SUIOT manual and the UNSD Handbook on SUTs.

Due to the unavailability of outputs by product (q), the SUT framework is transformed[2] from Figure 1 into Figure 2 to run the SUT-RAS[3] method for updating supply and use tables. Figure 2 then underlines the required data needed to benchmark the national tables to the latest main aggregates data:

- industry outputs (x);
- total imports (m);
- gross value added by industry (gva);
- final use at purchasers prices (y'pp);
- Total taxes less subsidies on products (tls).

Figure 1: Integrated input-output framework

	domestic products	imported products	industries	final demand	TOTAL
domestic products			Ud	Yd	q
imported products			Um	Ym	m
industries	V				x
gross value-added B1G			gva'		*total gva*
TLS D21X31			td'	tf'	*total TLS*
Total	q'	m'	x'	y'pp	

Note: Regular lowercase = column vector; italics lowercase = scalar; regular uppercase = matrix; and ' = transposition.

[2] Transformation based on Temursho, Oosterhaven and Cardenete (2020), 'A multi-regional generalized RAS updating technique', Spatial Economic Analysis, DOI: 10.1080/17421772.2020.1825782.

[3] Temurshoev and Timmer (2011), Joint estimation of supply and use tables, Papers in Regional Science, 90 (4), 863–882 and Valderas-Jaramillo, Rueda-Cantuche, Olmedo and Beutel (2019) Projecting supply and use tables: new variants and fair comparisons, Economic Systems Research, 31 (3), pp. 423-444.

Figure 2: Transformed schema for the SUT-RAS method

	industries	imported products	industries	final use	TOTAL
domestic products	-V'		Ud	Yd	0
imported products		-m	Um	Ym	0
TLS D21X31			td'	tf'	*total TLS*
Total	-x'	*-m*	(x - gva)'	y' pp	

Note: Regular lowercase = column vector; italics lowercase = scalar; regular uppercase = matrix; and ' = transposition.

The main macro aggregates are collected from the ESA 2010 transmission programme for the FIGARO countries. Eurostat data is completed with OECD data, taken from the SNA Tables 1, 3, 6 and 7 for the United States.

Once the SUTs are benchmarked to the national accounts data (main aggregates), we then benchmark the input-output tables to the new subtotals coming from the SUTs both for product-by-product input-output tables and industry-by-industry input-output tables. The priors are generally the available national IOTs.

For product-by-product input-output tables (see Figure 3), the final use elements are by definition identical to those of the national use tables, including the corresponding taxes less subsidies on products. The total use of domestically produced products (u1) in the use table serves as the benchmark for the total output by product in the IOT (see Figure 4). Analogously, the total intermediate consumption by products in the use table serves as the rows target for the balancing process of the existing (outdated) product-by-product IOT. We eventually use the GRAS method[4] to benchmark the outdated IOT.

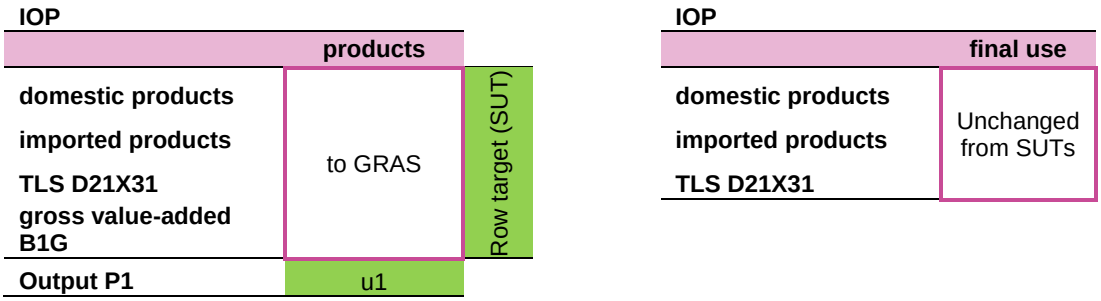
Figure 3: SUT benchmarked

SUT benchmarked

	industries		final use	total use
domestic products	Ud	Row target (SUT)	Yd	u1
imported products	Um		Ym	u2
TLS D21X31	TLS		TLSfd	
gross value-added B1G	B1G			
Output P1	P1			

[4] Günlük-Senesen and Bates (1988), Some experiments with methods of adjusting unbalanced data matrices, Journal of the Royal Statistical Society, Series A, 151, pp. 473–490; Junius and Oosterhaven (2003), The solution of updating or regionalizing a matrix with both positive and negatives entries, Economic Systems Research, 15, pp. 87–96.

Figure 4: IOP benchmarked



For industry-by-industry input-output tables (see Figure 5), the value added components, the taxes less subsidies on products and the total output by industry are by definition identical to those of the national use tables. The total industry output (P1) of domestically produced products in the use table serves as the benchmark for the total use by industry in the IOT (see Figure 6). Analogously, the total intermediate consumption of industries and the totals of the final use components in the use table serve as columns target for the balancing process of the existing (outdated) industry-by-industry IOT. Ultimately, we rescale imports by industry from the existing industry-by-industry IOT to define the new targets in line with the new overall import totals (This last step has not been implemented for the May 2021 release). We eventually use the GRAS method to benchmark the outdated IOT.

Figure 5: SUT benchmarked

SUT benchmarked

	industries	final use	total use
domestic products	Ud	Yd	u1
imported products	Um	Ym	u2
	Column target (SUT)		
TLS D21X31	TLS	TLSfd	
gross value-added B1G	B1G		
Output P1	P1		

Figure 6: IOI benchmarked