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EU INTER-COUNTRY SUPPLY, USE AND INPUT-OUTPUT TABLES (FIGARO PROJECT)

Methodological note

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1. Background

Over the last decade, the scientific community has been working on the construction of several **multi-regional Input-Output (MRIO) databases**. The main objective has varied from environmental applications (e.g. footprints) to socio-economic applications (e.g. global value chains - GVCs). Two outstanding examples are the OECD's TiVA initiative[1], under which annual global Inter-country Input-Output Tables are constructed for the period 1995-2011 and the EU funded project[2] "World Input-Output Database: Constructions and Applications" (WIOD), under which annual current and deflated Inter-country Input-Output Tables were constructed for the same period (and recently updated to 2014). The development of various databases alongside each other has given researchers the opportunity to compare their approaches. Methodologies and their underlying assumptions differ between the databases and so do the results, although in some cases the differences may also come from the different direct input data (e.g. carbon dioxide footprints). As a result, convergence of these methods is now called for.

Eurostat, together with the European Commission's Joint Research Centre (JRC), has taken up the challenge to develop a statistical standard recognised by international organisations such as the Organisation for Economic Co-operation and Development (OECD), the United Nations Statistics Division (UNSD) and the World Trade Organisation (WTO). The project is called FIGARO (Full International and Global Accounts for Research in Input-Output Analysis).

This project fits into the medium-term strategy for National Accounts in the context of the European statistical programme for 2013-2017 and relates to the following headings:

- Economic globalisation with the enhanced measurement of globalised production; analysis of global value chains, through appropriate Input-Output Tables and global business statistics;
- Economic and social performance with the implementation of ESA 2010 and the database for growth and productivity measurement; and
- Environmental sustainability as the EU Supply, Use and Input-Output Tables are an input for Input-Output modelling with environmental accounts. Regulation (EU) No 549/2013 of the European Parliament and of the Council of 21 May 2013 on the European System of National and Regional Accounts in the European Union determines the project's underlying methodology.

The FIGARO project aims to produce an experimental database of EU inter-country Supply, Use and Input-Output Tables (EU-IC-SUIOTs) by December 2017 for the reference year 2010 in line with the European System of Accounts (ESA) 2010 methodology. Based on the experience gained in the project, a work plan will be developed for the annual production of EU-IC-SUIOTs and the production of a time

[1] http://www.oecd.org/sti/ind/inter-country-input-output-tables.htm
http://www.oecd.org/sti/ind/measuringtradeinvalue-addedanoecd-wtojointinitiative.htm

[2] www.wiod.org

series of EU-IC-SUIOTs from 2010 to 2015[3]. EU-IC-SUIOTs constitute a further development of the consolidated SUIOTs for the EU and the euro area, which are currently published on a regular basis[4].

This project relies on the reuse of available Eurostat data and is based on the latest relevant ESA 2010 methodological framework. This ensures quality assurance of the data in the National Accounts framework. The FIGARO project also aims to create the conditions for sustained data provision of EU-IC-SUIOTs.

The EU-IC-SUIOTs are developed based on:

- a regular coordination and interaction between Eurostat's global business statistics and macro-economic data statistics on an annual basis (e.g. trade statistics, trade by enterprise characteristics, business statistics, National Accounts);
- a careful check of the user needs of various Commission Directorate-Generals (DGs) for policy analyses, i.e. DG ESTAT, DG ECFIN, DG TRADE, DG ENV, DG RTD, DG EMPL, DG GROW, together with other EU institutions such as the European Central Bank. These include studies and analyses supporting EU trade policy (e.g. global value chains), industrial policy (e.g. economic growth), social policy (e.g. employment) and climate change and environmental policy (e.g. footprints).
- an institutional perspective by setting up consistent EU-IC-SUIOTs that are recognised by international agencies such as the OECD, WTO and the UNSD, and are used as such in global inter-country Input-Output frameworks. National compilers of the EU Member States are also involved to ensure that they take ownership of the national data used in constructing the EU-IC-SUIOTs.

The experimental EU-IC-SUIOTs provide an industry breakdown of 64 activities[5]. The EU-IC-SUIOTs use the latest statistical classifications of economic activities and products currently applied in EU: NACE Rev. 2 (ISIC Rev. 4) and CPC/CPA 2008. The tables cover the EU Member States (EU-28) plus the USA to capitalise on work already undertaken by Eurostat in recent years so that United States (US) data are also presented in NACE Rev. 2 and CPA 2008 classifications, as the European SUIOTs[6].

The data presented on the Eurostat's experimental statistics page are the first version of the EU-IC-SUIOTs compiled under the FIGARO project. The FIGARO

[3] Input-Output Tables — IOTs — 2010-2015; Supply and Use Tables — SUTs — 2010 and 2015

[4] However, the methodology underlying the consolidated EU tables is different from the one applied in the FIGARO tables.

[5] When Eurostat will be regularly producing the FIGARO tables the most recent year/years will provide a breakdown of at least ten activities until more detailed input data will be available from EU countries.

[6] Eurostat has developed a methodology for converting US data from the NAICS classification to NACE and CPA classifications. For additional details on the methodology used, see: http://ec.europa.eu/eurostat/documents/51957/51999/Compilation-usa-suiot-2008-2011.doc

methodology was presented during the course of the project to various technical groups such as the National Accounts Working Group, Eurostat's Directors of Macroeconomic Statistics as well international bodies (OECD and UNSD) and the academic community (e.g. International Input-Output Association, Hispanic-American Input-Output Society).

The EU-IC-SUIOTs serve to support the analyses of the economic, social and environmental consequences of globalisation in the EU by means of studies on competitiveness, growth, productivity, employment, environmental footprints and international trade (e.g. GVCs). They aim to be the reference for national and international agencies in terms of analysis of policies on trade, globalisation, socio-economic, National Accounts and environment.

2. Introduction

This report describes the method Eurostat has developed to construct EU-IC-SUIOTs. The approach builds on the latest related developments undertaken by OECD (Fortanier and Sarrazin, 2016; Fortanier et al, 2016; Miao and Fortanier, 2017) on the construction of balanced bilateral trade statistics; and Ahmad (2017) in relation to the construction of global inter-country Input-Output Tables.

Following Fortanier and Sarrazin (2016), the entire process for the construction of EU IC-SUIOTs is also characterised by the following key features: transparency; modularity; collaboration and collective ownership; and long-term perspective.

On transparency, it means that any necessary adjustment of the reported official data is well documented, and the balancing procedure is based on simple and transparent calculations. This therefore avoids as much as possible mathematical model-based optimisation techniques.

The modular construction of EU-IC-SUIOTs involves different steps (or building blocks). The entire process involves five main (official) data sources:

- National Accounts (as benchmark);
- national Input-Output framework[7] (SUTs and IOTs);
- international merchandise (goods) trade data;
- international services trade data;
- business statistics

All of them are used to construct the three main data inputs that feed the process for constructing the EU IC-SUIOTs:

- a balanced bilateral trade database (for goods and services);
- a full set of national SUTs (basic and purchaser's prices); and
- a full set of national IOTs[8].

[7] ESA2010, par. 9.02: "The core of the Input-Output framework is the Supply and Use Tables in current prices and prices of the previous year. The framework is completed by the symmetric Input-Output Tables which are derived from the Supply and Use Tables by using assumptions or additional data".

[8] Although the national IOTs do not enter the process for the construction of the EU-IC-SUIOTs they contribute in validating the national SUTs or in estimating Use Tables in basic prices whenever missing.

The EU IC-SUIOTs are designed to continuously build on the work of EU national statistical offices in order to increase collaboration and gain collective ownership at EU level. The same applies to other international agencies such as the OECD. The project has a long time horizon and aims to be a permanent source of data for users, with frequent updates and annual (and five-yearly) publications.

3. Concept and data framework

Following United Nations (2018), Figure 1 presents the conceptual correspondence of inter-country SUTs with respect to national SUTs framework for three countries, four products and three industries. The segments without cells (shown in grey colour) correspond to non-existent data by construction. The other coloured cells refer to the entries based on the source data of Country A, with each colour showing the link to the relevant segment in the national SUTs.

As shown in Figure 1, the domestic transaction parts (in pale colours) of the inter-country SUTs can be directly moved from the original tables into the uniform product/industrial classification (for the EU, NACE Rev. 2 classification of activities and CPA 2.1 classification of products). In contrast, international transaction parts (in dark colours) require some processing before linking, as illustrated below (United Nations, 2018).

National accounts constitute the benchmark for the international comparison of economies provided that they are compiled based on international agreed standards. The System of National Accounts (SNA[9]) describes a coherent, consistent and integrated set of macroeconomic accounts in the context of a set of internationally agreed concepts, definitions, classifications and accounting rules. Among other accounts, it provides an overview of economic processes, recording how production is distributed among consumers, businesses, government and foreign nations. Consequently, the National Accounts are one of the building blocks of macroeconomic statistics forming a basis for economic analysis and policy formulation.

A national Input-Output framework consists of national SUTs and IOTs[10]. SUTs can be interpreted as the mixed output of industries and the use of inputs by industries respectively. On the one hand, the Supply Table consists of a matrix of goods and services (rows) produced by industries (columns), plus additional information on imports (in CIF), trade and transport margins (TTM) and taxes less subsidies (TLS) on products; all of these make up the total Supply of products of an economy. On the other hand, the Use Table depicts domestically produced and imported intermediate and final uses in the form of two separate matrices. They may be valued at basic prices and at purchaser's prices. There are additional column vectors that show the final use categories, i.e. final consumption, investment and exports (FOB), and additional rows that depict gross value added split into labour costs, capital use, other TLS on production and net operating surplus. It should be noted that imports and exports are shown in the national SUTs with no separation between intermediate and final exports by countries of origin and destination, all of which are crucial for the construction of global (or regional) inter-country SUIOTs. These tables form the basis for the subsequent construction of inter-

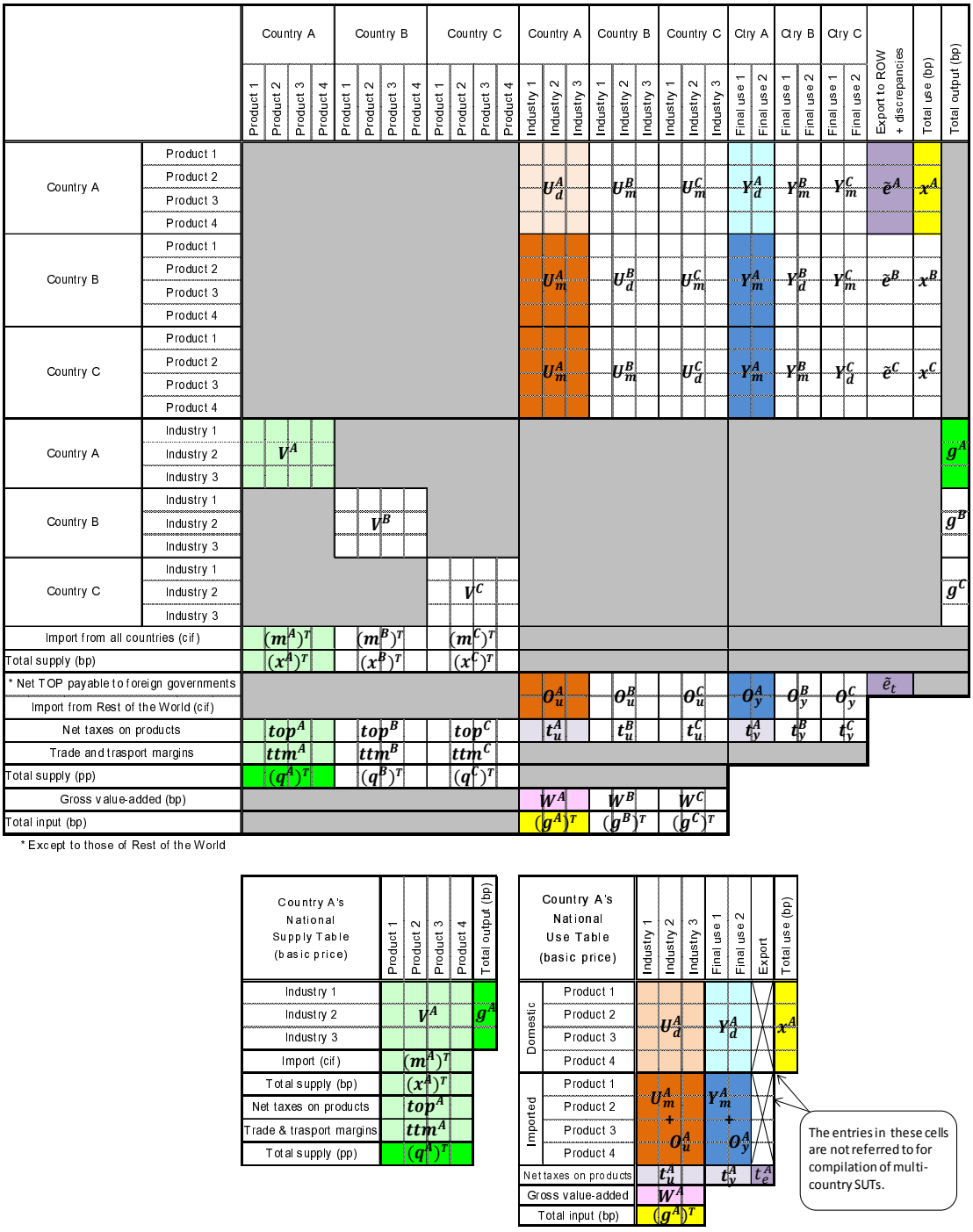
[9] https://unstats.un.org/unsd/nationalaccount/sna.asp

[10] Simplified supply, use and Input-Output tables are available in Eurostat (2008) in tables 1.1, 1.2 and 1.4.

country Input-Output (ICIO) tables and with it Input-Output modelling and GVC analysis.

Figure 1

Inter-country SUTs and its conceptual correspondence to a national SUTs framework



Source: United Nations (2018)

The list of labels and notation is shown below Figure 1, where superscript *r* is country code (*r* = A, B, and C) and superscript *T* indicates a transpose of a vector/matrix. Upper-case bold italic refers to a matrix, lower-case bold italic to a vector, and lower-case italic to a scalar.

$\boldsymbol{V^r}$ Domestic output matrix (= transpose of Supply matrix)

$\boldsymbol{U_d^r}$ Intermediate Use matrix for domestic products

$\boldsymbol{U_m^r}$ Intermediate Use matrix for imported products

$\boldsymbol{Y_d^r}$ Final Use matrix for domestic products

$\boldsymbol{Y_m^r}$ Final Use matrix for imported products

$\tilde{e}^r$ Export to Rest of the World and statistical discrepancies

$\boldsymbol{top^r}$ Net taxes on products, by product or taxes less subsidies on products (TLS)

$\boldsymbol{ttm^r}$ Trade and transport margins (TTM), by product

$\boldsymbol{m^r}$ Total import, by product

$\boldsymbol{O_u^r}$ Other entries for intermediate use

$\boldsymbol{O_y^r}$ Other entries for final use

$\tilde{\boldsymbol{e}}_{\boldsymbol{t}}$ Net taxes on products paid out by the countries in Rest of the World

$\boldsymbol{t_u^r}$ Net taxes on products for intermediate use, by industry, derived through the conversion process of matrices into basic price by using top^r in Supply Table

$\boldsymbol{t_y^r}$ Net taxes on products for final use, by final use sector, derived through the conversion process of matrices into basic price by using top^r in Supply Table

t_e^r Net taxes on products for export, derived through the conversion process of the export vector into basic price by using top^r in Supply Table

$\boldsymbol{W^r}$ Gross value added

$\boldsymbol{q^r}$ Total supply, purchaser's price

$\boldsymbol{x^r}$ Total Supply/use, basic price (= total output by product)

$\boldsymbol{g^r}$ Total Input/Output, basic price, by industry

bp Basic price Supply

pp Purchasers' price

cif Cost, freight and insurance

The extension from national to inter-country SUIOTs involves splitting the national SUT imports of intermediate and final goods and services by country of origin (and exporting industries). This in turn produces an indirect estimation of the exports of intermediate and final goods and services by country of destination (and importing industry). It could also be the other way round, i.e. by splitting national SUT exports by country of destination and by type of use (intermediate or final), the imports of goods and services by country of origin (and exporting industry) can be estimated indirectly. The OECD and Eurostat prefer the latter option due to the fact that both exports in the national SUTs (at purchaser's prices[11]) and in merchandise trade statistics are valued free on board (FOB), which is the appropriate valuation for the first step in the construction of an inter-country SUT. The two approaches should not differ in principle as long as the view of bilateral trade among countries is balanced at the level of each good or service

[11] Use Tables at basic prices should report exports at basic prices i.e. excluding domestic trade and transport margins and taxes less subsidies on products associated to the exported goods (from the factory to the border).

and both exports and imports are valued FOB. However, this is not the case in the real world and bilateral asymmetries on reported trade flows among countries exist.

Besides National Accounts and national SUIOTs, international trade in goods and services constitutes the third pillar in the construction of inter-country SUIOTs. Even though efforts are being made to overcome bilateral trade asymmetries among countries, the problem still remains. The differences between exports (imports) and mirror exports (imports) (Jansen, 2014) can be attributed to:

- different valuation of exports (FOB) and imports (CIF) value;
- product misclassification;
- time lag between exports and imports (e.g. goods leaving country A in 2016 might only reach country B in 2017);
- goods passing through third countries (transit trade, re-exports);
- goods entering customs warehousing for several months;
- unallocated trade flows or goods being classified differently;
- countries having different trade systems (general versus special trade system); and
- goods passing through industrial processing zones that may or may not be recorded by the exporting country.

The construction of inter-country SUIOTs requires a balanced view of bilateral trade statistics among countries and of each good or service. Current efforts to create a balanced view of trade include the OECD preparing a separate database for goods and services in addition to the global ICIO tables, the collaborative work among the NAFTA and APEC countries and the work that Eurostat is doing for the EU countries. These include regular workshops where country representatives meet and try to gain insights into the differences recorded by their trade statistics.

Business statistics can complement inter-country SUIOTs by providing supplementary information on the size of firms, their exporter status, their ownership and the type of use (final use or intermediate use) of the goods and services consumed. Such information is partially available at EU Member States level on a voluntary basis but was not taken into account in the FIGARO tables for the year 2010. Moreover, the collection of firm-level data such as foreign direct investment inflows and outflows, property income received and paid, operating surpluses, gross value added, output, financial and non-financial assets, exports and imports of processing goods is also crucial for GVC types of analysis. Collecting additional information on the countries of origin and destination of goods and services for intermediate and final uses separately for a specific industry would make a real difference in the construction of inter-country SUIOTs. All the additional information described above were not used in the current FIGARO tables for the year 2010 but will be integrated as much as possible into the future work.

4. Construction approach: Overview

Inter-country SUIOTs depict the production and consumption of products by economic activities (or industries) and economic agents in a number of countries and across trading partners. On the one hand, national import matrices reflect the average user's structure (across all trading partners) by each reporting country and product, whilst on the other hand merchandise trade statistics and international services trade provide the geographical distribution of the trade flows (and the trading partner shares) but not who

the users were. Therefore, a careful combination of both databases allows the identification of trading partners and users in order to construct inter-country SUIOTs; of course, provided some adjustments are previously made due to different valuation schemes (basic prices, purchaser's prices, CIF, FOB, etc.).

This methodology has pros and cons. On the positive side, it allows us using detailed bilateral trade flows and user's structures of national Import Tables to construct the Inter-country Supply, Use and Input-Output Tables. Alternatively, trade data classified by Broad Economic Classifications (BEC), Trade Enterprise Characteristics statistics on goods (TEC) and on services (STEC) as well as COMEXT data at HS6 classification can provide guidance on the distinction between intermediate and final users. However, there are limitations in this approach, most of them coming from the absence of available data:

- Bilateral goods trade flows have to be previously balanced (removing asymmetries) and import values converted to FOB with some assumptions on CIF-FOB margins.

- In services, there is much less information (with respect to trade in goods) and there is reduced number of services categories (EBOPS). Moreover, a conversion matrix to CPA is needed.

- Only one common row structure across all countries of origin coming from the national Import Tables (previously converted to FOB with some assumptions on CIF-FOB margins) is applied in the absence of other data.

In any case, following up on the previous Section, the construction of EU-IC-SUIOTs involves different building blocks as shown in Figures 2 and 3. The entire process involves five main building blocks of (official) source data (orange boxes):

- National Accounts (as benchmark);
- a national Input-Output framework (SUTs and IOTs);
- international merchandise (goods) trade data;
- international services trade data;
- business statistics.

All of them are used to construct the three main data inputs (yellow boxes) that feed the process for constructing the inter-country SUIOTs:

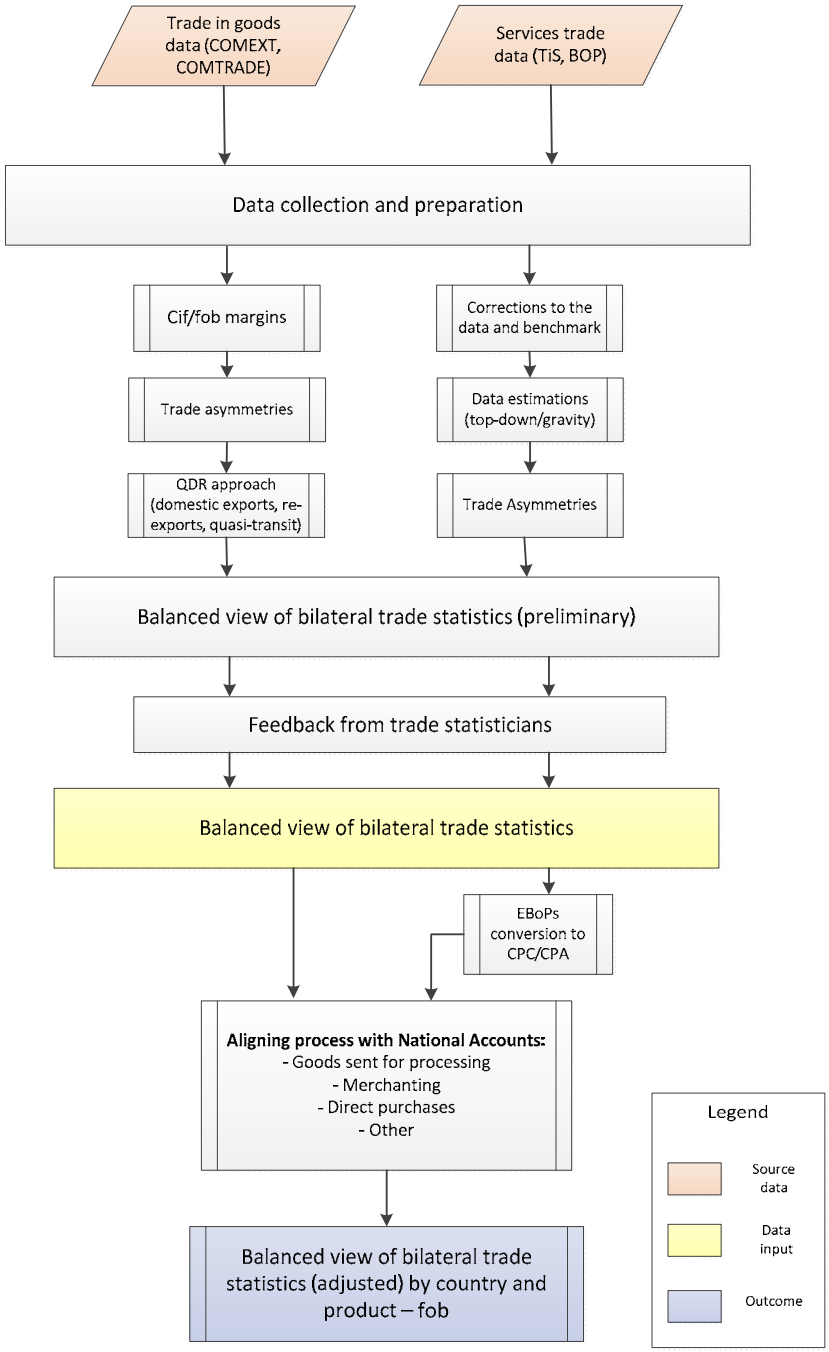
- a balanced view of bilateral trade (in goods and services);
- a full set of national SUTs (basic and purchaser's prices); and
- a full set of national IOTs.

The blue boxes indicate the desired output data from the process.

While National Accounts and national Input-Output frameworks paint individual pictures of the national economies across the EU or worldwide a balanced view of bilateral trade brings all of them together in a consistent framework. Figure 2 illustrates the estimation process. Goods and services trade data merit different treatments even though both suffer from the same problem of bilateral trade asymmetries, i.e. when the export values reported by one country do not match the values (mirror exports) reported by its counterpart. The same applies for imports. In some cases, the information is also unobserved, unallocated or confidential, which calls for additional estimations in order to have a complete dataset.

For merchandise trade statistics, exports are valued FOB and imports are valued CIF. One of the reasons for a trade asymmetry in goods is therefore different valuations, which need to be corrected before trying to find solutions for the asymmetries. In the absence of available data from the EU Member States, we used the OECD dataset of CIF-FOB valuation adjustments[12] to convert imports CIF into FOB valuation.

Figure 2. Construction of the (adjusted) balanced view of trade in goods and services



Source: Own elaboration

[12] http://stats.oecd.org/Index.aspx?DataSetCode=CIF_FOB_ITIC.

Inter-country SUTs require the country of origin and intermediate/final destination to be identified when dealing with bilateral trade. For goods trade data, a combination of COMEXT and UN COMTRADE databases was used to differentiate between domestic exports, re-exports and quasi-transit trade. First, the COMEXT goods trade data was balanced. The number and size of bilateral trade asymmetries can be enormous and overwhelming. The strategy adopted therefore involved manually addressing the largest differences and trying to find a consensus on a single figure provided there was sufficient time and resources. All remaining differences were further reconciled based on a symmetry index (or reliability index) used to compute a weighted average of the two reported values available for each bilateral trade flow. The weightings were based on the proportion of each country's total trade that roughly matches the partners' reported trade. This process follows the same philosophy as the OECD reconciliation methodology (Fortanier and Sarrazin, 2016) and the earlier methodology developed in the Global Trade Analysis Project (GTAP)[13].

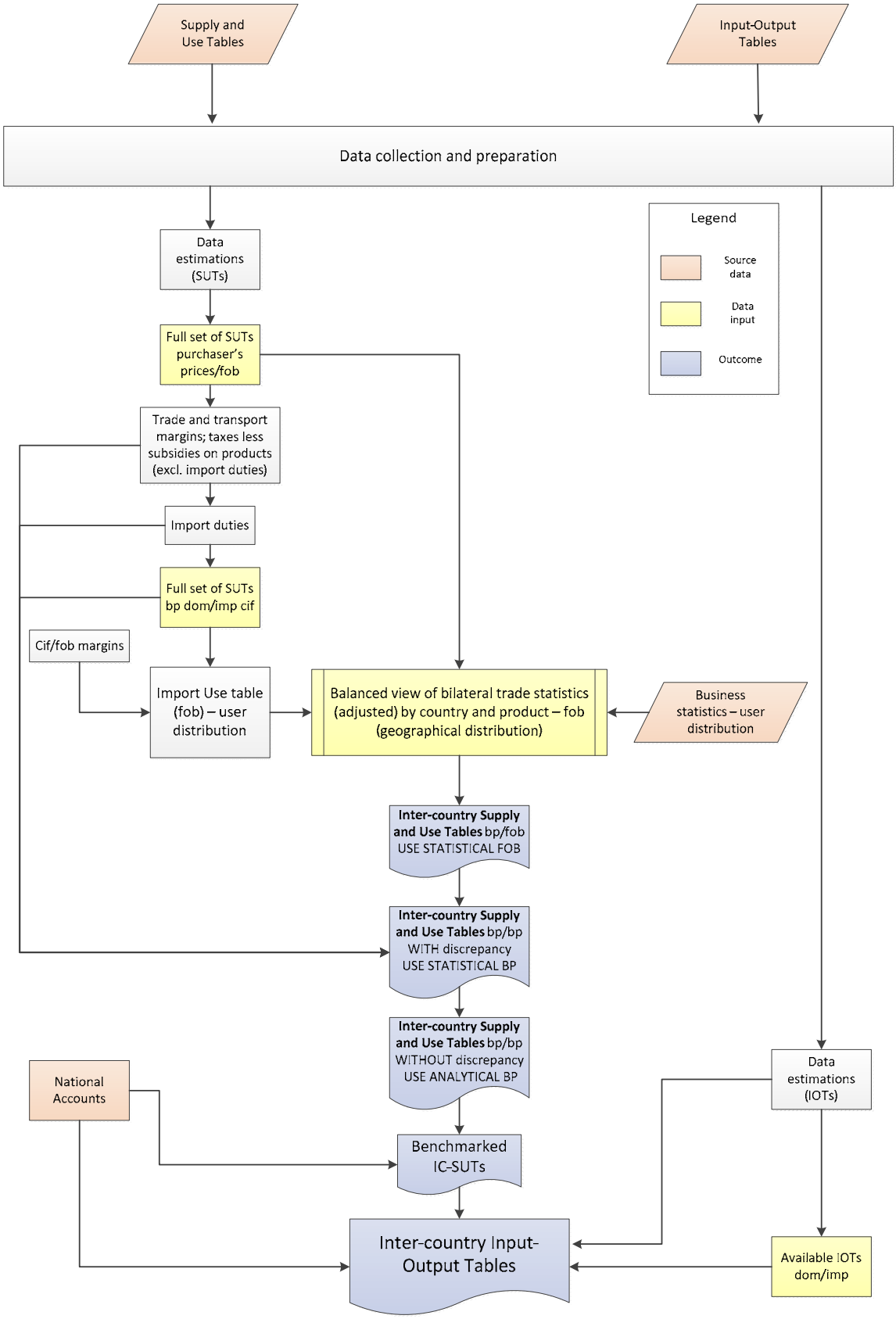
Second, quasi-transit trade was removed from COMEXT by difference with respect to UN COMTRADE trade data. Implicitly, there is the assumption that UN COMTRADE reflects merchandise trade without quasi-transit trade. Next, in the case of re-exports, the re-exporter country is not the country of origin or, in other words, the country that produced the re-exported goods. As a result, some adjustments had to be made in the balanced trade dataset to duly reflect the geographical allocation of exports and imports to the producer country. These adjustments were made on the basis of COMEXT data on imports by country of origin. Subsequently, an estimation of domestic exports and re-exports resulted from these adjustments.

On international services trade data, there are various reasons why the availability and quality of services trade data is unsatisfactory, certainly when compared to goods trade statistics. Unlike goods that can be seen and physically measured and observed as they cross borders, service transactions can be performed via a number of modes (Rueda-Cantuche et al, 2016); only the financial flows can be observed as a rule, although it is also difficult trying to single out the corresponding services delivered (Fortanier et al, 2016). As a result, a variety of different data sources and estimation techniques need to be used in practice, and these can sometimes differ by country. Data confidentiality and the different classification of services (EBOPS versus CPA/CPC) can also complicate the scheme. Once a complete (albeit unbalanced) dataset of bilateral trade flows of services data was achieved, the same balancing approach and principle (symmetry index) set out in Fortanier and Sarrazin (2016) was followed to estimate a single value for each bilateral trade flow. Manual adjustments are also recommended for the largest asymmetries provided there is sufficient time and resources. In the next Section, we will elaborate this aspect in more detail.

During the project, the quality of the results obtained was checked from the balanced view of trade with national or international trade statisticians, wherever possible, both for goods and services trade. Ideally, this feedback loop could be regularly established to derive subsequent revised and enhanced balanced datasets.

[13] This methodology is however done at country level and with less automated procedures. https://www.iioa.org/conferences/22nd/papers/files/1803_20140510051_ConstuctingofTradeDataforGTAPI-OConference.pdf

Figure 3. Construction of the EU-IC-SUIOTs



Source: Own elaboration

According to Ahmad (2017), there are still two sources of differences between the balanced view of bilateral trade in goods and services and the comparable view of imports and exports shown in National Accounts (and national SUTs)[14]:

- an unallocated component, reflecting the outcome of the balancing process (that can be allocated on a proportional basis if needed for analytical purposes); and
- the adjustments needed to align the concepts underlying the balanced bilateral trade estimates with the concepts and coverage of the SNA.

On concepts, differences include the treatment of goods sent abroad for processing and merchanting activities, and differences in coverage — including imputations of unobserved trade (e.g. smuggling, low-level trade below a certain threshold used by customs officials), re-exports and purchases by non-residents in the recording economy.

By definition, the EU-IC-SUIOTs are valued at basic prices[15], including both exports and imports. The importance of basic prices relies on the fact that, unlike purchaser's prices[16], basic prices reallocates TTM and TLS on products. All these features would distort the input structures of the inter-country Use Table in such a way that any Input-Output analysis in terms of GVC would be biased.

Use Tables are generally shown at purchaser's prices, which mean the price users pay for goods and services for final use or intermediate inputs (including TTM and TLS). This is consistent with the way information is collected, i.e. mainly through surveys involving producer companies and consumers. With the appropriate reallocation of TTM from the goods to the corresponding trade and transport sectors and the reallocation of the associated TLS on products to a separate row, Use Tables are transferred into basic prices. As in merchandise trade statistics, exports are valued FOB (free on board), including all domestic TTM from the factory to the border of the exporting country and also any domestic-related taxes or subsidies on the products sold. Imports are valued at CIF values in the Supply Table, including international freight and insurance costs of international transportation.

[14] The Gross National Income (GNI) inventories for 2010 list the necessary adjustments to be provided by EU member States according to paragraphs 3.163 to 3.178 of the ESA 2010.

[15] ESA2010, par. 3.44: " the basic price is the price receivable by the producers from the purchaser for a unit of a good or service produced as output minus any tax (i.e. taxes on products) payable on that unit as a consequence of its production or sale, plus any subsidy (i.e. subsidies on products) receivable on that unit as a consequence of its production or sale. It excludes any transport charges invoiced separately by the producer. It also excludes holding gains and losses on financial and non-financial assets".

[16] ESA2010, par. 1.97: "as a result of transport costs, trade margins and taxes less subsidies on products, the producer and the user of a given product usually perceive its value differently. In order to keep as close as possible to the views of the transactors, the ESA 2010 system records all uses at purchaser's prices, which include transport costs, trade margins and taxes less subsidies on products, while output is recorded at basic prices, which exclude those elements".

At national level, it is therefore crucial to have a set of SUTs both at purchaser's prices and at basic prices for the construction[17] of EU-IC-SUIOTs. Ideally, fully fledged TTM matrices as well as TLS on products (with import duties separated) would be preferable. For 2010, all this (except import duties) is guaranteed by the European Commission ESA2010 data transmission programme, although with some exceptions because of derogations. If necessary, missing tables were estimated using the methodology described in Rueda-Cantuche et al. (2017).

On national IOTs, these are not strictly necessary for the construction of inter-country IOTs provided there are inter-country SUTs. This is, for instance, the WIOD and the OECD's experience, which produce industry by industry global ICIO tables on the basis of previously estimated inter-country SUTs. Standard models described in the Eurostat Manual on Supply, Use and Input-Output Tables (Eurostat, 2008) such as the product technology assumption (Model A) and the industry technology assumption (Model B) can serve to produce product by product inter-country IOTs on a piecemeal basis (country-wise). Alternatively, fixed industry (Model C) or fixed product (Model D) sales structure assumptions can be used to produce industry by industry inter-country IOTs. The OECD uses Model D in its construction of industry by industry global ICIO tables. Moreover, the situation could become more difficult if official national IOTs were considered as benchmark, instead of deriving the inter-country IOTs from inter-country SUTs, as done in the FIGARO project.

As shown in Figure 3, the adjusted balanced view of bilateral trade (valued FOB and at purchaser's prices) has to be first compared against the export values of the national Use Table at purchaser's prices (also valued FOB) for checking purposes. Second, a set of national SUTs at basic prices was used with a distinction made between domestic and import uses. Domestic Use Tables were placed along the main diagonal of the inter-country Use Table.

National import flow matrices are valued CIF. They were therefore converted to FOB values in order to use the previous adjusted balanced view of trade. The CIF-FOB valuation adjustments database developed by the OECD was used for this. As a result, the derived national import flows do not necessarily have to match those of the balanced international trade import figures. However, these discrepancies can be reduced (but not eliminated entirely) through a series of transparent and replicable conversion matrices; the main idea is to allocate differences across products in order to preserve each country's recorded imports by industry and the geographical allocation of the balanced view of trade.

Export values were then converted from FOB prices to basic prices by reallocating trade and transport margins and TLS on products (excluding import duties) in the exporting countries. However, the lack of available national matrices of import duties made the full conversion impossible so the corresponding net taxes on products payable to foreign governments have not been separated in the conversion process.

The end result of the entire process is an EU inter-country SUTs valued at basic prices that can be converted into inter-country IOTs using standard methods described by Eurostat (2008).

[17] Even when the construction is made on the basis of Use Tables at basic prices, Use Tables at purchaser's prices are used to check export (FOB) values against those of international trade in goods statistics.

The final EU-IC-SUIOTs contain a column and a row of discrepancies[18]. Depending on particular needs and preferences, these discrepancies can:

a) either remain as such and even be used as an indicator to identify areas where further work is needed to reconcile national and bilateral statistics[19].
b) may also include vintage problems between the official SUT figures and revised figures of GDP and other macroeconomic variables that did not lead to the corresponding changes in the SUTs.

The FIGARO project decided to provide both tables — with discrepancy items (Statistical Tables) and without discrepancy items (Analytical Tables). Lastly, an additional benchmark to the latest figures of National Accounts might be needed at the end of the process[20]. A final simple balancing procedure would be used across the full table to implement this.

Regarding national SUTs, the EU-IC-SUTs will preserve the national values in the SUTs of 2010 (without any change) of the domestic Use Tables (intermediate and final use, including exports at basic prices), value added components, taxes less subsidies on products and GDP.

As a result, Eurostat is publishing experimental statistics: the derived Statistical EU-IC-SUIOTs and the Analytical inter-country Use Tables and inter-country Input-Output Tables, both in industry by industry format and product by product format.

5. FIGARO construction in practice: Eurostat's methodology

In reality, the construction of inter-country SUIOTs is mired in empirical challenges, including the need to make up for the at times (but not for 2010) limited availability of national SUIOTs and level of detail;

- estimating missing countries, import flow matrices and/or trade and transport margins matrices;
- overcoming national data inconsistencies between National Accounts and trade statistics, particularly those caused by goods sent abroad for processing and merchanting in the 2008 SNA;
- estimating international TTM matrices;

[18] This is a result of the decision to fully constrain the system to the officially published GDP of each country and the fact that the sum of intra-EU exports included in these GDP numbers is larger than the sum of intra-EU imports.

[19] The discrepancies can also be eliminated by a final, simple balancing procedure (e.g. Generalised RAS (GRAS)).

[20] For the reference year 2010 the FIGARO process does not include this benchmark. Input data correspond to the latest data transmissions by the Member States up to the end of 2016. During the validation and estimation process national data are then set to these macro-economic statistics on GDP, final consumption and gross capital formation.

- reconciling international trade asymmetries (goods and services) with an appropriate geographical allocation of trade by countries of origin and destination; and
- harmonising different classifications for products (HS, EBOPS, CPA) and for differences in industries (ISIC versus national systems).

This Section describes these challenges in detail as well as how the FIGARO project addressed them.

5.1. Estimating missing countries, import flow matrices and/or trade and transport margins matrices

Unlike countries outside the EU, most of the EU countries (except for derogations) are able to provide national SUIOTs with comparable levels of industry detail and coherent valuations (basic prices and purchaser's prices). A collection of national SUTs (at basic prices) with a distinction between domestic and import uses is required[21]. In addition, Use Tables at purchaser's prices are needed to compare their export values with the resulting balanced view of international trade. The sectoral classification is NACE Rev. 2, with the commodity classification referring to CPA/CPC 2008. The tables comprise 64 industries and 64 commodities, which can also be easily referred to ISIC Rev. 4 classification.

A collection of national IOTs with a distinction between domestic and import uses is required via the National Accounts transmission program every five years (for reference years ending by 0 and 5). However, this collection is usually incomplete given that some of the EU Member States ask for derogations in data submission. Moreover, the compilation process to construct Input-Output Tables across Member States is not as homogenous as for the Supply and Use Tables. The usual standard assumptions are frequently accompanied by manual corrections that reflect country-specific knowledge or overall balancing adjustments. In the FIGARO project the inter-country Input-Output Tables were compiled directly on the basis of the derived inter-country Supply and Use Tables instead of estimating national missing IOTs beforehand[22].

When estimating missing tables, the project used a study outsourced by Eurostat (Rueda-Cantuche et al, 2017). This examined a few non-exhaustive methods for the estimation of trade and transport margins matrices, domestic and Import Use Tables at basic prices and Use Tables (totals) at basic prices with a selection of auxiliary information. They also provided an indication of how much the estimates matched reality in the absence of other official tables. Their main conclusion was that the usage of tables from previous years generally provides the best options in each case. This is mainly because they gather detailed country-specific information that is not expected to change in the short term. On trade and transport margins, it is better to start with an estimation of

[21] ESA 2010 Transmission program of data (link) p. 102.

[22] The FIGARO project used (nation-wise) the industry technology assumption (Model B, Eurostat, 2008) for product by product IOTs and the fixed product sales structure assumption (Model D, Eurostat, 2008) for industry by industry IOTs. Official IOTs (of whatever type — product by product or industry by industry) may also be used as constraints to the system in each case. This latter option is not included in the FIGARO process for the reference year 2010. Constraining the EU ICIO tables to the national IOTs will be investigated in the next project.

matrices of TLS on products. The TTM matrix would then be calculated by difference with respect to the (if available) Use Table at basic prices. This solution performed better than the other way round. For the split between domestic and imported uses, the availability of a previous year's IOT or current IOT of imports makes a difference. In the case of missing Use Tables (total) at basic prices: using the joint structure of the trade and transport margins matrices from a previous year proved to be the best option (i.e. difference between the Use Table at purchaser's prices and the Use Table at basic prices from a previous year, if both available).

At the end of this step, we have achieved a complete harmonised set of Supply and Use (domestic and import CIF) tables in basic and purchaser's prices for all EU countries, including their trade and transport margins and taxes less subsidies on products tables.

5.2. Creating a coherent view of EU bilateral trade statistics of goods

The process for constructing a balanced bilateral trade dataset for goods and services is less straightforward. For goods trade data, a combination of COMEXT and UN COMTRADE databases was used to differentiate between domestic exports, re-exports and quasi-transit trade.

On the one hand, COMEXT has higher quality data in principle compared with UN COMTRADE due to the existing production process and the amount of resources available. It is also a richer database, including information on country of consignment (mandatory) and country of origin (voluntary) and with a higher level of granularity. COMEXT is also the official reference on international trade in goods within the European Statistical System and is a statistical product well recognised by users. However, the main caveat is that COMEXT uses the community principle for intra-EU trade instead of the national principle, which is more suited to FIGARO. The community principle includes quasi-transit trade, which distorts the view of the true economic relationship among FIGARO countries. The difference between the two principles provides an estimation of quasi-transit trade.

On the other, UN COMTRADE uses the national principle, i.e. quasi-transit trade is excluded in the majority of cases. It also includes many more declarants or reporting areas (around 170, while COMEXT includes richer data information whenever a EU Member State is concerned). However, UN COMTRADE does not provide both the country where the good was originated and the country from where it was dispatched. This information is useful to understand the re-exports' dynamic.

Re-exports[23] are foreign goods imported and then exported without being processed or changed substantially from one country to another via a third country (re-exporter). The goods need to cross the borders of the third country. SUTs/SNA typically includes re-exports (also designated as foreign exports) in the export column of the Import Use Table by type of product (although this might not be true for all countries). However, international merchandise (goods) trade statistics do not distinguish between domestic and foreign exports (re-exports). International merchandise trade data would therefore require some additional information and adjustments to separate domestic

[23] In re-exports, there must be a change of ownership; otherwise it would be considered quasi-transit trade, which should not be taken into account for National Accounts.

exports from re-exports in order to be aligned with the SUT/SNA total values of domestic and foreign exports. As mentioned before, these adjustments were estimated by combining UN COMTRADE and COMEXT databases.

The optimum option is therefore to use both databases, taking the best features from each. This can be illustrated with a real example involving crude oil trade between Spain and Portugal. UN COMTRADE and COMEXT both report around EUR 576 million of Portuguese imports (CIF) of crude oil from Spain. Both databases also report exports (FOB) of crude oil from Spain to Portugal of around EUR 510 million. The difference between import and export values can easily be attributed to product misclassification, time lag between exports and imports or any other reason for asymmetries. Here both databases provide more or less the same values. There was therefore no quasi- transit trade. However, by looking at the information on country of origin in COMEXT, which is not available in UN COMTRADE, Portugal reports EUR 505 million of crude oil imported from Algeria (country of origin) and EUR 71 million coming from Spain (country of origin). This clearly indicates that Spain is re-exporting crude oil from Algeria to Portugal for an amount of EUR 505 million. This is confirmed by the total output of mining and quarrying products (including crude oil) from the Spanish Supply Table, which amounts to around EUR 110 million of production, of which EUR 71 million is exported to Portugal (domestic exports). A part of the Spanish re-export value would correspond to an international trade margin charged by Spain, which can easily be assumed — in the absence of other information — to be the same as that for the Spanish domestic margin for the same product (assuming 10 % without loss of generality). By combining all the above information, the following conclusions can therefore be made: a) domestic trade flow of crude oil between Algeria and Portugal (EUR 454.5 million); b) another domestic trade flow of crude oil between Spain and Portugal (EUR 71 million); and c) domestic trade flow (of services) between Portugal and Spain (margin on re-exports).

In short, quasi-transit trade flows are estimated by first comparing COMEXT with UN COMTRADE. Second, by comparing country of consignment with country of origin in COMEXT (excluding quasi-transit trade), the gross value of re-exports and their origin are estimated. Third, these gross values are further split into the net value of the goods re-exported and their associated trade services. Domestic exports are easily identified — by definition, country of consignment and country of origin are the same.

Trade statisticians are familiar with trade asymmetries. For the sake of consistency, a balanced view of international trade requires that exports/imports and mirror exports/mirror imports coincide. However, this is not generally the case for several reasons. One of them is simply the different valuation between exports (FOB) and imports (CIF), with the latter including international transport and insurance costs. Before addressing a realistic analysis of trade asymmetries, import (CIF) values must therefore be converted into import (FOB) values. To do this, we need data on CIF-FOB margins on a bilateral basis and for individual products.

In the absence of direct information by EU[24] Member States, the CIF-FOB margins by product and partner of each bilateral trade flow are taken from the estimations made by the OECD (Miao and Fortanier, 2017).

[24] Unfortunately, this information is rarely available for EU Member States. Alternatively, the difference between exports (FOB) and mirror exports (CIF) can be used as a proxy variable to try and create a gravity

Once imports have been converted to FOB, the next step is to reconcile bilateral trade flows. A symmetry index[25] (or reliability index) is used to compute a weighted average of the two reported values available for each bilateral trade flow. The weightings are based on the proportion of each country's total trade that roughly matches the other partner's reported trade. This process basically follows the same philosophy as the OECD reconciliation methodology (Fortanier and Sarrazin, 2016). However, some manual corrections have to be made beforehand for the biggest asymmetries and with the information provided by the Member States affected, whenever available.

One last important issue before the final balancing of asymmetries is the treatment of confidential[26] data, trade not geographically specified or trade not allocated, which in some cases can be very important (e.g. German and Austrian trade in petroleum and natural gas). Proportionality was generally assumed across countries or products before applying the symmetry index.

Both COMEXT and UN COMTRADE were reconciled by Eurostat at HS6 digit level separately and independently of each other. These two balanced datasets then constituted the starting points for estimating the breakdown of COMEXT data (i.e. balanced trade flows by country of consignment) into domestic exports, re-exports and quasi-transit trade. In the absence of additional information, the same geographical distribution across trading partners was assumed for quasi-transit trade and re-exports. As mentioned before, domestic trade margins were used to estimate the part of the gross value of re-exports that would correspond to the associated trade service, thereby assuming the same margin for domestic and international transactions. Finally, bilateral

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model based on: geographical distance; GDP per capita of reporter and partner countries; average annual oil price; EU median unit values (at CPA08-4 digit level) as a proxy of insurance costs; a dummy variable reflecting contiguity of countries; fixed factor effects for products and partner countries; and a time trend. Data on imports and exports for the gravity model were taken from the COMEXT database (EU trade since 1988 by CPA_2008 — DS-057009) for 1995-2015. Imports and exports were available in both monetary values (EUR) and quantities (100 kg) for all EU Member States at 4-digit level and by partner country. Gravity variables (distance and contiguity) were taken from the CEPII database. GDP per capita (current US$) came from the World Bank, while the average oil price was obtained from the Europe Brent Spot Price FOB (Dollars per Barrel) issued by the U.S. Energy Information Administration. Finally, Eurostat exchange rates were used to convert GDP per capita and the oil price from US$ to EUR. The results were not satisfactory enough as they seemed to be overestimated in comparison to the OECD data. Actually, our dependent variable might well include other additional concepts different from just the transportation and insurance costs due to the fact that we used the difference between exports (FOB) and mirror exports (CIF) as a proxy.

[25] The symmetry index is calculated as follows. For each reporter *i*, partner *j*, product *k* in a given year, the Asymmetry Level (AL) is calculated as follows: $AL_{ijk} = \frac{|X_{ijk} - M_{jik}|}{X_{ijk} + M_{jikt}}$, where X and M refer to reported exports and imports respectively. Subsequently, only those export and import values for which $AL_{ijkt} \leq 0.10$ are retained (exports (X^r) and imports (M^r). The export symmetry index SI^x is then calculated as the ratio of the sum of retained export values as a share of total exports (by reporter, product and year), while the import symmetry index SI^m is similarly defined as the sum of retained import values as a share of total imports, and is used for the country weightings: $SI_{ik}^x = \sum_j \frac{X_{ijk}^r}{X_{ijk}} \ \ and \ \ SI_{ik}^m =$.

[26] Ideally, confidential data should be used as much as possible as long as no disclosure is made. Currently, confidential data in merchandise trade statistics is merged with not geographically specified and/or not allocated trade.

trade flows were re-directed in order to accurately reflect the country of origin whenever it was different from the country of consignment.

In the absence of information about country of origin, country of consignment is generally assumed to be the same as country of origin, which might lead to overestimate the domestic share of the total trade flow. In order to correct for this bias, we constrained the share of (domestic exports)/(domestic exports + re-exports) to the one provided by the national Use Tables at basic prices[27] (domestic over total Use Tables) by reporting country and product.

The derived three-layer balanced view of bilateral trade flows that makes a distinction between domestic exports, re-exports and quasi-transit trade can also be useful for other purposes: (1) domestic exports can be compared with the export values shown in the Use Tables at purchaser's prices; (2) re-export values can be used to split the re-export column of a Use Table of imports by trading partner (provided some adjustments are made beforehand to convert imports to FOB and to purchaser's prices); (3) associated trade margins to re-exports can also be used to estimate international trade margins by product.

So far, we have achieved a balanced bilateral trade in goods data set at the HS 6-digit level in FOB (and also in CPA by aggregation); however not completely in line with the information given in the SUTs.

5.3. Creating a coherent view of EU bilateral trade statistics of services

As mentioned earlier, the estimation process of missing international services trade data can be more demanding than for merchandise (goods) trade data. There are various reasons why the availability and quality of services trade data is unsatisfactory, certainly when compared to goods trade statistics. Unlike goods that can be seen and physically measured and observed as they cross borders, service transactions can be performed via a number of modes (Rueda-Cantuche et al, 2016); only the financial flows can be observed as a rule (Fortanier et al, 2016). As a result, a variety of different data sources and estimation techniques need to be used in practice, and these can sometimes differ by country. Data confidentiality and the different classification of services (EBOPS versus CPA/CPC) can also complicate the scheme.

Following Fortanier et al (2016), we used a top-down approach to estimate missing trade (and mirror) flows for imports and exports separately whenever official data were available. The process was divided into several steps:

1) collect all available information on trade in services available in Eurostat (i.e. for 2010-2015 in BPM6 and by EBOPS2010 categories);
2) compute missing (services and geographical) aggregates and check integrity rules (e.g. for negatives, consistency in sums…);
3) compute missing values (subtotals) with available information and simple derivations;

[27] The underlying assumption is that national Use Tables give an upper limit for the ratio of domestic trade over total trade. This ratio is then assumed not to be underestimated.

4) compute missing values using structural information over time, linear interpolations…;
5) use gravity models[28] for specific items;
6) perform manual corrections based on the contributions of EU Member States in the workshops on trade asymmetries organised by Eurostat;
7) distribute unallocated trade across service categories and trading partners;
8) create top-down benchmark against the aggregate values of the balance of payments data.

Total services trade by Extended Balance of Payments Services (EBOPS) category and country were available, all of which were used as a benchmark for the estimation of the other sub-items.

In step 5 above, the gravity models used four types of independent variables:

- economic (such as GDP of reporter and partner countries, GDP per capita of reporter country and overall exports and/or imports of services by partner and reporter countries);
- distance;
- dummy variables specifying common border (contiguity), language affinity, territorial link (e.g. Czech Republic and Slovakia were one country in the past), EU membership (for more than 20 years), euro area; and
- fixed effects for partner and year.

The models provided us with estimations of bilateral trade flows for the following items: travel services (SD), which consist of goods (SD1), local transport services (SD2), accommodation services (SD3), food-serving services (SD4) and other services (SD5); charges for the use of intellectual property rights (SH), which consist of franchises and trademark licensing fees (SH1), licences for the use of outcomes of research and development (SH2), licences to reproduce and/or distribute computer software (SH3), licences to reproduce and/or distribute audio-visual products (SH41), licences to reproduce and/or distribute products other than audio-visual ones (SH42), audio-visual and related services category (SK). These estimates were further used in steps 6 to 8 to come up with a complete dataset of bilateral trade services flows.

As mentioned before, the FIGARO project benefitted from the additional information provided by the conclusions of the workshop on trade in services asymmetries organised by Eurostat with representatives of the EU Member States side by side with the Balance of Payments Working Group meeting in October 2016. During this workshop, experts from EU Member States had the opportunity to exchange experiences, discuss bilaterally and decide on specific measures to resolve their corresponding trade asymmetries. The conclusions were discussed at subsequent balance of payments and international trade in services working group meetings[29].

[28] This step could have been done the last one in order to increase the number of degrees of freedom of the models and the number of observations. However, it will be implemented in the next FIGARO project.

[29] A few items were corrected in step 6 including feedback from the workshops.

Once a complete (albeit unbalanced) dataset of bilateral trade flows of services data was achieved, the same balancing approach and principle (symmetry index) set out in Fortanier and Sarrazin (2016) was applied to EU countries to deal with trade asymmetries. Unlike merchandise trade data, the resulting balanced bilateral trade dataset had to be converted from EBOPS items into CPA/CPC products using a combination of EBOPS-CPA/CPC concordance tables (up to 5 digit level) and SUIOTs. The conversion values for item SD (Travel) were based on our own estimations of direct purchases abroad (see Section 5.6) and those of SA (Manufacturing services on physical inputs owned by others) were based on our own estimates of goods sent abroad for processing (see Section 5.4). Alternatively, the use of the RACE algorithm (Rueda-Cantuche et al, 2013) to come up with country-based and service-based specific conversion tables is scheduled for the near future.

As a result, a balanced view of services trade data for all EU countries and US was achieved in CPA classification at the desired disaggregation level for the EU-IC-SUIOTs.

5.4. Overcoming national data inconsistencies between National Accounts and trade statistics

International trade statistics, in particular merchandise trade statistics (in practice also often services trade statistics), do not follow the same concepts as those used for imports and exports in the SNA (the key accounting framework used in constructing official national SUIOTs). The difference in merchandise trade totals and National Accounts totals for goods can be significant because of the adjustments for non-residents' expenditures in the domestic economy and residents' expenditures abroad, which are captured in trade in services statistics and not merchandise trade data.

However, the changes made in the 2008 SNA for goods sent abroad for processing and merchanting in particular imply significant changes for some countries, notably for trading 'hubs' (such as the Netherlands) but also for countries with large processing sectors (such as the Czech Republic for the automobile industry) and, also, for those countries providing the intermediate inputs and purchasing the output from processing countries.

Balances for merchandise trade statistics include all the underlying flows related to goods for processing — the processing services provided by the processing firm and the goods used by the processor in the production that were supplied without a change of ownership taking place between the principal and the processor. National SUTs that conform to the 2008 SNA require that for the processing firm (and country), merchandise trade data exclude the value of the goods imported that have not changed ownership. As a result, exports of goods by the processing firm should be excluded from the goods account, instead the processing fee, charged by the processor should be recorded in services account[30] (i.e. Balance of Payments). Likewise for the principal firm (and country), exports should exclude the value of goods supplied to the processor (without a change in ownership), with a corresponding correction for any imports from the processor.

[30] Although these manufacturing services will eventually have to be allocated to the corresponding goods account (in CPA/NACE classification).

Bilateral partner estimates of processing fees are available in the balanced estimates of trade in services produced by countries (EBOPS, category SA: manufacturing services). However, what is also needed for aligning flows of merchandise trade data with comparable flows in SUTs are estimates of these processing services by CPA product and, in addition, estimates of the value of imported and exported goods whose ownership has not changed but are included in merchandise trade data. By definition, this information (or at least national estimates of this information) must be available in theory to produce national SUTs[31]. The challenge is to create equivalent estimates of these flows on a partner basis.

For example, Germany exports EUR 100 of a certain good for processing to the Czech Republic. The good comes back to Germany (it could also be another country) processed for EUR 110. There is no change in economic ownership in the goods exported and imported. Germany should therefore have EUR 100 less of imports from the Czech Republic and EUR 100 less of exports to the Czech Republic. Ultimately, a manufacturing service import (classified as a good in CPA) for EUR 10 from the Czech Republic should be allocated to Germany.

Unfortunately, the information available to make these additional adjustments to international merchandise trade data is limited, i.e. how much gross trade is related to these types of goods and the amount of processing service fees paid by country and by types of goods traded. For instance, partial information can be found in the balance of payments data — BPM6 — of countries and/or by combining business statistics and merchandise and international trade services data. The FIGARO project has used the information provided in the Gross National Income inventories (ESA2010) and the Eurostat's report on "Statistics on goods under merchanting and goods sent abroad for processing" presented at the third meeting of the Eurostat's Task Force on Integrated Global Accounts[32] (April 2017).

A detailed description of the work carried out under the FIGARO project on the estimation of GSA and merchanting can be found in the Annex. This work can be used to provide information on how to construct an ICIO compliant with the System of Environmental and Economic Accounts, e.g. one where GSA are still recorded as physical flows. With such purpose, a bridge column of GSA adjustments by exporting country and product will be published. A fully fledge matrix of adjustments will be kept for internal use.

In this step, the balanced view of trade in goods has been adjusted for the new treatment of GSA and merchanting in the ESA2010.

[31] See columns P6D (goods sent abroad) and MCH (merchanting) in the Statistical Use Table.

[32] This report shows the gross flows connected to both inward processing and outward processing based on ITGS sent by Member States for the years 2013-2015. The identification of these flows is made by countries using Nature of Transaction codes (NoT) and the report suggests that these data might be more reliable when it refers to inward processing, particularly for countries such as Bulgaria, Estonia, Croatia, Cyprus, Hungary, Latvia, Lithuania, Portugal, and Slovenia. This report also suggests that it is preferable to collect additional direct information from trade in services data rather than using NoT codes from ITGS. This recommendation will be followed in future developments of the EU-IC-SUIOTs as much as these services trade data will be available.

5.5. Estimation of international transport and insurance costs

As mentioned in the previous Section, for merchandise trade statistics, imports are valued CIF and exports valued FOB. In national SUTs at basic prices, import flow matrices are typically reported in CIF by product type, while total imports (summed over all products) must be valued FOB. Depending on whether the transport company is resident or non-resident, a CIF-FOB (National Accounts) adjustment therefore needs to be made. The adjustment column consists of a deduction from the services items for transport and insurance with an offsetting global adjustment made to imports of goods (2008 SNA, para. 28.10).

However, the construction of inter-country SUIOTs refers in particular to a slightly different concept, the CIF-FOB reclassification[33]. This is defined as the difference between the import flows in CIF and their mirror imports in FOB. The expected difference would be the amount of transportation and insurance costs paid either by the seller or the buyer in each transaction. Nevertheless, the 2008 SNA requires merchanting services to be added to the value of the imported good (instead of as a trade service); this leads to a new factor contributing to such a difference.

Within the inter-country SUT framework, the costs associated with the international transport and insurance of merchandise trade (also referred to as CIF-FOB margins) are crucial for two reasons: a) to address bilateral trade asymmetries of imports and exports at the same valuation; b) to adjust national import flow matrices to the FOB valuation. To this end, the OECD recently published a global bilateral database of CIF-FOB margins. It combines the largest and most detailed cross-country sample of official national statistics on explicit CIF-FOB margins to date, with estimates from an econometric gravity model and a novel approach to pooling product codes across Harmonised System[34] nomenclature vintages. The database shows that distance, natural barriers and infrastructure continue to play an important role in shaping regional (and global) value chains. However, this database is based on BPM5. As a result, CIF-FOB margins do not capture international trade margins (merchanting), which would need to be estimated differently by looking into available data on goods purchased and goods sold under merchanting, together with the support of services trade statistics data. Nevertheless, in the absence of available data for EU countries, we had to use the OECD global bilateral database of CIF-FOB margins[35].

Official statistics on CIF-FOB margins are still some way from being produced regularly by national statistical offices. This would help improve the quality of the balanced view of bilateral trade, which is used to support the construction of EU-IC-SUIOTs.

[33] See ESA 3.178 and 3.179.

[34] http://www.wcoomd.org/en/topics/nomenclature/overview/what-is-the-harmonized-system.aspx

[35] In the FIGARO project, CIF-FOB margins are used to: a) convert national import Use Tables from CIF to FOB in order to use the resulting row structures for the distribution of the balanced view of trade export data across intermediate and final users; b) convert merchandise import trade data from CIF to FOB as a previous step to balance the trade asymmetries.

5.6. Direct purchases[36] abroad

Direct purchases abroad by residents (imports) and direct purchases in the domestic territory by non-residents (exports) are typically included in National Accounts as a lump-sum total (including businesses, travel and government expenditures). However, they are not separated by product, as is required to perform conventional Input-Output analysis. Even though they are available through the balanced view of trade under the 'Travel' item in EBOPS categories (most of them but not all), they still need to be separated from pure travel services using Tourism Satellite Accounts[37] (TSAs), SUIOTs or any other related source data. The estimated values are then transferred to the goods categories and partners (i.e. the country of origin of the non-resident).

Although there will be differences between the spending patterns of tourists in a given country depending on their nationality, information available in TSAs is rarely available at this level of detail. In these circumstances, the simplest way to achieve a global balance of travel expenditures by product is to assume that all tourists in a given country have the same spending patterns (by product). In other words, they purchase the same basket of goods and services for every euro spent, making use of the information on product breakdowns from TSAs in that country or, traditionally, making use of fixed assumptions.

By extension, import statistics by product are also directly generated using the statistics on exports by partner, which are generated in the balanced set of travel statistics. This in turn automatically generates a coherent and equivalent set of import statistics by partner and product. However, there may still be a difference between the equivalent National Accounts estimates. This difference should then be allocated in such a way that the balanced view of trade is preserved by product across countries of origin.

Accordingly, the FIGARO approach firstly benchmarked bilateral trade flows of "Travel" services (category SD) by countries to the equivalent National Accounts estimates[38] (i.e. direct purchases abroad and purchases by non-residents in the domestic territory). The geographical balanced view of travel services is therefore changed to accommodate the National Accounts values using the GRAS method. Subsequently, the resulting benchmarked and balanced view of travel services was split by CPA categories using bridge tables that preserved the balanced view of trade across the different SD sub-items (SD1 to SD5) and for each reporting country.

These bridge tables were constructed on the basis of the information provided by the UK Statistical Office in terms of the decomposition of direct purchases abroad and non-residents purchases in the domestic territory by CPA categories. Although there will be differences between the spending patterns of tourists in a given country (e.g. UK), depending on their nationality, information is rarely available at this level of detail, and

[36] "Direct purchases abroad" include both goods and services purchased by residents abroad and by non-residents in the domestic territory.

[37] For this project, we have used other related data sources (as it is explained in the text), thus leaving the use of TSAs for the near future.

[38] The values came from Eurostat's national SUIOTs except for United Kingdom (ONS), Ireland (CSO), United States (OECD) and the rest of the world, calculated by difference with respect to the world total provided by the OECD. OECD exchange annual rates were applied for currency conversions.

so, in these circumstances the simplest way of arriving at a global balance of travel expenditures by product, is to assume that all tourists in a given country (e.g. UK) have the same spending patterns (by product). In other words, they purchase the same basket of goods and services for every 1EUR spent. Therefore, we applied the CPA structure of direct purchases abroad for the UK and the CPA structures of non-residents purchases in the domestic territory for the other countries.

The resulting decomposition was further refined by appropriately summing up CPA categories and come up with estimates of SD1 to SD5 sub-items. Then, these estimates were benchmarked to reflect the same structure across sub-items of the balanced view of trade for each bilateral flow. As a result, country-specific CPA distributions were obtained for splitting up the bilateral trade flows totals of travel services (SD) consistently with the underlying structures of SD1 to SD5 given by the balanced view of trade[39]. These results will be presented separately from the EU-IC-SUIOTs.

5.7. Harmonising different classifications

Merchandise trade data are compiled using the Harmonised System (HS) of products. Because of the significant disaggregation of data available, these are readily convertible to the product classifications used in constructing national SUTs (which are typically much more aggregated) such as the international product standard CPC. However, the same does not hold for trade in services data, which are based on EBOPS, and where the level of detail collected by countries is often less than the comparable detail used in national SUTs. As mentioned earlier in Section 5.3, a combination of EBOPS-CPA/CPC concordance tables, SUIOTs and other data sources such as business statistics are normally used to make such conversion.

As regard the FIGARO approach, we have used customised bridge tables provided by the national statistics institutes of Austria, Czech Republic, Estonia, Germany and Slovenia. For the other remaining countries, we have produced a dummy bridge table on the basis of these available countries. The conversion has been made at the most detailed level in terms of EBOPS categories, wherever available; otherwise, the upper level structures were implemented instead. For travel services (SD), the conversion shares from EBOPS to CPA were based on the estimation process of direct purchases abroad (see previous Section).

For convenience and to help better explain the classifications', the 12 key (aggregated) product groupings used in EBOPS (2010) — which is often the only level of detail produced by many economies — are shown below:

1. Manufacturing services on physical inputs owned by others (goods for processing)
2. Maintenance and repair services not included elsewhere
3. Transportation

[39] A bridge table between SD sub-items and CPA has been developed within the project. At the level of SD: Accommodation and food services activities (45%); Textiles, wearing apparel and leather products (20%); Food products, beverages and tobacco (9%); Education (4%); Furniture and other manufacturing (3%); Land transport (3%); Chemicals and chemical products (2%); Rubber and plastics (2%); Motor vehicles, trailers and semitrailers (1%); Coke and refining products (1%); Other products (summing up 10%).

4. Travel
5. Construction
6. Insurance and pension services
7. Financial services
8. Charges for the use of intellectual property not included elsewhere
9. Telecommunications, computer and information services
10. Other business services
11. Personal, cultural and recreational services
12. Government goods and services not included elsewhere

The challenge when constructing inter-country SUIOTs is to convert these data into equivalent CPC (or CPA classifications typically preferred). For most of the categories above, this is not an overly difficult exercise, however, two categories warrant special mention and attention: 'Manufacturing services on physical inputs owned by others' and 'Travel'.

As mentioned above, despite the CPC's international coverage, the CPA system is generally preferred in the construction of SUTs as its architecture and structure (by design) mimics that of the corresponding industry classification NACE, which is closely related to the international standard ISIC. However, 'Manufacturing services on physical inputs owned by others' are recorded under goods in the CPA classification (as the output of the manufacturing sector). Similarly, 'Travel' — which covers non-residents' expenditures (exports) and residents' expenditures abroad (imports) — consists of a number of products (including goods) and is usually shown as a separate item in national SUTs (a negative adjustment item in household final consumption and a corresponding positive entry in exports for non-residents' expenditures, and a positive entry to imports and equivalent positive to household final consumption). Besides the specific table for direct purchases abroad (see Section 5.6), these items are just reflected in the FIGARO tables without any change or modification from the national SUTs.

5.8. To balance or not to balance…and when

Figure 2 (in Section 4) allows for two separate EU-IC-SUTs, i.e. with or without discrepancy items. The tables with an explicit discrepancy item[40] would perhaps provide a more accurate view of the underlying state of statistics available across countries and give pointers to national statistics offices[41] on those areas where data improvements could be made. However, most users prefer a balanced table without discrepancy items[42] (knowing that the discrepancies above could also be negative and not just positive; this adds another level of complexity when interpreting results from unbalanced tables).

Bearing this in mind, it is important to note that any coherent and balanced view of trade (consistent with the National Accounts concepts) cannot satisfy the dual constraint of no changes in current account balances and GDP (and value added by industry) if discrepancies exist between total intra-EU exports and total intra-EU imports

[40] See Statistical tables.

[41] See http://ec.europa.eu/eurostat/web/links/national_statistical_offices

[42] See Analytical tables.

recorded in national SUTs — which is the case. In other words, some residual (discrepancy) item is needed to overcome this contradiction unless changes to GDP and the current account balance are made; this should be avoided as the primary focus of an EU inter-country SUIOT is to analyse the interactions between trade and production (and not least because the estimates of output and factors of production are usually of good quality). As such, whether tables are automatically balanced or not, constraining to published National Accounts at EU (and also in general global) level requires a discrepancy item.

As required by users, perhaps the simplest way to achieve EU balanced inter-country SUTs without discrepancy items is to use a standard optimisation model such as GRAS (Temurshoev et al, 2013).

The FIGARO project has eventually produced two different inter-country Use Tables: an inter-country "Statistical" Use Table with explicit discrepancies and an inter-country "Analytical" Use Table, where all discrepancies have been absorbed by the off-diagonal (national) blocs of the "Statistical" Use Table using the GRAS method.

5.9. Construction of inter-country Supply, Use and Input-Output Tables

Once the balanced view of bilateral trade in goods and services was complete and the full set of national SUTs at purchaser's prices and basic prices (with a distinction between domestic and import uses) prepared, the next step was to build the EU-IC-SUTs at basic prices (both from an analytical approach — balanced — and from a statistical approach — unbalanced).

National Import Use Tables (CIF) are generally compiled by national statistical offices without taking into account a global or an EU view of the entire trade affecting the compiler country. Trade asymmetries are not addressed at all except in very few cases, depending very much on the willingness of the affected countries. As a result, the EU balanced view of international bilateral trade undoubtedly provides a better picture of the geographical distribution of trade and the amount of industry imports than national Import Use Tables can do. This is the main reason why it was decided to use exports (FOB) values from the balanced view of trade to populate the EU inter-country Use Table exogenously and then estimate endogenously the corresponding national Import Use Tables (FOB) by country of origin.

First, we used the OECD CIF-FOB margins database to convert national Import Tables from CIF to FOB valuation and compute (average) users' structures to be further distributed across countries of origin. Since the CIF-FOB margins database did not report values across users (intermediate and final) but rather across products and trading partners only, we chose to split the country totals of CIF-FOB margins paid by product across the users' structures provided by the national Import Tables[43] (CIF).

Second, the balanced view of bilateral trade of goods and services (corrected for GSA, merchanting and direct purchases abroad) by trading partner is combined with users' structures of national Import Tables (FOB) in order to build up the intermediate

[43] By doing it this way, we are fully aware that the resulting users' structures of national Import Tables FOB will coincide with those of CIF. However, applying a different users' structure coming from other related data sources can make it different.

and final trade blocs of the EU inter-country Use Table, by product, user and trading partner. The domestic blocs (for EU countries and United States) are copied and pasted from national domestic Use Tables at basic prices together with their value added components and the national rows of taxes less subsidies on products. There is no attempt to estimate a domestic bloc for the rest of the world, which should come from additional coordinated work with the OECD in order to further integrate the FIGARO tables with the global OECD ICIO tables.

The inter-country Use Table is then completed with:

(a) a single row of imports from countries besides the EU Member States and United States and a column of exports to the same geographical areas.

(b) a single row accounting for the reported CIF-FOB National Accounts adjustment values split across users and trading partners[44].

(c) two corresponding rows for direct purchases abroad and purchases of non-residents in the domestic territory (see Section 5.6 for more details) by trading partner.

The inter-country Supply Table is compiled just merging national Supply Tables. Auxiliary columns of imports (CIF) from the rest of the world, domestic trade and transport margins, taxes less subsidies on products and international transport and insurance costs are added to complete the total Supply at purchaser's prices in FOB valuation.

One last adjustment is the conversion of the trade blocs from FOB to basic prices. This was done using fully-fledged national trade and transport margins tables, which were used to estimate the domestic trade and transport margins associated to the bilateral trade flows of the exporting countries.

Additional auxiliary tables are also provided for the total adjustments for GSA and merchanting by reporting country and product; direct purchases abroad by product and country of origin and purchases of non-residents in the domestic territory by product and country of destination.

And last but not least, one single row and one single column of discrepancies are added to the inter-country use Table to account for the difference between the estimated trade (import and export) values and the ones reported by national domestic (i.e. exports) and imports Use Tables. We have denoted this table as the "Statistical" inter-country Use Table because it tries to reflect the statistical concept and coverage differences between trade statistics and National Accounts.

Following Ahmad (2017), misclassification of products might have happened in the course of the conversions of trade statistics by product to the corresponding products in SUTs or during the balancing process of trade asymmetries in trade in goods and services statistics. This method leads to the reduction of discrepancies by product in a replicable and transparent manner by re-classifying product bilateral trade flows while preserving import (by trading partner) totals in each country. Although these discrepancies can be reduced (but not eliminated completely), the main idea is to allocate

[44] The approach is similar to the process described for the full inter-country Use Table; the total CIF-FOB National Accounts adjustment is split across (intermediate and final) users on the basis of national Import Tables and across trading partners using the balanced view of trade in goods adjusted for GSA, merchanting and direct purchases abroad.

differences across products in a way that preserves each country's recorded imports by industry and the geographical allocation of the balanced view of trade. The implementation of Ahmad's approach in order to manually reduce discrepancies can be done either before splitting the balanced bilateral trade flows by product and trading partner across intermediate and final users or afterwards[45].

In the first case, just a table with the balanced view of trade by product and trading partners would be required. Then, the Ahmad's method consists of reallocating positive discrepancies to negative, or negative discrepancies to positive (depending on which one accounts for a higher aggregated absolute value), eliminating entirely either all positive or negative differences. This is done first allocating proportionally discrepancies by trading partner, and afterwards, applying a specific conversion matrix to reallocate product flows without altering the geographical balanced view of trade.

Nevertheless, these adjustments on products can sometimes be higher than the existing flows for some trading partners, thus leading to a negative trade flow for some products (e.g. when positive discrepancies are higher than negative discrepancies). We suggest then re-building the conversion matrix in order to reallocate negative discrepancies instead of positive discrepancies in all cases. This would prevent the generation of negative trade flows as long as the existing trade flows by trading partner are all positive and the total discrepancy is lower than the aggregated flow of the product. The outcome of this process would be a new balanced view of trade where all the positive or negative discrepancies would have been removed preserving the imports total in each country. This new balanced view of trade is subsequently split across intermediate and final users. However, in this project, we have not implemented this approach yet but we envisage doing it in the following revisions of the FIGARO tables.

Subsequently, remaining discrepancies are removed using the GRAS method and providing the user with a balanced and complete "Analytical" inter-country Use Table at basic prices. A last benchmarking process should be carried out to meet the latest National Accounts totals (e.g. GRAS).

The construction of inter-country IOTs was based on the estimated inter-country SUTs. For product by product IOTs, the final use component remains unchanged by definition so no further changes were made in the final use component of the inter-country IOTs. The changes therefore affect only to the intermediate uses by exporting country, trade partner and product and value added by country and product (using either the product or the industry technology assumption, Eurostat, 2008). The final inter-country IOT may also have to respect available national IOTs and eventually be benchmarked against the latest aggregate National Accounts data (i.e.: using GRAS), however none of these were made in the current version of the FIGARO tables.

On industry by industry IOTs, intermediate and final uses (from the inter-country SUTs) have to change by definition while value added remains unchanged. In such case, we assume either fixed product or fixed industry sales structures (Eurostat, 2008) for

[45] This method applied to the fully fledged inter-country Use Table implies the use of bi-proportional adjustments (e.g. GRAS) that might not necessarily converge depending on the restrictions imposed (i.e. import totals by industry and geographical distribution of balanced bilateral trade flows unchanged). During the course of the project, we investigated this approach and did not come up with solutions for all cases.

estimating the missing IOTs. The final IOT should also be benchmarked against the latest aggregate National Accounts data but this was not done this time in order to reflect accurately the SUTs values, even when they were sometimes outdated.

As a final remark, using one single common methodology (e.g. industry technology assumption) across all Member States for the construction of EU inter-country IOTs may turn out to be more consistent than trying to replicate or balance available official IOTs with estimated IOTs together in one single framework. This is precisely what we did for the FIGARO inter-country Input-Output Tables.

As the very last step, we made the appropriate aggregations in products and industries to avoid disclosing confidential data from countries.

5.10. Quality assessment

The modular approach adopted in the FIGARO project to map the different adjustments and imputations to the original data will allow each adjustment/imputation to be measured at the different stages of the compilation process. Summary statistics are provided with the data. Further quality indicators based on Eurostat quality standards will be drawn up in the 2018-2020.

A set of validation rules was implemented to the national Supply, Use and Input-Output Tables and the FIGARO tables, they refer to integrity and consistency checks on each and every element of the tables (e.g. negatives, positives and zeroes should be in the right place); on totals and sub-totals within the tables; and on the balance between Supply, Use and Input-Output Tables work programme.

6. Limitations, further work and recommendations

The FIGARO project should be understood as a first attempt to compile official EU-IC-SUIOTs. The scope of the methods and the assumptions made has been mostly driven by the data availability in each stage of the process. This is the reason why the FIGARO tables still need to be considered as experimental until more official data are incorporated, the methods are agreed among the EU Member States and the tables are regularly produced by Eurostat and integrated into the OECD global inter-country Input-Output Tables.

From 2018 to 2020, Eurostat and the European Commission’s Joint Research Centre will continue to construct a time series of EU-IC-SUIOTs (based on current and previous year’s prices) and improve the data and methods used in this experimental project. This work will also be carried out in close collaboration with the OECD.

A (non-exhaustive) list of potential topics to cover can be the following:

- Estimation of CIF-FOB margins for the EU Member States with information gathered on imports FOB and imports CIF by products and trading partners, wherever possible.
- Collection of more data on adjustments made for GSA and merchanting by product and trading partners;
- Use of Tourism satellite accounts to improve the estimation of direct purchases abroad by product and countries of origin and destination;
- Use the RACE method for the conversion of EBOPS to CPA categories;

- Re-run gravity models to estimate missing trade flows of services trade;
- Use of STEC and TEC data as well as the UN Classification of Broad Economic Categories (BEC) to have more insight in the differentiation between intermediate and final exports;
- Use of estimated re-exports margins based on merchandise trade statistics;
- Further explore the causes of discrepancies and propose solutions;
- Re-think where to make the benchmark to National Accounts data;
- Improve the definition, assessment and monitoring of quality measures by identifying intermediate results and the changes between them.

From this first pilot experience, the quality of the results of the FIGARO tables could be progressively increased in the future if more efforts are put in:

- Aligning the trade figures provided by National Accounts and Balance of Payments;
- Producing more detailed information on the type of goods sent abroad for processing and their corresponding trading partners; the same applies for merchanting activities.
- Progressively reducing trade asymmetries in merchandise trade statistics and international trade in services statistics.

Annex: FIGARO treatment of goods sent abroad for processing and merchanting

We consider the reported adjustment of goods sent abroad for processing (GSA) net of processing services. Some countries report the total GSA adjustment they applied to 2010 data (Germany, Greece, Spain, Cyprus, Latvia, Luxembourg and the Netherlands). For these countries, we directly used the values they provided. Other countries reported total GSA adjustment for 2011 or 2012 (Belgium, Czech Republic, Denmark, Croatia, Italy, Poland, and Slovakia) instead of 2010. So, we computed how much the GSA adjustment was as a share over their total value of exports of goods for 2011 and 2012 and we applied an average share to the total exports of goods of 2010. For the remaining countries that did not report any explicit value in the GNI inventories, we derived the total GSA adjustment using the information provided in the Eurostat report "Statistics on goods under merchanting and goods sent abroad for processing" (Eurostat, 2017) on gross flows connected to inward and outward processing. The information was however for 2013, so we estimated the GSA adjustment for 2010 in the same way as explained earlier for values of 2011 and 2012.

Subsequently, the decomposition of the total GSA adjustment values across trading partners had to be based on the balanced view of manufacturing services trade on physical inputs owned by others (item SA) in the absence of information about bilateral trade flows of goods sent abroad for processing (gross terms) – with the exception of Germany. Since those manufacturing services can be considered as a share of the gross value of the goods traded, this can be derived by applying to the manufacturing services the inverse of a processing margin (Fortanier and Miao, 2017, p. 7). To derive the processing margin we derived implicit processing fees related to inward processing as the difference between exports after processing and imports before processing, and the processing margin as the ratio between processing fees and exports after processing. By using one processing margin per country wherever available (or reliable), we therefore computed a first approximation of the bilateral gross trade flows of the GSA adjustment. As a result, since manufacturing services were already split by trading partner, for each country we were also able to compute the GSA adjustment distributed by trading partner. However, these values had to be eventually benchmarked against those earlier estimated from the GNI inventories and Eurostat (2017) using the GRAS method (Temurshoev et al, 2013).

The decomposition of each GSA bilateral trade flow by CPA product was initially based on the CPA structures of those countries (across all trading partners) that provided information about the type of goods traded with such purpose (Belgium, the Czech Republic, Germany, Italy and the Netherlands) and an average structure for the remaining ones. However, it turned out that these structures were very country-specific, thus leading to meaningless allocations in average structures. Therefore, in the absence of superior data, we eventually opted for assuming the structures given by the balanced view of trade in goods even though we were fully aware that not all goods produced in the economy are susceptible of being sold abroad for processing[46].

[46] At this respect, one way to explore further is to identify goods typically used for intermediate uses and final uses at the most disaggregated level so that different geographical distributions of bilateral trade come up both for intermediate and final goods. This was the approach used in the World Input-Output Database project.

In particular, Belgium (Van den Cruyce, 2016) and Germany provided some information on export (import) after inward (outward) processing and processing fees split by product. The Czech Republic provided information on the exported and imported GSA processing fees distributed by product; so we used the structure of exported processing services to distribute the GSA adjustment across products. The Netherlands (Chong, 2015) and Italy (Bracci et al., 2015) provided information of the GSA processing fees distributed by industry. We derived the gross flows related to the processing fees and the GSA adjustment split by industry, and we used the distribution obtained as a proxy of the distribution of the GSA adjustment by product.

The resulting estimations of the GSA adjustments by CPA product were further used to build up the part of the EBOPS-CPA bridge matrix related to item SA (Manufacturing services on physical inputs owned by others). Ultimately, some ad-hoc adjustments had to be made in a few cases to avoid negatives whenever the adjustment turned out to be higher than the bilateral trade flow.

In practice, a merchanting activity is nothing other than a re-export without the good crossing the border of the merchanting country. Very few countries are able to produce statistics that identify the origin country of merchanting services. The transactions related to merchanting are recorded in goods account under the 2008 SNA. As such, for consistency with national SUTs, merchanting services need to be added to the balanced merchandise trade statistics to align with the National Accounts estimates of exports.

For merchanting transactions (under the 2008 SNA), adjustments are needed to ensure that exports of goods include the merchanting margin applied by the merchant in the country where it is resident. Assuming that the merchanting transaction occurs in the same period, the adjustment to merchandise trade statistics requires a positive entry (export) of goods in the merchanting country as the corresponding import of goods in the counterpart country is already included. In this context, it is important to remember that the balanced view of bilateral trade in services explicitly excludes merchanting-related transactions from both the estimates of exports and imports of any given country.

For example, a Dutch trader sells fish from a Danish ship at the Port of Helsinki for EUR 1.5 million, with a merchanting fee of EUR 0.5 million. The international merchandise trade statistics record EUR 1 million for Finnish imports of fish from Denmark and EUR 0.5 million for Finnish imports of trade services from the Netherlands. However, SNA requires that EUR 1 million is recorded for the Dutch import (negative export) of fish from Denmark and EUR 1.5 million for the Dutch export of fish to Finland, including the merchanting fee. The necessary adjustments to align trade statistics with SNA would therefore consist of reducing Finnish imports of fish from Denmark by EUR 1 million, reducing Finnish imports of merchanting (trade) services from the Netherlands by EUR 0.5 million, adding (negative) exports of fish from Denmark to the Netherlands of EUR 1 million and adding Dutch exports of fish to Finland of EUR 1.5 million. The difference is considered the output of the merchanting activity recorded in the Dutch economy (merchanting fee).

The balance of payments provides information about the net exports of goods under merchanting by country; however, it contains limited information about the goods linked to those merchanting activities and who the trading partners are. Total adjustments for 2010 made in relation to net exports of goods under merchanting by country are collected in the Balance of Payments statistics and in the GNI inventories. Whenever the

reference year was missing (in four countries), we made an estimation based on the subsequent years (2011-2016, depending on availability).

For the geographical distribution, the balanced view of trade in goods was used as a general rule constrained to country-specific information for euro-area, non-euro area and extra-EU regions (BOP). On product distribution, two possible options were considered — that provided by the balanced view of merchandise trade or that derived from the international TTM (CIF-FOB ratios applied to balanced merchandise trade).

The decomposition of each bilateral merchanting adjustment by CPA product was initially based on the balanced view of international transport and insurance costs. Nevertheless, not all goods produced in the economy are susceptible of being sold under merchanting. So, we adjusted the initial distribution to take into account the CPA structures of those countries (across all trading partners) that provided information about the type of goods traded under merchanting (Austria, Estonia, Finland, Poland and the Netherlands[47]) and an average structure for the remaining ones. However, for similar reasons as for GSA adjustments, we eventually opted for applying the CPA structure of the balanced view of trade in goods for the remaining countries instead of the average structures of the ones providing the necessary data.

[47] On an industry basis.

Layout of the EU-IC-SUIOTs

Statistical Supply Table

	INDUSE →	A01	A02	...	U	P1_TC	P7	TS_BP	D21X31	OTTM	TS_PP	ITTM	TS_PF
REF_AREA	**PROD_NA ↓**												
AT	CPA_A01			...									
AT	CPA_A02			...									
AT	...	...	...	...	...	...	...	...	...	...	...	...	...
AT	CPA_U			...									
AT	**P1_TR (=TOTAL)**			...									
AT	C01												
AT	C02												
AT	**C03**			...									
AT	P11			...									
AT	P12			...									
AT	P13			...									
BE	CPA_A01			...									
BE	CPA_A02												
BE	...	...	...	...	...	...	...	...	...	...	...	...	...
BE	CPA_U			...									
BE	**P1_TR (=TOTAL)**			...									
BE	C01												
BE	C02												
BE	**C03**			...									
BE	P11			...									
BE	P12			...									
BE	P13			...									
...	...	...	...	...	...	...	...	...	...	...	...	...	...
US	CPA_A01			...									
US	CPA_A02			...									
US	...	...	...	...	...	...	...	...	...	...	...	...	...
US	CPA_U			...									
US	**P1_TR (=TOTAL)**			...									
US	C01												
US	C02												
US	**C03**			...									
US	P11			...									
US	P12			...									
US	P13			...									

Labels:

REF_AREA: Country of reference, e.g. AT (Austria), BE (Belgium), US (United States).
PROD_NA: Product classification, e.g. CPA_A01 (Agriculture)
IND_USE: NACE classification, e.g. A01 (Agriculture)
C01: CIF/FOB adjustment on imports
C02: Direct purchases abroad by residents; C03= C01+C02
P1_TR = Total output by industry
P11: Market output
P12: Output for own final use
P13: Non-market output
P1_TC: Total output by product
P7: Imports CIF
TS_BP: Total Supply at basic prices
D21x31: Taxes less subsidies on products
OTTM: Trade and transport margins
TS_PP: Total Supply at purchaser's prices
ITTM: International trade and transport margins
TS_PF: Total Supply at purchaser's prices and FOB

Colours: Subtotals (yellow); Products and other concepts (orange); Activities and other concepts (blue); void cells (grey).

Statistical Use Table

	INDUSE →	A01	A02	...	U	A01	A02	...	U	...	A01	A02	...	U	P2_TC	P3_S14	P3_S15	P3_S13	P51G	P5M	P3_S14	P3_S15	P3_S13	P51G	P5M	...	P3_S14	P3_S15	P3_S13	P51G	P5M	P6	TFU	C_DISC	TU
	COUNTERPART_AREA →	AT	AT	...	AT	BE	BE	...	BE	...	US	US	...	US	W2	AT	AT	AT	AT	AT	BE	BE	BE	BE	BE	...	US	US	US	US	US	FIGX	W2	W2	W2
REF_AREA	**PROD_NA ↓**			...				...					...																						
AT	CPA_A01			...				...					...																						
AT	CPA_A02			...				...					...																						
AT	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
AT	CPA_U			...				...					...																						
BE	CPA_A01			...				...					...																						
BE	CPA_A02			...				...					...																						
BE	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
BE	CPA_U			...				...					...																						
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
US	CPA_A01			...				...					...																						
US	CPA_A02			...				...					...																						
US	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
US	CPA_U			...				...					...																						
FIGX	P7			...				...					...																						
W2	CIFOBADJ			...				...					...																						
W2	**P2_TR**			...				...		...			...																						
W2	**R_DISC**			...				...					...																						
W2	C02																																		
W2	C05																																		
W2	C07			...				...					...																						
W2	**C09**			...				...					...																						
W2	D1			...				...					...																						
W2	D29X39			...				...					...																						
W2	B2A3G			...				...					...																						
W2	**B1G**			...				...					...																						
W2	**P1**			...				...					...																						

Colours: (same as Statistical Supply Table)

Labels:

REF_AREA: Country of reference, e.g. AT (Austria), BE (Belgium), US (United States).
COUNTERPART_AREA: Trading partner, e.g. AT (Austria), BE (Belgium)…
P7: Imports CIF
FIGX: Rest of the world
CIFOBADJ: CIF/FOB adjustment (from SUTs)
P2_TR: Total intermediate consumption by activity
C02: Direct purchases abroad by residents
C05: Purchases of non-residents in the domestic territory
P2_TC: total intermediate consumption by product
C_DISC: Column of discrepancy
PROD_NA: Product classification, e.g. CPA_A01 (Agriculture)

P3_S14: Consumption of households
P3_S15: consumption NPISH
P3_S13: Government consumption
P51G: Gross fixed capital formation
P5M: Changes in valuables and inventories
TU: Total use

C07: Taxes less subsidies on products (also D21x31)
D1: Compensation of employees
D29x39: Other net taxes on production
B2A3G: Gross operating surplus
B1G: Gross value added
P1 = Total output
W2: Domestic
P6: Exports
TFU: Total final use
R_DISC: Row of discrepancy
IND_USE: NACE classification, e.g. A01 (Agriculture)

C09: Totals of intermediate consumption and final use

Analytical Use Table

	INDUSE →	A01	A02	...	U	A01	A02	...	U	...	A01	A02	...	U	P2_TC	P3_S14	P3_S15	P3_S13	P51G	P5M	P3_S14	P3_S15	P3_S13	P51G	P5M	...	P3_S14	P3_S15	P3_S13	P51G	P5M	P6	TFU	TU
	COUNTERPART_AREA →	AT	AT	...	AT	BE	BE	...	BE	...	US	US	...	US	W2	AT	AT	AT	AT	AT	BE	BE	BE	BE	BE	...	US	US	US	US	US	FIGX	W2	W2
REF_AREA	**PROD_NA ↓**			...				...					...																					
AT	CPA_A01			...				...					...																					
AT	CPA_A02			...				...					...																					
AT	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...	...	...	...	...	...
AT	CPA_U			...				...					...																					
BE	CPA_A01			...				...					...																					
BE	CPA_A02			...				...					...																					
BE	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...	...	...	...	...	...
BE	CPA_U			...				...					...																					
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...	...	...	...	...	...
US	CPA_A01			...				...					...																					
US	CPA_A02			...				...					...																					
US	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...	...	...	...	...	...
US	CPA_U			...				...					...																					
FIGX	P7			...				...					...																					
W2	CIFOBADJ			...				...					...																					
W2	**P2_TR**			...				...		...			...																					
W2	C02																																	
W2	C05																																	
W2	C07			...				...					...																					
W2	**C09**			...				...					...																					
W2	D1			...				...					...																					
W2	D29X39			...				...					...																					
W2	B2A3G			...				...					...																					
W2	**B1G**			...				...					...																					
W2	**P1**			...				...					...																					

Colours: (same as Statistical Supply Table)

Labels:

REF_AREA: Country of reference, e.g. AT (Austria), BE (Belgium), US (United States).
COUNTERPART_AREA: Trading partner, e.g. AT (Austria), BE (Belgium)…
P7: Imports CIF
FIGX: Rest of the world
CIFOBADJ: CIF/FOB adjustment (from SUTs)
P2_TR: Total intermediate consumption by activity
C02: Direct purchases abroad by residents
C05: Purchases of non-residents in the domestic territory
P2_TC: total intermediate consumption by product
PROD_NA: Product classification, e.g. CPA_A01 (Agriculture)

P3_S14: Consumption of households
P3_S15: consumption NPISH
P3_S13: Government consumption
P51G: Gross fixed capital formation
P5M: Changes in valuables and inventories
TU: Total use

C07: Taxes less subsidies on products (also D21x31)
D1: Compensation of employees
D29x39: Other net taxes on production
B2A3G: Gross operating surplus
B1G: Gross value added
P1 = Total output
W2: Domestic
P6: Exports
TFU: Total final use
IND_USE: NACE classification, e.g. A01 (Agriculture)

C09: Totals of intermediate consumption and final use

Analytical Input-Output Table
(product by product)

	PROD_NA →	CPA_A01	CPA_A02	…	CPA_U	CPA_A01	CPA_A02	…	CPA_U	…	CPA_A01	CPA_A02	…	CPA_U	P2_TC	P3_S14	P3_S15	P3_S13	P51G	P5M	P3_S14	P3_S15	P3_S13	P51G	P5M	…	P3_S14	P3_S15	P3_S13	P51G	P5M	P6	TFU	TU
	COUNTERPART_AREA →	AT	AT	…	AT	BE	BE	…	BE	…	US	US	…	US	W2	AT	AT	AT	AT	AT	BE	BE	BE	BE	BE	…	US	US	US	US	US	FIGX	W2	W2
REF_AREA	PROD_NA ↓			…				…					…																				
AT	CPA_A01			…				…					…																				
AT	CPA_A02			…				…					…																				
AT	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…		…	…	…	…	…	…	…	…	…	…	…	…	…
AT	CPA_U			…				…					…																				
BE	CPA_A01			…				…					…																				
BE	CPA_A02			…				…					…																				
BE	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…		…	…	…	…	…	…	…	…	…	…	…	…	…
BE	CPA_U			…				…					…																				
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…		…	…	…	…	…	…	…	…	…	…	…	…	…
US	CPA_A01			…				…					…																				
US	CPA_A02			…				…					…																				
US	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…		…	…	…	…	…	…	…	…	…	…	…	…	…
US	CPA_U			…				…					…																				
FIGX	P7			…				…					…																				
W2	CIFOBADJ			…				…					…																				
W2	**P2_TR**			…				…		…			…																				
W2	C02																																
W2	C05																																
W2	C07			…				…					…																				
W2	**C09**			…				…					…																				
W2	D1			…				…					…																				
W2	D29X39			…				…					…																				
W2	B2A3G			…				…					…																				
W2	**B1G**			…				…					…																				
W2	**P1**			…				…					…																				

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P6: Exports
TFU: Total final use
C09: Totals of intermediate consumption and final use

Analytical Input-Output Table
(industry by industry)

	INDUSE →	A01	A02	...	U	A01	A02	...	U	...	A01	A02	...	U	P2_TC	P3_S14	P3_S15	P3_S13	P51G	P5M	P3_S14	P3_S15	P3_S13	P51G	P5M	...	P3_S14	P3_S15	P3_S13	P51G	P5M	P6	TFU	TU
	COUNTERPART_AREA →	AT	AT	...	AT	BE	BE	...	BE	...	US	US	...	US	W2	AT	AT	AT	AT	AT	BE	BE	BE	BE	BE	...	US	US	US	US	US	FIGX	W2	W2
REF_AREA	**IND_USE ↓**			...				...					...																					
AT	A01			...				...					...																					
AT	A02			...				...					...																					
AT	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...	...	...	...	...
AT	U			...				...					...																					
BE	A01			...				...					...																					
BE	A02			...				...					...																					
BE	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...	...	...	...	...
BE	U			...				...					...																					
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...	...	...	...	...
US	A01			...				...					...																					
US	...			...				...					...																					
US	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...	...	...	...	...
US	U			...				...					...																					
FIGX	P7			...				...					...																					
W2	CIFOBADJ			...				...					...																					
W2	**P2_TR**			...				...		...			...																					
W2	C02																																	
W2	C05																																	
W2	C07			...				...					...																					
W2	**C09**			...				...					...																					
W2	D1			...				...					...																					
W2	D29X39			...				...					...																					
W2	B2A3G			...				...					...																					
W2	**B1G**			...				...					...																					
W2	**P1**			...				...					...																					

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List of acronyms/explanations

APEC	Asia-Pacific Economic Cooperation
BEC	Broad Economic Categories (UN classification)
BPM5	Balance of Payments and International Investment Position Manual, fifth edition (IMF)
BPM6	Balance of Payments and International Investment Position Manual, sixth edition (IMF)
CEPII	Centre d'Études Prospectives et d'Informations Internationales (French institute for research into international economics)
CIF	Cost, insurance and freight
COMEXT	Eurostat's reference database for detailed statistics on international trade in goods
CPA	Classification of products by activity
CPC	Central product classification
DG	Directorate General (European Commission)
EBOPS	Extended Balance of Payments Services
ECFIN	DG Economic and Financial Affairs
EMPL	DG Employment, Social Affairs and Inclusion
ENV	DG Environment
ESA	European System of Accounts
ESTAT	Eurostat
EU	European Union
EU-IC-SUIOT	EU inter-country Supply, Use and Input-Output Tables
EUR	euro currency
FIGARO	Full International and Global Accounts for Research in Input-Output Analysis
FOB	Free on board
GRAS	Generalised RAS
GROW	DG Internal Market, Industry, Entrepreneurship and SMEs
GVC	Global value chain
HS	Harmonised System (World Customs Organization)
ICIO	Inter-country Input-Output
IC-SUIOT	Inter-country Supply, Use and Input-Output Tables
IOT	Input-output table
ISIC	International Standard Industrial Classification
NACE	Statistical classification of economic activities in the European Community
NAFTA	North American Free Trade Agreement
OECD	Organisation for Economic Co-operation and Development
RTD	DG Research and Innovation
STEC	Services trade by enterprise characteristics
SUIOT	Supply, use and Input-Output Tables
SUT	Supply and Use Table
TEC	Trade by enterprise characteristics
TLS	Taxes less subsidies
TRADE	DG Trade
TTM	Trade and transport margins
UN COMTRADE	United Nations International Trade Statistics database
UNSD	United Nations Statistics Division