Measuring International Trade and Economic Globalization

Ronald Jansen (United Nations)

André Loranger (Statistics Canada)

Moreno Da Pont (Statistics Canada)

Bert Kroese (Statistics Netherlands)

Oscar Lemmers (Statistics Netherlands)

Rutger Hoekstra (Statistics Netherlands)

Paper Prepared for the IARIW 33rd General Conference

Rotterdam, the Netherlands, August 24-30, 2014

Session 7C

Time: Friday, August 29, Morning

Measuring International Trade and Economic Globalization

Ronald Jansen (United Nations Statistics Division)[1]
André Loranger (Statistics Canada)[2]
Moreno Da Pont (Statistics Canada)
Bert Kroese (Statistics Netherlands)
Oscar Lemmers (Statistics Netherlands)
Rutger Hoekstra (Statistics Netherlands)

Abstract

In recent years, concerns were raised about the shortcomings of the existing official trade statistics, since they do not reflect the changing business practices and could be misleading for the non-expert user. The high level of import content in exports makes gross bilateral trade statistics unsuitable for bilateral trade negotiations, and requires new measures which better reflect the unprecedented level of interdependency among countries engaged in global value chains. In order to understand the true nature of trade relationships, we need to know what each country along a global value chain contributes to the value of a final product. We also need to know how that contribution is linked to those of other suppliers in other countries coming before and after along the chain, and how much employment is generated through this value addition.

Within this changed economic landscape, more complex measures of trade and production are necessary while linking the micro- and macro-approaches. This paper presents the new developments within the context of the Friends of Chair group on International Trade and Economic Globalization under the auspices of the United Nations Statistical Commission. The paper also presents examples of some recent work in this respect by Statistics Canada and Statistics Netherlands.

---

[1] This paper is developed within the context of the referenced Friends of the Chair group, but is not a product of this group. The authors only are accountable for the paper and any of its shortcomings. Readers are invited to provide their comments to Ronald Jansen, jansen1@un.org.
[2] In addition to the two authors of Statistics Canada mentioned in the title section, we would like to gratefully acknowledge the contributions of their colleagues Daniela Ravindra, James Tebrake and Patrick O'Hagan.

1.   Introduction

In recent years, concerns were raised about the shortcomings of the existing official trade statistics, since they do not properly reflect bilateral economic relations[3]. The high level of import content in exports makes gross bilateral trade statistics unsuitable for bilateral trade negotiations. Trade analysis requires new measures which better reflect the level of interdependencies among countries engaged in global value chains (GVCs). In order to understand the true nature of trade relationships, we need to know what each country along a global value chain contributes to the value of a final product. We also need to know how that contribution is linked to those of other suppliers in other countries coming before and after along the chain, and how much employment and income is generated through this value addition.

The statistical community responded to these concerns through a number of initiatives, such as the Global Forum on Trade Statistics organized by the United Nations Statistics Division (UNSD), Eurostat, WTO and UNCTAD in 2011, the OECD-WTO initiative on Trade in Value-Added launched in 2012, and the 2013 Eurostat report on Global Value Chains. An official response was delivered by bringing the measurement of international trade and economic globalization to the agenda of the UN Statistical Commission in 2013 (UN, 2013a) and again in 2014 (UN, 2014). The corresponding decisions of the Commission stress the need for a measurement framework and a mechanism for coordination. Specifically, in Decision 44/106 of its session in 2013 (UN 2013b), the Commission recognized the need for an overarching measurement framework for international trade and economic globalization, taking into account the existing frameworks and guidelines of the System of National Accounts, Balance of Payments, and the Guidelines on Integrated Economic Statistics, as well as the research and studies done by Eurostat, the OECD, the IMF and various working groups. The Commission also recognized the need for an appropriate mechanism for coordination of the work in this field, ensuring that the functions of the existing expert groups, working groups and task forces are accounted for at the international and regional levels. In the same decision, the Commission agreed to the creation of a "friends of the chair" (FOC) group tasked with preparing a concept paper on the scope and content of the framework, and on the appropriate mechanism for coordination of the work in this area.

This paper presents the proposal on how to frame the measurement of international trade and economic globalization, and how to formulate a corresponding research agenda. The paper also presents examples of the work in this respect by Statistics Netherlands and Statistics Canada.

---

[3] An overview of concerns is given in the introduction of the 2013 report of the Secretary General to the United Nations Statistical Commission on international trade statistics (UN, 2013a)

2.   Globalization of business practices

The global economy is increasingly structured around GVCs that account for a rising share of international trade, global GDP and employment. GVCs link firms, workers and consumers around the world and often provide a stepping stone for firms and workers in developing countries to integrate into the global economy. A GVC describes the full range of activities that firms and workers perform to bring a product from its conception to end use. This includes activities such as design, production, marketing, distribution and support to the final consumer.

Figure 1. Basic components of a production network (Dicken, 2011)
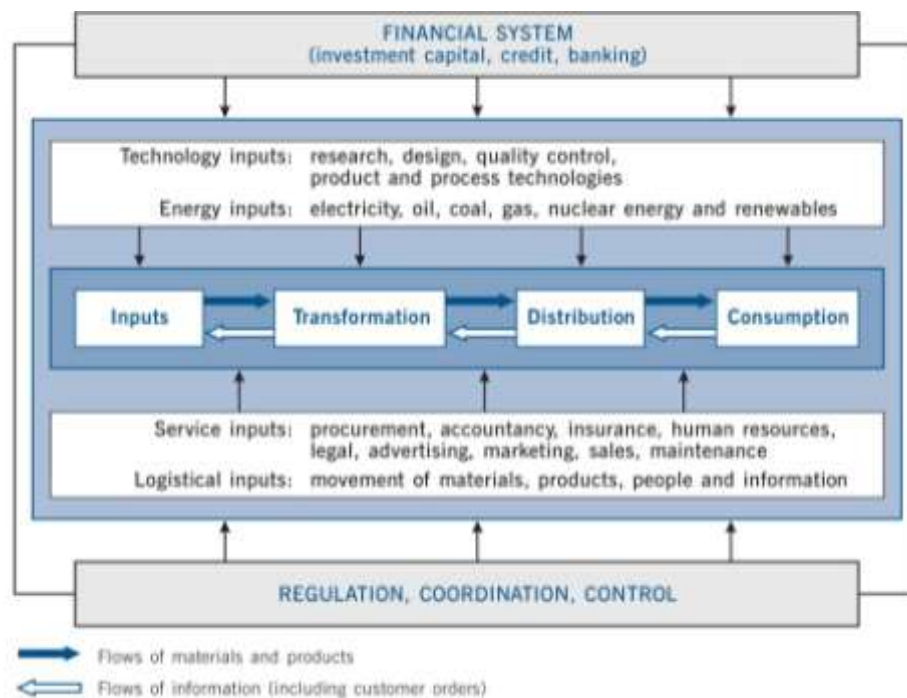
The flow chart above from Peter Dicken's Global Shift publication in 2011 (Dicken, 2011) shows the many processes typically involved in the production of a good or service. These processes could in principle be executed locally by one large enterprise. However, nowadays these processes are most often distributed over a number of enterprises, which typically are spread over many countries. These enterprises could be linked through arm's length arrangements or through intra-firm trade inside a multi-national enterprise.

The fact that exports increasingly embody intermediate inputs sourced from abroad renders it difficult to identify the real contribution that a given export may make to an economy's material well-being, whether in terms of income or of employment. Moreover, conventional trade statistics are not necessarily able to determine those sectors of the economy where value added originates. In developed economies, a large share of the total value added generated by manufactured exports originates in the service sector. Disentangling the domestic value chain

into its sectoral components can therefore shed new light on the sources of international competitiveness and the direct and indirect employment impacts of trade.

In the context of globalization, the activities that constitute a value chain are carried out in inter-firm networks on a global scale. The dependency structures of the firms in the GVC networks are of crucial importance in order to measure where income, knowledge and employment are generated, and to understand potential risk and vulnerabilities in case of a financial crisis. Within this changed economic landscape, more complex measures of trade and production are necessary both on micro-and macro-economic level. An overview of the work on GVC analysis can be found in the 2013 synthesis report of OECD[4] (OECD, 2013) and at the website of Duke University's Center for Globalization, Governance and Competitiveness[5].

3.   Global production and the impact of globalization on national accounts

The UNECE Task Force on the impact of globalization on national accounts summarized the changing business practices very well, when it stated in its 2011 Handbook that in national accounts terms, globalization is the process of replacing national economic structures and transactions by international ones (UNECE, 2011). Corporations organize their production and marketing at a global level, with vertical production processes spanning several countries. Capital such as intellectual property can be used simultaneously across the world in a multinational enterprise (MNE). Labour is mobile, and income returned to the home country can be an important part of its national (disposable) income. Household and business spending becomes more international as the worldwide web expands spending opportunities. The increasingly global nature of economic transactions and arrangements presents a challenge to the application of national accounts concepts and the use of data collection and compilation systems for measuring developments in the domestic economy. Features of globalization which directly affect national accounts measures include the following:

i.   MNEs organizing their business across national boundaries to maximize production efficiency and minimize their global tax burden.

ii.   Far more foreign direct investment (FDI) relationships, and the need to identify and allocate direct investment flows.

iii.   Transfer pricing between affiliated corporations (pricing of imports and exports between affiliated companies in the absence of a market transaction).

iv.   The use of offshore vehicles (special purpose entities (SPEs)) to arrange finance for global activities and for other purposes.

---

[4] See http://www.oecd.org/industry/ind/global-value-chains.htm
[5] See http://www.cggc.duke.edu/

    v.   The increase in international trade in services, including the practice of sending goods abroad for processing with no change in ownership.

    vi.   An increase in international merchanting, where the merchant arranges the export of goods from country A to country B, without the goods ever crossing the borders of the country where the merchant is resident.

   vii.   The trade in and use of intellectual property products (IPPs) across the world.

To a large extent these issues are still on the research agenda. This work was therefore continued by the UNECE Task Force on Global Production, which is about to release its Guidelines on Measuring Global Production, addressing among others the typology of global production arrangements. A paper on these guidelines is also presented at this IARIW conference (De Haan, et al., 2014).

The main purpose of the typology is to enhance international comparability by helping national accountants and balance of payments compilers to determine:

    a.   The roles of the various actors in a global value chain;

    b.   Who are the economic owners of input, outputs and assets along the production chain;

    c.   The nature of transactions taking place inside the global value chain.

The typology for arrangements involving the manufacturing of goods is comprehensively developed. However, global production has also entered the domain of services. At this point in time, the obtained evidence on the international value chains of services was too limited and further guidance needs to be developed. The Task Force discussed extensively the issue of Factoryless Goods Producers (FGPs) as producers that outsource their manufacturing activities but own the underlying intellectual property products (IPPs) and control the outcome of the production process. While a majority opinion on the treatment of FGPs was given to the Advisory Expert Group on National Accounts for its meeting in September 2014, no definite solution was available at this time.

4.   Framing the measurement of international trade and economic globalization

National economies relate to one another in a number of ways be it through trade in goods, trade in services, tourism, foreign direct investment, establishment of foreign affiliates, transfer of knowledge, creation of jobs, redistribution of income, migrant workers, emissions of CO_2 or in other ways. As further explained below, a comprehensive way of charting those interdependencies is through global Supply and Use tables (SUTs), in which countries connect through imports and exports of goods and services into and out of specific industries. Using various assumptions about technology, symmetric Input-Output tables (IOTs) can be derived from SUTs in basic prices. The tables can be of a product-by-product type or an industry-by-industry type. An industry-by-industry IOT essentially maps the purchases and sales of each

industry sector to and from all other industry sectors. A product-by-product IOT maps in monetary terms how which products are used to produce a specific product (Remond-Tiedrez et al, 2011).

An overview of global SUTs and global Input-Output Tables (IOTs) was recently described by Tukker and Dietzenbacher (2013). They brought together examples of the world's most ambitious projects and studies in the field of global multiregional input–output (GMRIO) modeling, such as WIOD (Dietzenbacher et al., 2013), EORA (Lenzen et al., 2012a; 2012b) and EXIOBASE (Tukker et al., 2009; 2013).

4.1   National Supply and Use tables

As indicated in the *System of National Accounts 2008* (UN et al., 2009), national supply and use tables are powerful tools with which to compare and contrast data from various sources and improve the coherence of the economic information system. They permit an analysis of markets and industries and allow productivity to be studied at the level of business statistics. The amount of a product available for use within the economy must have been supplied either by domestic production or by imports. The same amount of the product entering an economy in an accounting period must be used for intermediate consumption, final consumption, capital formation (including changes in inventories) or exports, which provides a statement of a product balance. Assuming that output, imports and exports are well measured then the identity of the product balance can be used to generate data for consumption that will be consistent with other items in the identity. With a complete set of product balances, supply and use tables can be created. Supply and use tables exist in pairs with common valuation and level of detail as regards the products identified.

4.2   Global Supply and Use Tables

Ideally, the global SUTs contain for each international flow an export of a product from an industry of one country into an industry (or into final consumption) of another country, as the corresponding and matching import. In principle, only one pair of global SUTs should exist to be used by all national and international agencies for the analysis of trade and globalization. Besides the implicitly mentioned matching of bilateral trade flows (both for goods and services), further refinement may be necessary, for example, regarding the use of inputs by type of enterprise for either the domestic or the international market, including the special cases of multi-national enterprises and their foreign affiliates, goods for processing (manufacturing services) and re-exports.

Compiling a global SUT requires a very close alignment and harmonization of national SUTs, price statistics and trade statistics. In the longer term, the existing recommendations for international trade statistics would need to be reviewed with the purpose of making them more symmetrical in terms of the reporting of exports and imports, and thus more suitable for the compilation of a global SUT. To achieve results in the short term, some practical decisions need

to be taken and agreed upon internationally for the creation of a symmetrical and fully balanced bilateral trade matrix at the global level, which would have buy-in, cooperation and endorsement of all concerned countries. This matrix would be built strictly for the purpose of compiling an internationally recognized and accepted SUT, for which an appropriate governance structure would also have to be agreed upon. Methods might also be developed to create tables that are closer to the national official statistics of one of the countries (see example from Netherlands).

4.3 Measuring Trade in Value Added

The OECD and WTO joined forces in 2012 to produce new estimates[6] of international trade by measuring trade in value added instead of in gross terms (OECD, 2011; OECD-WTO, 2012; Ahmad, 2013). The first results of Trade in Value Added (TiVA) estimates were launched in January 2013, followed by some more recent releases covering more years, countries and indicators. The compilation of these TiVA estimates uses inter-country input-output tables (IOTs) based on national supply-use tables (SUTs) and national IOTs. Depending on a country's economic diversification, more sophisticated national SUTs would need to be developed using relevant strata, such as the size and export intensity of firms. For instance, for China and Mexico, there is a very important distinction between exporting firms that process under contract, other exporting firms and non-exporting firms, and aggregations of production units over those strata within SUTs will improve their validity.

In a recent paper titled "Extending OECD's Work on Measuring Trade in Value-Added" (OECD, 2014) OECD recognizes four advantages of creating global SUTs over creating global IOTs:

o   Increased availability of national SUTs, as recommended in the 2008 SNA;
o   Increased coherence between trade statistics (measured on a product level) and SUTs, compiled on a product by industry basis;
o   Coherence between SUTs and the national accounts;
o   Increased timeliness of national SUTs, compared to IOTs.

An extended framework for SUTs would entail a breakdown of current industry classifications (2-digit ISIC) into new sub categories that aggregate firms on the basis of (a) ownership, (b) export intensity and (c) size, where the format of the extended SUT need not be the same for all countries. Different criteria could be used to aggregate units based on the underlying statistical information system and prevalence of the types of firms engaged in GVCs. The OECD paper provides illustrations of an extended Supply table and an extended Use table, which includes a number of additional items, such as Jobs, Income related to Foreign Direct Investment, and also Emissions.

---

[6] See http://www.oecd.org/industry/ind/measuringtradeinvalue-addedanoecd-wtojointinitiative.htm

4.4 A System of International Accounts

The implications of building a global SUT are farther reaching than just addressing asymmetries in trade and heterogeneity in firms. The underlying concepts and definitions as basis for measurement of these international statistics would need to be reviewed. In terms of the 2008 SNA, the Rest of the World Account would need to be more explicitly defined, especially since a global SUT implies a perfect alignment of international flows, and some international recommendations regarding heterogeneity of firms (where economically relevant). In the longer term, this set of new concepts and definitions could form a System of International Accounts, as the measurement framework for international trade and economic globalization.

5. Micro-Macro links: some new initiatives

International economic and other relations among countries are first of all measured at micro-level be it through trade in goods, trade in services, foreign direct investment, establishment of foreign affiliates or transfer of intellectual property products. Some understanding of the interconnectedness of economies comes from an understanding of the production networks organized through global value chains with various governance structures, including multi-national enterprise groups. Whereas the micro-data give some understanding of the importance of an industry sector, a product or a trading partner, the relative importance nationally, regionally and globally is not easily determined, especially not if we want to consider the value added of the transactions. As outlined in the previous section, a System of International Accounts with the use of global Supply and Use tables could be the macro-frame against which that relative importance of – for instance – industrial sectors in terms of micro-data could be evaluated.

5.1 A global database of SUTs

Within the context of the post-2015 development agenda and its need for integrated – economic, environmental and social – indicators, a proposal was recently[7] presented to establish a repository of national SUTs for use by the global community of researchers in order to construct a global SUT/IOT. National, regional and global sustainable development indicators could then be compiled using this global SUT/IOT. Specifically, Tukker and Geschke proposed a global laboratory in a cloud environment with collaboration and active input from the international organizations, the national statistical systems and the scientific community (Tukker and Geschke, 2014). The measurement of international trade and economic globalization could be part of that project.

---

[7] See http://unstats.un.org/unsd/envaccounting/ceea/ and
http://unstats.un.org/unsd/envaccounting/ceea/meetings/ninth_meeting/lod9.htm

5.2   Balancing bilateral trade

At the same time efforts are underway to improve the harmonization of bilateral trade statistics. Ideally, a global SUT contains for each international flow an export of a product from an industry of one country into an industry (or into final consumption) of another country, as the corresponding and matching import. This implies that reported bilateral exports would match reported bilateral imports (from partner countries). This issue is not new (see Guo, et al., 2009), but receives renewed attention due to emphasis on constructing a global SUT.

5.3   Global Value Chain mapping and SUTs

Besides the more macro-level approaches of global SUT and TiVA, firm-level analysis has received a lot of attention over recent years as well. Analysis of GVCs has been a driver for improvement of measurement of economic globalization (Gereffi and Fernandez-Stark, 2011; Millberg and Winkler, 2010; Cattaneo, et al., 2013; WTO and IDE-JETRO, 2011; Goger et al., 2014). At the same time the international sourcing of core and supplementary business functions was integrated into the GVC analysis (see Sturgeon et al, 2014). An overview of the work on GVCs and business functions was recently given by Timothy Sturgeon on behalf of Eurostat (Sturgeon, 2013). He provided a synthesis of the measurement of GVCs, outsourcing of business functions, international trade and economic globalization within the European context.

Against this background, UNSD in collaboration with the Duke Center on Globalization, Governance and Competitiveness attempts to link mappings of GVCs directly to SUTs in order to measure the economic impact of a particular GVC in the overall (national, regional or global) economy. The joint paper, which will be presented at the conference[8] on the measurement of international trade and economic globalization in Aguascalientes at the end of September 2014, gives examples of the GVC for the textile industry and of several GVCs in relation to the economy of Costa Rica.

6.   Examples of the Micro-Macro approach at national level

The programme of the modernisation of European enterprise and trade statistics (MEETS), which ran within the European statistical system (ESS)[9] from 2009 until 2013, was among others about integration of data collection and data processing. The objective was to more effectively use existing data by integrating data already collected into a single system or by using micro-data linking techniques. Additionally, efforts were directed at increasing the use of administrative data and taking advantage of the harmonization of accounting standards. The MEETS aimed to improve:

---

[8] See http://unstats.un.org/unsd/trade/events/2014/mexico.asp
[9] ESS is a partnership between Eurostat and national statistical institutes or other national authorities in each European Union (EU) Member State responsible for developing, producing and disseminating European statistics.

- Consistency of concepts and methods for business and trade-related statistics;
- EuroGroup Register (EGR) methodology and profiling;
- Use of administrative data, data warehouse and linking;
- Methodology for modern business statistics

On 25-26 June 2014 in Luxembourg, a dedicated conference[10] was organized to present the results of the MEETS programme. These results provide important input for the future of European business and trade statistics, in particular with regards to its integration and better reflection of globalization phenomena. In his opening remarks, Walter Radermacher, Chief Statistician of the European Union, urged the EU member states to put the obtained results into practice and stressed that always a close link should be kept between the micro-statistics and the macro-statistics.

In the sections hereafter, Statistics Netherlands and Statistics Canada provide specific examples of how micro-data can be effectively linked to the macro-framework.

6.1 Improving TiVA and carbon footprint indicators that are consistent with national accounts and that use micro-data of re-exports (Statistics Netherlands)

Over the last couple of years Statistics Netherlands has been experimenting with two types of indicators that are related to globalization: the carbon footprint and trade in value-added. To properly calculate these indicators it is important to use a multi-regional input-output (MRIO) database. However, the problem of MRIOs is that these are, inevitably, inconsistent with national official statistics. MRIOs may be different from national statistics for a variety of reasons, as systematically recorded by Hoekstra et al. (2014). One of the most important reasons is the problem of bilateral asymmetries in trade statistics, by which – for instance - Dutch exports to Germany differ from German imports from the Netherlands.

The advantage of the MRIO (over a set of national IO tables) is that it contains harmonized data, constructed with the same methodology (for example the conversion from SUT to IOT), which makes it an excellent data source for the analysis of global policies, since it enables the user to compare several countries in a consistent manner. However, due to the adjustments made to the national data in MRIO databases, national policy makers often no longer recognize the data of their own country. GDP and the imports and exports may differ from officially published macro-economic aggregates. Edens et al. (2011) gave the example of GTAP7, in which the Netherlands is a net importer, whereas the official Dutch statistics have the Netherlands as a net exporter.

For the production of the TiVA and carbon footprint indicators it was thus decided that an MRIO would be used, but with the restriction that it would properly reflect the official Dutch data. National Statistical Offices (NSOs) have the resources, the specific knowledge of the local situation and its peculiarities, and the access to more detailed (and confidential) information.

---

[10] See http://www.cros-portal.eu/content/meets-conference-homepage

NSOs can therefore amend MRIOs to better address the needs of the local policy makers. The adjustment of the global MRIO to official Dutch data is hereafter called a Single-country National Accounts Consistent with MRIO, and is abbreviated as SNAC-MRIO.

6.1.1 Construction of a SNAC-MRIO

Statistics Netherlands chose to use the World Input Output Database (WIOD) (Timmer et al. 2012) as the basis for its calculations. WIOD is an open source database, where all the intermediate steps (and data) of its production are published. Statistics Netherlands was therefore able to intervene midway in the production process and replace the Dutch international SUTs by a more detailed version of the Dutch National Accounts. Thereafter, the prescribed procedures of WIOD are followed, including the reconciliation of all SUTs. In this step the Dutch part remains fixed to be consistent with the Dutch National Accounts. A more detailed description of this process is given in Hoekstra et al. (2014).

### 6.1.2 Using micro-data in the SNAC-MRIO

A peculiarity of the Dutch economy is its re-exports. To take full account of such a national peculiarity would take a lot of extra time for a MRIO-compiler due to the lack of specific information and knowledge. Re-exports are generally not important enough in the global economy to receive much attention. When making a MRIO, it is therefore customary to remove these re-exports because these are not related to domestic production or consumption.

For most countries the re-exports form only a small part of exports (Duprez and Dresse, 2013), but their share in total Dutch exports is about 50 percent. Given that re-exports enter an economy through corresponding imports, a proper allocation of the origin of re-exports is required for the Dutch economy. For example, if imports from a given country for Dutch re-exports are underestimated (or completely neglected), Dutch imports from that country for domestic use will be overestimated.

In the detailed Dutch exports records, re-exports are well identified by country of destination. Additional information, however, is required to identify which imported goods are destined for re-exports, and where these goods are imported from. Various estimation methods are used to determine the country of origin of the re-exported goods. For instance, if a trader has sufficient imports in comparison to its re-exports, the re-exported goods are proportionally allocated to the same countries of origin. For example, if 30 percent of imports of a commodity by a trader is from Germany, the assumption is that it is the same for re-exports. However, sometimes a trader, who re-exports goods, does not have the corresponding imports, because another trader in the same enterprise group imports those goods (see Figure 2). Using information from visits and telephone calls, about 200 large traders were clustered such that the clusters had sufficient imports. For this purpose, only traders with at least 100 million euro of imports missing (as compared to their re-exports) were considered. Thereafter, the imports for re-exports were again

proportionally divided among the countries of origin. See Lemmers (2013) for a more detailed description.

Figure 2. Using micro data on the level of the trader and extra information
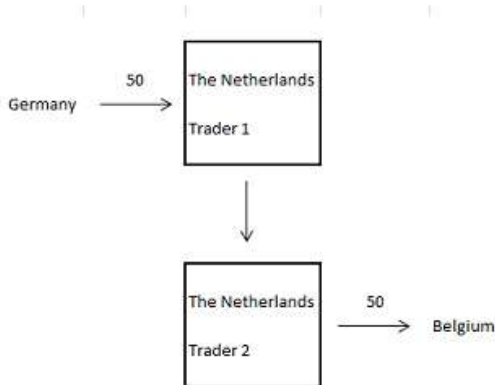
6.1.3 Results for the SNAC-footprint and SNAC-TiVA

The SNAC footprint and SNAC-TiVA were calculated for the years 2003 and 2009 using this procedure. Looking at the carbon footprint, the foreign part of the Dutch CO_2 footprint reduced by about 20% compared to the original WIOD data (see Table 1). Edens et al. (2013) show that this discrepancy occurs, because the WIOD database uses a larger portion of imports for Dutch domestic use than Statistics Netherlands does. Hence the emissions due to imports will be higher in WIOD than in SNAC WIOD.

Table 1. Country breakdown of CO2 footprint for the Netherlands using SNAC WIOD and WIOD, 2009

	CO_2 footprint according to		Share of total CO_2 footprint according to		Difference
	SNAC WIOD	WIOD	SNAC WIOD	WIOD	
	Kt CO_2		%		% point
Total	82158	100648	100	100	0
China	15787	21109	19.2	21.0	-1.8
Germany	7874	8987	9.6	8.9	0.7
Russia	6827	8220	8.3	8.2	0.1
USA	4974	6060	6.1	6.0	0.0
Belgium	3160	4299	3.8	4.3	-0.4

The change of emissions in China is noteworthy: around 5000 KtCO2 less in SNAC WIOD than in the original WIOD, which accounts for a drop of 1.8 percentage point in the total foreign footprint share. The share of Chinese value-added embodied in Dutch final demand (see Table 2) falls as well (Lemmers, 2013). This was to be expected. Chinese commodities are more often re-

exported to other countries than similar imports from the European trade partners of the Netherlands. Due to the lack of knowledge on re-exports, WIOD will underestimate Dutch imports from China for re-exports and overestimate Dutch imports from China for domestic use. This leads to overestimation of Chinese emissions and value-added in Dutch final consumption. SNAC- WIOD makes the correction, because it can properly attribute the re-exports using the micro-data on traders.

In terms of foreign value added embodied in domestic final demand, ignoring re-exports will lead to an over-estimation of final demand from those countries, of which imported goods often move on through re-exports to third countries. For instance, a part of the imports from USA, UK and China coming into the port of Rotterdam will go on as re-exports to Germany and other European countries. Table 2 shows that WIOD overestimates the final demand for USA, UK and China compared to SNAC-WIOD. The OECD-WTO estimates are better in line with the SNAC-WIOD estimates. However, OECD-WTO under-estimate the final demand from Germany, perhaps making an adjustment for re-exports which in this case would not be necessary.

Table 2. Foreign value added embodied in domestic final demand as a percentage of Dutch GDP, 2009

	Share of Dutch final demand fulfilled by abroad according to		
	WIOD SNAC %	WIOD	OECD-WTO
Germany	4.2	4.3	3.4
United States	2.4	3.1	2.8
United Kingdom	2.1	3.1	1.7
Belgium	1.6	1.9	1.2
China	1.6	3.1	1.6

7.   Profiling large enterprises to improve Supply and Use tables (Statistics Canada)

In Canada, the 320 largest enterprises account for 40% of total revenues generated. As a result, economic survey programs and the System of National Accounts rely heavily on data from these enterprises to achieve statistical quality targets. Statistics Canada has a long history of working collaboratively with Canada's largest and most complex businesses to improve the quality of reported data while reducing response burden to the greatest extent possible. Of course, achieving an acceptable balance between these two objectives is very challenging. It requires the cooperative and integrated effort of numerous players in the statistical system. Subject matter staff must work in concert with national accountants and business respondents to achieve the right balance. In Canada, this collective effort is orchestrated through the Enterprise Portfolio Management (EPM) program. One of the main objectives of the program is to maintain the

structure of large and complex businesses on Canada's Business Register (BR) through a process called profiling. The EPM program was explained in detail in a paper by Moreno Da Pont at a recent conference[11] of Eurostat (Da Pont, 2014). This section is taken largely from that paper.

7.1   Canada's Business Registers

Statistics Canada's BR is the common frame used for the economic survey program. It covers all entities operating in Canada and identifies those that have links to foreign businesses. It is updated via a number of sources including data obtained directly from tax files collected through the Canada Revenue Agency, feedback received from conducting Statistics Canada business surveys, publicly available information and profiling activities. The objective of profiling is to understand how a company's business and accounting structures relate to their reporting capabilities and to ensure that the BR accurately represents their corporate structures. Profiling covers a range of activities including direct contact with businesses to obtain information about their operations and conducting company specific research. Examples of research are reviewing information that is readily accessible from the Internet or other media sources, reviewing annual reports, and reviewing information from administrative files.

There are four statistical attributes that are accessible for each entity on the BR. The highest level in the integrated business structure is the statistical enterprise which often corresponds to a legal unit, but for some very complex businesses, it may consist of a family of legal units. At the enterprise level, complete financial statements are available and these statements are often consolidated to account for all operations. The next level in the structure is the statistical company, which is the lowest level where investment can be measured. Operating profit can also be calculated at this level, and assets and liabilities can be measured. At this level in the business structure financial statements are not consolidated. Below the company is the statistical establishment, which in most cases is equivalent to a profit center. At this level the value of output and the cost of inputs, including labour, can be measured. Finally, the statistical location is the lowest level entity. Employment and/or revenue data are available at this level.

Statistics Canada's economic surveys target different levels of a business structure depending on statistical requirements. For example, for surveys measuring assets and liabilities, the statistical enterprise or company will be targeted. By contrast, production surveys will target the statistical establishment or location since these levels provide the most detailed view of the industrial and geographic distribution of economic activity in Canada. Production data at this detailed level is an important SNA input for constructing quality regional economic accounts, such as Supply and Use tables.

The vast majority of entities identified on the BR are referred to as 'simple' in that they have one operating entity and are classified to one industry and one geographic region. These simple businesses account for over 99% of the 5 million businesses on the BR. For these, the four

---

[11] See http://accounts-of-society.eu/

statistical attributes appearing on the BR will usually be identical in that the enterprise, company, establishment and location are one and the same entity. Complex businesses, that is, businesses that have more than one operating entity are relatively small in number, less than 1% of the total, but they account for approximately 50% of revenues generated in the Canadian economy. Of course, this proportion can vary significantly depending on the industry of interest. Some industries are highly concentrated, e.g., manufacturers of automobiles.

7.2   Canada's Enterprise Portfolio Management Program (EPM)

The largest and most complex economic production entities pose numerous measurement challenges for statistical agencies. For example, for these units which often have multi-national operations, it is inherently difficult to maintain an up-to-date frame. One reason is because many economic frames, such as Statistics Canada's BR, are principally updated from administrative data sources and data from these sources often correspond to the legal structure of a business. For simple businesses, this makes for an extremely effective and efficient way to maintain and update the frame since the legal entity will correspond with the most detailed production unit on the frame, i.e., the statistical establishment or location.

For complex units, however, where the legal entity often incorporates data for numerous establishments engaged in diverse activities and located in different geographic regions, the administrative data are not sufficient. Additional effort is required to ensure complex business structures are fully articulated on the BR and data associated with the operations are both coherent and accurate.

The EPM program, created in 2005, is mandated to maintain the BR for Canada's most complex businesses. In addition to maintaining business structures for 320 of the largest and most complex businesses operating in the country, program staff are responsible for managing collection efforts for these businesses, establishing on-going relations with business respondents, and resolving data coherence issues.

7.2.1   Methodology to select complex enterprises

Enterprises are selected to the program based on methodological measures of complexity. The methodology ranks entities on the BR from most to least complex based on: the number of different industries they are classified to on the BR; the number of regions (provinces) where they have operations; and their relative importance to these industries and regions in terms of size, which is calculated based on revenues and employment. Rankings are updated every two years and are used to determine if adjustments to EPM program coverage are required. In addition to these quantitative rankings, final decisions on program coverage also take into account feedback from subject matter and SNA staff, who may identify specific complex enterprises that are creating measurement issues for their respective programs. The current enterprises covered by the program account for 40% of the total revenues of all entities on the BR, and are crucial to the quality of economic data estimates.

The EPM program is resourced with 10 full time portfolio analysts, who are supported by 6 researchers. Analysts devote approximately 50% of their time to maintain up-to-date company profiles on the BR. Accurate business profiles are essential for survey programs. The profile information is used to determine which businesses receive surveys, the types of surveys that will be sent, and the person within the company that is best placed to respond. Business respondents also benefit since the surveys they receive can be more easily linked to their operations, thus reducing their reporting burden.

7.3   Profiling of large and complex enterprises

Profiling work is suited to individuals that have an accounting or financial background so they can correctly interpret how the legal and operating structures of a company fit within the statistical frameworks of the BR and the SNA. To work efficiently, EPM analysts tend to focus on businesses that operate in specific sectors of the economy where they can develop expertise. In terms of professional development, these staff will sometimes require industry specific training to better understand the composition of businesses within their portfolio. Since this type of training is generally not available through internal training programs, there is some investment in external training. For example, in Canada, EPM staff responsible for enterprises operating in the oil and gas sector recently attended a course developed by a Canadian energy research institute that focused on industry terminology and all activities from energy exploration to transportation. Learning more about how industries operate and industry specific terminology results in more effective discussions with business respondents.

The EPMs also benefit from an understanding of their users' needs, namely industry or national accounts analysts. The program of the Canadian System of National Accounts recently includes a comprehensive training program. Part of the training program focuses on the inputs required to construct a set of national accounts. The EPMs will be encouraged to attend specific modules of this program.

7.3.1   Visiting complex enterprises

When a company visit occurs, EPMs complete a standardized documentation template which provides extensive details about their visit findings, including identifying any structural changes that are required on the BR along with reasons for requisite changes. Most visits are aimed at obtaining information required to accurately reflect how a business operates and to update the frame accordingly. In addition, emphasis is placed on determining business reporting capabilities. Since the largest and most complex businesses receive a multitude of statistical surveys, it is very important to only send relevant questionnaires that are designed to collect reportable information. This promotes buy-in from the business and improves the quality of information reported. Before each visit, the EPM compiles an inventory of all surveys in scope for the enterprise along with the response status for each survey. This provides a basis for a

discussion with the company to determine reasons for non-response and for addressing response burden concerns.

EPMs also play a key role in resolving data issues and reporting problems for their assigned companies.

7.4   Profiling and the update of the Supply and Use tables

The profiling of Canada's large enterprise by the EPM program has a positive impact on the quality of the Canadian Supply and Use tables. The EPM profiles ensure that all activities of the large enterprises are captured on the BR. This ensures that all the establishments of these large enterprises can be sampled in the Canadian annual establishment surveys. In cases were data is collected at the enterprise level and allocation is required – a complete profile of the establishment ensures data is allocated to the full set of activities of the enterprise. In addition, Canada has a very detailed set of regional accounts (Provincial and Territorial within the Canadian nomenclature). The EPM profiling not only ensures a proper industrial allocation of the data but probably more important from the Canadian perspective – a regional allocation. The Canadian regional SUT are used by the Canadian Department of Finance and Provincial Finance ministries to allocation billions of dollars of tax revenue and other payments from the Federal (Central) government to the Provincial (State) governments.

There are a number of instances where the profiling of large enterprises has led to a quality improvement in the Canadian SUT. Profiling not only ensures complete coverage of the enterprise but it also allows Statistics Canada to better understand how respondents report their information to the agency. In some cases it was discovered that there was double counting in data received from large enterprises (respondents were providing enterprise totals on the individual establishment questionnaires). In other cases it was discovered that intra-enterprise transactions were missing or information from complete parts of the enterprise were missing. The updated profiling and clarification on reporting requirements resulted in improved data for the SUT and improved the SUT balancing exercise as the source data were more coherent to begin with.

7.5   Achieving Data Coherence

For Canada, an important goal of the economic survey program is to provide a coherent set of statistical data that can easily be integrated into national and regional economic accounts. For this to happen, it is essential to apply standard concepts, methods and processes across survey programs. Using the BR, where standard industry and geography classifications are applied, is a necessary first step. But it is also important to apply common methods and processes throughout the survey model.

Canada recently launched the Integrated Business Statistics Program (IBSP) which has many objectives, including improving data coherence. The IBSP provides a standardized framework

for economic surveys. Questionnaires are based on harmonized concepts and content closely aligned to SNA requirements, and thus to the underlying concepts of the SUT. Surveys share common sampling, collection and processing methodologies that are driven by metadata. In addition, common tools are in place to edit, correct and analyse data. All of these common features help achieve data coherence by design.

7.5.1 Intra-enterprise coherence

For the largest and most complex companies that are subject to numerous surveys, it is important to determine if data reported for detailed production entities, i.e., establishments and locations, is coherent with data reported at the enterprise level. For example, for the same enterprise, the sum of the profits from all of its establishments should be equal to the total profit of the enterprise; the sum of the enterprise's monthly sales should be equal to its annual sales; or, in a country such as Canada, the sum of the provincial and territorial data should be equal to national results. The EPM program in Canada works closely with a coherence team to ensure intra-enterprise coherence in data reporting which is essential for the comprehensive measurement of economic activity. In fact, the coherence team prepares a company specific report before each EPM visit to identify coherence issues that can be discussed and resolved during company visits.

7.5.2 Coherence across various programs

The analysis undertaken by the coherence team is helpful in identifying various sources of errors or discrepancies. These range from bridging differences between SNA accounting and business accounting, understanding differences between tax and business accounting, classification issues, coverage and structure issues, questionnaire conceptual issues, and accounting peculiarities. By investigating these issues, coherence analysis has helped Statistics Canada identify gaps in reported data or duplication of data across different programs. For example, in Canada manufacturing and wholesaling activities are measured through two different survey programs. For complex enterprises engaged in both activities, separating the two for data reporting can prove challenging and data are sometimes duplicated. By conducting coherence analysis, this over-reporting issue can be identified and resolved. In resolving such issues, the coherence analyst and EPM will work closely with subject matter and SNA analysts to determine the appropriate corrective measures. In addition, the EPM will work directly with the respondent to inform them of the issue and explain how the statistical concepts are intended to be reported. Results of the coherence analysis work are systematically documented and made available to all impacted parties.

The coherence analysts work primarily with micro-data collected through annual and sub-annual surveys, at the enterprise and establishment levels. Other sources of data include companies' administrative (tax) data, as well as annual reports. Auxiliary data such as information found via the company's website, elsewhere online through news sources and articles, government websites, etc. are also used to complement the analysis when relevant. Concentrating the

coherence analysis work within a relatively small team has exposed the group to a variety of measurement issues and has allowed them to identify industries where quality challenges are more likely to occur. For example, the industry for holding companies in Canada was found to have a high rate of misclassification compared to other industries and some businesses classified to the industry were found to have significant revenues from operations. After identifying this issue, the coherence team developed a set of procedures, based on how tax data were reported by these companies, to systematically identify which businesses were likely misclassified so they could be reviewed and updated.

Like EPM analysts, an important asset for coherence analysts is knowledge of financial accounting. The coherence analysts' specialization in this area allows them to delve deeper into the issues that impact the coherence of Statistics Canada's data. In an ever-evolving economy, coherence analysis is also useful in identifying shifts in activity, changes in companies' business models, and the appearance or growing importance of activities such as factory-less goods production that may not fit neatly into Statistics Canada's existing collection or profiling vehicles.

7.6   Impact and benefits of profiling and coherence on the quality of SUTs

The profiling and coherence work allows analysts to acquire a deep understanding of how the most complex companies operate: what is their production and distribution process, what part of their operations are national versus international, how their transfer pricing works, whether they own factors of production, how much and what type of contracting is being done. This information would benefit the development of a structure for an extended SUT which would entail a breakdown of current industry classifications into new sub categories that aggregate firms on the basis of (a) ownership, (b) export intensity and (c) size.

Companies have to continuously adapt to ensure that they stay competitive in a fast changing world. The profiling and coherence work enables Statistics Canada to continuously monitor these developments in order to reflect them in statistical compilations. In developing the structure of an international SUT, the participant countries would need to acquire a similar type of understanding of the structure and value chain process for their largest most complex national enterprises.

Establishing a team of dedicated staff to update statistical profiles, manage collection efforts, and establish a strong working relationship with the largest, most complex businesses in Canada has provided many benefits to Statistics Canada's economic survey and macroeconomic accounts programs. Up-to-date business structures on the BR allow surveying divisions to effectively target the operations of these businesses. The data reported undergo a thorough coherence analysis process, which improves the quality of data for program stakeholders, including macroeconomic accounts compilers. The interpersonal relationship established with business respondents provides a means for rapidly reacting to data reporting concerns. And the integrated

approach that links the frame, collection efforts and data coherence analysis, results in a more robust set of statistics from the largest and most complex businesses that are crucial respondents for achieving statistical data quality targets.

7.6.1   The EPM program as partnership with the business community

The EPM program is also of great benefit to the business community. It provides a single point of contact within Statistics Canada where the business respondent can clarify their information reporting requirements, and resolve issues with collection instruments or conceptual frameworks. A recent example in Canada is how the new auto sector trading pact between Canada and South Korea could impact the Canadian economy in terms of imports of automobiles and domestic production and sales. Through the EPM responsible for the auto sector, Statistics Canada was able to quickly bring together various stakeholders, including the SNA, to develop topics for an information session with Canadian auto sector experts. The information obtained provides a head start for understanding the ramifications of the new pact on data programs at Statistics Canada.

In many cases, due to the high volume of information required from these businesses, the EPM will develop a customized reporting arrangement to reduce reporting burden while at the same time ensuring that the most critical information requirements are respected. Such arrangements are developed in conjunction with internal program stakeholders, including the SNA, and business respondents. When new regulations are brought forward, such as the recent move to International Financial Reporting Standards (IFRS), a program such as Canada's EPM program can be used to contact businesses to obtain information about when changes will be implemented in their accounting systems and whether they foresee any major adjustments in the way that statistical data are provided. This is of great benefit to statistical programs since they can better plan for integrating adjustments into their data series.

The EPM program is truly a partnership between the largest and most complex businesses in Canada and Statistics Canada, and is mutually beneficial.

8.   Concluding remarks

The FOC group was established in 2013 and was mandated to report back to the UN Statistical Commission with a concept paper, which sets out the future direction of the measurement of international trade and economic globalization, and advises on an appropriate coordination of efforts. Many issues are and have been under discussion in this field, and many of these issues have been well documented, as shown in the references of this paper. Some of these issues are, for instance, multi-national enterprises organizing their business across national boundaries to maximize production efficiency and minimize their global tax burden; the practice of sending goods abroad for processing with no change in ownership; the roles of the various actors and the

nature of transactions taking place inside global value chains; and the measurement of trade in value-added.

However, it is still not fully clear how the various issues can be brought together within a coherent programme of work. The following bullet points could form the main ingredients of such work programme:

- System of International Accounts and its global SUTs
- Typology of global business and trade arrangements
- Measuring trade in value-added, jobs, income and use of natural resources
- Global Value Chain mapping and its link to SUTs
- Harmonization of bilateral trade flows to build the global SUTs
- Business and trade related framework of key statistics and indicators for internationalization and globalization to diversify the SUTs

A System of International Accounts with a global Supply and a global Use table may well become the frame to make the various efforts coherent.

Finally, keeping a close link between the micro- and macro-approaches should always be an objective. These approaches cannot (and should not) be separated. Macro-statistics cannot be compiled without knowledge about the micro-statistics; and the relevance of the micro-statistics on specific economic sectors can only be properly evaluated with information at the macro-level. The examples of the Netherlands and Canada illustrate the importance of micro-data for adjustments of macro-indicators. Re-exports and profiling of complex enterprises are just two examples of many, where good and solid knowledge of micro-data has a direct impact on macro-indicators. Reconciliation of bilateral trade asymmetries, as well as proper allocation of trade by industry and by end-use will improve the quality of the macro-indicators derived from Supply-Use and Input-Output tables.

9. References

Ahmad, N., (2013) "Measuring Trade in Value Added, and Beyond", Prepared for the Conference on *Measuring the Effects of Globalization,* Washington DC, February 28-1 March 2013

Cattaneo, O., Gereffi. G., Miroudot, S. and D. Taglioni (2013) "Joining, Upgrading and Being Competitive in Global Value Chains", *Policy Research Working Paper*, 6406, World Bank, Washington DC

Da Pont, M. (2014) "Improving Data Quality for Large Enterprises through Profiling and Coherence Analysis", Prepared for *the Accounts Society*, Luxembourg, 12-13 June 2014

De Haan, M., Connolly, M., Dimova, T. and R. Peltola (2014), "Measuring Global Production in the National Accounts and the Balance of Payments", Prepared for the *IARIW 33rd General Conference*, Rotterdam, the Netherlands, August 24-30, 2014

Dicken, P., (2011) *Global Shift, 6th Edition, Mapping the Changing Contours of the Global Economy*, Guilford Press, New York

Dietzenbacher, E., B. Los, R. Stehrer, M. Timmer and G. de Vries, (2013) "The Construction of World Input–Output Tables in the WIOD Project", *Economic Systems Research*, 25, 71–98

Duprez, C., and L. Dresse, (2013) "The Belgian economy in global value chains. An exploratory analysis", *Economic Review,* September 2013, Banque nationale de Belgique.

Edens, B., R. Delahaye, M. van Rossum, and S. Schenau, (2011) "Analysis of changes in Dutch emission trade balance(s) between 1996 and 2007", *Ecological Economics* 70 (12), pp. 2334 – 2340.

Edens, B. and R. Hoekstra, (2013) "Towards a MRIO based national accounts consistent carbon footprint", Chapter 9 in *Environmental Accounts of the Netherlands 2012*, Statistics Netherlands.

Gereffi, G. and K. Fernandez-Stark, (2011) "Global Value Chain Analysis: A Primer", *Center on Globalization, Governance & Competitiveness*, Duke University, Durham, NC, USA

Goger, A., Hull, A., Barrientos, S., Gereffi, G. and S. Godfrey, (2014) "Capturing the Gains in Africa: Making the Most of Global Value Chain Participation", *Center on Globalization, Governance and Competitiveness,* prepared for OECD, Paris

Guo, D., C. Webb and N. Yamano (2009), "Towards Harmonised Bilateral Trade Data for Inter-Country Input-Output Analyses: Statistical Issues", *OECD Science, Technology and Industry Working Papers*, 2009/04, OECD, Paris

Hoekstra, R., D. Zult, B. Edens, O. Lemmers, H. Wilting and R. Wu, (2013) "Producing carbon footprints that are consistent to the Dutch national and environmental accounts", Paper prepared for the 21st International Input-Output Conference, July 9 – 12th 2013, Kitakyushu, Japan & Workshop on the Wealth of Nations in a Globalising World, July 18-19th 2013, University of Groningen, The Netherlands.

Hoekstra, R., Edens, B., Zult, D. and H. Wilting, (2014) "Reducing the variation of environmental footprint estimates based on multiregional input-output databases", *Sustainability Accounting, Management and Policy Journal* (forthcoming)

Lemmers, O. (2013) "Using enterprise data to improve trade in value added estimates". Paper prepared for OECD workshop "Measuring trade in value added", 5-6 December 2013, OECD, Paris

Lenzen, M., K. Kanemoto, D. Moran and A. Geschke, (2012a) "Mapping the Structure of the World Economy", *Environmental Science and Technology*, 46, 8374–8381.

Lenzen, M., D. Moran, K. Kanemoto, B. Foran, L. Lobefaro and A. Geschke (2012b) "International Trade Drives Biodiversity Threats in Developing Nations", *Nature*, 486, 109–112

Milberg, W. and D. Winkler, (2010) "Trade Crisis and Recovery; restructuring of Global Value Chains", *Policy Research Working Paper*, 5294, World Bank, Washington DC

Organisation for Economic Co-operation and Development (2011) "Developments on Measuring Trade in Value-Added (and Employment)", prepared for *Working Party on National Accounts*, OECD, Paris, 27-28 October 2011

Organisation for Economic Co-operation and Development (2013) "Interconnected economies: benefiting from Global Value Chains", OECD, Paris

Organisation for Economic Co-operation and Development (2014) "Extending OECD's work on measuring trade in value-added", prepared for *Committee on Statistics and Statistical Policy*, OECD, Paris, 7-8 April 2014

Organisation for Economic Co-operation and Development and World Trade Organization (2012) "Trade in Value-Added: Concepts, Methodologies and Challenges (Joint OECD-WTO Note)", OECD, Paris

Remond-Tiedrez, I., Moll, S. and J. M. Rueda-Cantuche (2011) *Technical Documentation eeSUIOT project*, European Commission, Luxembourg

Statistics Denmark (2008) *International Sourcing − Moving Business Functions Abroad*. Joint publication by Statistics Denmark, Statistics Finland, Statistics Netherlands, Statistics Norway, Statistics Sweden. Issued by Statistics Denmark, Copenhagen

Sturgeon, T. (2013) *Global Value Chains and Economic Globalization*, Report to Eurostat, by T. Sturgeon, Massachusetts Institute of Technology, Boston

Sturgeon, T., Nielsen, P.B., Linden, G., Gereffi, G. and C. Brown (2014) "Direct Measurement of Global Value Chains: Collecting Product- and Firm-Level Statistics on Value Added and Business Function Outsourcing and Offshoring", in *Trade in Value Added: Developing New Measures Of Cross-Border Trade,* Mattoo, A., Wang, Z. and S.J. Wei (Eds.), World Bank, Washington DC

Timmer, M.P., A. A. Erumban, B. Los R. Stehrer and G. J. de Vries, (2014) "Slicing Up Global Value Chains", *Journal of Economic Perspectives* vol. 28(2).

Timmer, M. (ed), A.A. Erumban, R. Gouma, B. Los, U. Temurshoev and G.J. de Vries (University of Groningen), I. Arto, V. Andreoni, A. Genty, F. Neuwahl, J.M. Rueda-Cantuche and A. Villanueva (IPTS), J. Francois, O. Pindyuk, J. Pöschl and R. Stehrer (WIIW), G. Streicher (WIFO), (2012) *The World Input-Output Database (WIOD): Contents, Sources and Methods*. April 2012, Version 0.9

Tukker, A., E. Poliakov, R. Heijungs, T. Hawkins, F. Neuwahl, J.M. Rueda-Cantuche, S. Giljum, S. Moll, J. Oosterhaven and M. Bouwmeester, (2009) "Towards a Global Multi-regional Environmentally Extended Input–Output Database", *Ecological Economics*, 68, 1929–1937

Tukker, A., A. de Koning, R. Wood, T. Hawkins, S. Lutter, J. Acosta, J.M. Rueda Cantuche, M. Bouwmeester, J. Oosterhaven, T. Drosdowski and J. Kuenen, (2013) "EXIOPOL – Development and Illustrative Analyses of a Detailed Global MR EE SUT/IOT", *Economic Systems Research*, 25, 50–70

Tukker, A. and E. Dietzenbacher, (2013) "Global Multiregional Input–Output Frameworks: An Introduction and Outlook", *Economic Systems Research*, 25, 1–19

Tukker, A. and A. Geschke, (2014) "Towards UN global environmental MR EE IO tables supporting the UN SDGs", Prepared for *9th Meeting of the UN Committee of Experts on Environmental-Economic Accounting,* UN, New York, 25-27 June 2014

United Nations (2013a) "International Trade Statistics, Report of the Secretary General", *E/CN.3/2013/7*, United Nations, New York

United Nations (2013b) "Statistical Commission, Report on the forty-fourth session (26 February-1 March 2013)", *E/2013/24*, United Nations, New York

United Nations (2014) "Measurement of International Trade and Economic Globalization, Report of the Friends of the Chair group", *E/CN.3/2014/7*, United Nations, New York

United Nations, European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, and the World Bank (2009) *System of National Accounts 2008*, United Nations, New York

United Nations Economic Commission for Europe, Eurostat and Organisation for Economic Co-operation and Development (2011) *Guide on the Impact of Globalization on National Accounts*, United Nations, Geneva

World Trade Organization and IDE-JETRO (2011) *Trade Patterns and Global Value Chains in East Asia: From trade in goods to trade in tasks*, WTO, Geneva.