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DEVELOPMENTS ON MEASURING TRADE IN VALUE-ADDED (AND EMPLOYMENT)

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Following discretional funding made available by the OECD Secretary General, the OECD's Statistics Directorate, Directorate for Science Technology and Industry, and the Trade and Agriculture Directorate, have developed a work-program to develop estimates of trade in value-added. This note describes the motivation for that work, the project plan, and progress-to-date. Discussions are on-going with other international organisations, notably the WTO, but also USITC, IDE-JETRO and the World Bank, to see how the work could be coordinated under a more formal umbrella. Delegates are asked to support the work-programme and to consider ways in which improvements or developments in their input-output, supply-use and trade statistics could assist.

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DEVELOPMENTS ON MEASURING TRADE IN VALUE-ADDED (AND EMPLOYMENT)

I. Introduction

1. At the June 2011 meeting of the OECD Statistics Committee, Delegates supported a proposal by the Statistics Directorate, the Directorate for Science Technology and Industry, and the Trade and Agriculture Directorate, to construct estimates and a framework for the measurement of trade in value-added (STD/CSTAT/(2011)5) - financed by discretional funding (for 2011-2012) from the OECD Secretary-General through his Special Allocation Fund.

2. The activity, will report to two other Committees in addition to CSTAT: the Committee for Industry, Innovation and Entrepreneurship (CIIE), and the Trade Committee. This note provides an update and an outline of the project and elaborates on its motivation and deliverables.

3. Despite the short-term nature of the funding, the intention, subject to the success of the project, is to seek more secure funding arrangements in the future: The objective is that trade in value-added statistics and their related counterparts, such as global value-chains, become a core statistical output of the OECD, recognising the fact that globalisation continues apace, and the statistics needed to measure it need to keep pace.

II. Policy drivers

4. With the increasing globalisation of production processes, there is a growing awareness that conventional trade statistics may give a misleading perspective of the importance of trade for economic growth and income and that "what you see is not what you get" (Maurer and Degain, 2010). This reflects the fact that trade flows are measured in gross terms and, so, the value of products that cross borders several times for further processing will also be included several times in trade flows.

5. The key driver of the project therefore is to create new metrics of international trade that better reflect the contribution of trade to economic growth (value-added) and also employment, recognising the fact that current measures of international trade that record transactions on a gross basis can, in the words of WTO Director General, Pascal Lamy, lead to 'misleading perceptions'.

6. Such gross recording is not in and of itself problematic when the focus is on the (increasing) interconnectedness of economies or the study of supply-chains and production networks but it can be misleading, as is often the case, when one crudely interprets gross flows of exports say with gross value-added and income, or its components, such as labour costs and labour. For example, an exported good may require significant intermediate inputs from domestic manufacturers, who, in turn, require significant intermediate imports, and, so, much of the revenue from selling the exported good may accrue abroad to reflect purchases of intermediate imports used in production, leaving only marginal benefits in the exporting economy. An often-cited case study that well illustrates the issue relates to the production of an

Apple iPod (Dedrick *et al,* 2008[1]). The study showed that of the $144 (Chinese) factory-gate price of an iPod, less than 10% contributed to Chinese value added, with the bulk of the components (about $100) being imported from Japan, and with much of the rest coming from the US and Korea. Similar results are provided in other studies such as a report from the USITC[2], which also shows a 50% reduction in the EU15-China trade balance, and the Japan-China trade balance switching from a surplus in gross terms to a deficit in value-added terms.

7. In relatively closed economies, or indeed those where imports are typically goods or services used for final, as opposed to intermediate consumption, the assumption that a certain amount of exports generates an equivalent amount of benefits to the producing economy is relatively robust. But this characterises a world that, to some extent, no longer exists. Recent decades in particular have seen an acceleration in the globalisation of production processes, as trade costs have fallen (driven by technological progress, lower transportation costs, trade policy reforms etc), and, as this fragmentation of production grows, so too does the potential for gross flows of trade to mislead.

8. There is a need therefore for metrics that measure the contribution of trade to value-added, and, so, to income, employment etc. Measuring the value-added content of trade means accounting for trade in intermediates and calculating the contribution of each economy to the global value chain. This challenging recalculation of trade flows goes beyond simple statistical concerns however. Understanding the real patterns of trade flows has important policy implications.

9. There are a number of areas where current measures of international trade may create 'misguided perceptions' and where clarity, and ultimately better policies, could be provided by measuring trade in value-added. For example:

- ***Global imbalances***: As pressure for rebalancing trade deficits increases there is a risk of protectionist responses that would target countries at the end of global value chains on the basis of an inaccurate perception of the origin of trade imbalances. The Mutual Assessment Process conducted under the G20 should be based on sound trade figures, otherwise the distorted picture of bilateral imbalances might lead to the wrong policies. And these policies may indirectly negatively impact on exporters in the economies that the policies are designed to protect. For example, a study of the Swedish National Board of Trade on the European shoe industry highlights that shoes "manufactured in Asia" incorporate between 50% and 80% of European Union value-added. In 2006, anti-dumping rights were introduced by the European Commission on shoes imported from China and Vietnam. An analysis in value-added terms would have pointed out that EU value-added, not only Chinese and Vietnamese value-added, was in fact subject to the anti-dumping rights.[3]
- ***The impact of macro-economic shocks***: The 2008-2009 financial crisis was characterised by a synchronised trade collapse in all economies. Having a better mapping of the value added by countries in the automotive and equipment industries for example would have helped policy makers anticipate the impact of the crisis and have a more accurate picture of the international transmission of a macro-economic shock on aggregate demand.

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1 Dedrick J., Kraemer K., Linden G. (2008), Who Profits from Innovation in Global Value Chains? A Study of the iPod and notebook PCs. Sloan Foundation.

2 Koopman et al 2010

3 "Adding value to the European Economy. How anti-dumping can damage the supply of globalised European companies. Five case studies from the shoe industry", Swedish National Board of Trade, 2007.

- ***Trade and employment:*** Several studies on the impact of trade liberalisation on labour markets try to estimate the "job content" of trade. Such analysis is only relevant if one looks at the value-added of trade; which tell us where exactly jobs are created and who benefits from trade and investment liberalisation **(**see also, "Trade and Jobs", C/MIN(2011)13, presented at this year's OECD Meeting of the Council at Ministerial Level, 25-26 May).

III. Meeting policy needs

10. It is in response to these needs, and indeed in response to a direct request from the Director General of the WTO to the Secretary General of the OECD suggesting cooperation between the two institutions, that the OECD project has been developed. The project brings together the Science Technology and Industry Directorate, the Trade and Agriculture Directorate and the Statistics Directorate (STD) and aligns strongly with the policy needs also expressed in the Committee for Industry, Innovation and Entrepreneurship and the Trade Committee.

11. In a perfect world with perfect information it would be possible to decompose every single product in a value-added chain that was able to identify where the value-added originated by tracing the value-added throughout the production chain. Whilst it may be possible to estimate these flows for specific case studies, such as the Apple iPod, doing this for all products produced the world over is not possible. Indeed, even for single case-studies, such as the iPod, not every intermediate product is traced back to its original producer.

12. Input-output (IO) tables measure the interrelationships between the producers of goods and services (including imports) within an economy and the users of these same goods and services (including exports); albeit with producers and goods defined at a relatively aggregated level that, when used in analyses, typically assumes homogeneity in the companies and goods classified to a particular macro-aggregate. In this context, IO tables can be used to estimate the contribution that imports make in the production of any good (or service) for export. For example, if a motor car manufacturer imports certain components (*e.g.* the chassis) the direct import contribution will be the ratio of the value of the chassis to the total value of the car. And if the car manufacturer purchases other components from domestic manufacturers, who in turn use imports in their production process, those imports must be included in the car's value. These indirect imports should be included in any statistic that attempts to measure the contribution of imports to the production of motor cars for export. The total direct and indirect imports are known as 'embodied imports'. As such a national input-output table is able to determine how much domestic value-added is generated by exports in that economy.

13. But this tells only part of the story. In order to assess how much foreign value-added is embodied in the imports of that same economy, one needs information on input-output tables for each of the economies from which imports arise. This requires bilateral trade data. The two sets of information provide an assessment of a country's true trade balance in value-added terms.

14. Although bilateral trade flows and a series of national input-output tables are sufficient to provide trade balances in value-added, they are not able to identify how much domestic value-added is generated by a single industry. For example a national input-output table will be able to determine that a specific share say of the value of an export reflects imports but if these imports required intermediate inputs from the target economy, the true value of domestic value-added generated by that export will be higher.

15. Central to the development of indicators that comprehensively measure trade flows in value-added therefore and that allow the estimation of the total value-added of specific sectors (as opposed to the whole economy) is a global input-output table; which combines bilateral trade data with national input-

output tables, such that one can track the intermediate consumption of any input for any industry back to its original industry and country of production (see Annex 1 for a description of the methodology).

16. OECD's Science Technology and Industry Directorate (STI) has a long history of collecting national input-output tables (see Annex 2), and STI and STD collaborate in the production of bilateral trade in goods statistics, and recently in the elaboration of bilateral trade in services, and so the OECD has much of the information needed to construct a global input-output table (see Annex 2 on data sources). However the quality of the table, and so trade in value-added results, is critically dependent on the way in which international transactions between industries are estimated.

17. A simple starting point, often used in practice to create national input-output tables, is to use a 'proportionality' assumption, which takes total imports for a given product and allocates these proportionally to all users (industries, and final demand, except exports, assuming no re-exports) on the basis of imports' share of total supply of the same product. This simple technique can be extended to countries too, by assuming that the share of imports by a given industry for a given product from a given country is equal to that country's share of overall imports of that product.

18. This simple assumption however may not be ideal in the context of measuring trade in value-added flows and, so, the OECD project to measure trade in value-added flows depends critically on the ability to improve the quality of the methods used to allocate flows in international trade between producing industries and users (see Box 1).

Box 1: OECD proposal and recent initiatives using input-output tables to estimate international transactions

In recent years, a number of initiatives have been taken to develop global or international Input-Output Tables (see Table 1 below). These initiatives did not have the estimation of international transactions as their main objectives per se; rather the driver was the development of tools that would be able to serve a multitude of analytical and policy purposes, such as the measurement of environmental footprints. Indeed in some cases the initial motivation was to collect and harmonise national input-output tables such that they could be used to compare structural change within economies in a comparable way. But in the same way that globalisation has affected the way economies work, so too has it impacted on the ability of purely national input-output tables to explain these changes, and this has accelerated the development and proliferation of global or international input-output tables; particularly in the context of measuring trade in value-added. Central to the development of these tables has been the development of methodologies to estimate international transactions on a *whom* (sector) *-to- whom* (sector) basis.

Table 1: International Input-Output Table Initiatives in recent years

Project	Institution	Sources	Number of countries	Number of sectors	Years
Global Trade Analysis Project (GTAP)	Purdue University, consortium of 27 institutions	Various sources - not restricted to official statistics	94	57 products	2004
Asian International Input-Output Tables	IDE-JETRO	National Accounts and firm surveys	10	76 industries	1985,1990, 1995, 2000
OECD Input-Output Database	OECD	National Accounts	46	37 industries	1995, 2000, 2005
World Input-Output Database (WIOD)	University of Groningen, consortium of 11 institutions	National Accounts (supply-use tables)	40	35 industries and 59 products	1995-2006

All of the international initiatives mentioned in Table 1 above, have already been used to provide some assessment of trade in value-added, see for example: "Decomposing Net Trade in Value-Added and Trade in Factors",

Foster and Stehrer (2001), using WIOD; "Beyond the Crisis -Visions from International Input-Output Analyses" by Inomata and Uchida (2009), using IDE-JETRO; "Value-added trade and Regionalization", Daudin, Rifflart and Schweisguth, (2008), using GTAP; and "Trade Patterns and Global Value Chains in East Asia: From trade in goods to trade in tasks", WTO and IDE-JETRO (2011).

But there is a recognition in all of these efforts that the quality of the results depends critically on the ability to accurately estimate the flows in international trade from producers (industries) to consumers (industries, households, government, investment, exports). This necessarily requires access to detailed information on international trade flows, and indeed assumptions, to allocate these flows to users. Much can be gained therefore from sharing the methods used across all initiatives, and data sources where possible; which was one of the key objectives of a Conference[i] organised by the World Bank in June 2011 - indeed this is already explicit in the work of WIOD, (which is a time-bound project scheduled to end in May 2012), where the OECD is a member of the consortium (although not funded by it). And the OECD also has close association and links with the work of IDE-JETRO. The proposal at hand from the OECD would further complement these initiatives in the short term and provide scope for their extension and consolidation in the longer run.

In the short-term, the OECD proposal would complement other initiatives in three important respects:

- ***Methodology***: The proposal of the OECD further refines its provisional Bilateral Trade by Industry and End-Use database in a number of areas described below that will be of benefit to all of the above initiatives. It also links I-O macro-data to detailed micro-data (TEC) based on trade registers linked to business registers (see below). This provides the basis for further refinement of the estimation of intermediate imports by user and disaggregates industry aggregates into more relevant sub-groupings (on the basis of import and export intensities). In the longer term, the proposal foresees future work on refinements that disaggregate import/export intensive industry groupings by foreign/domestic ownership; providing not only improved estimates of international transactions but also an ability to start considering trade in income and not just value-added.

- ***Sources***: As can be seen in Table 1 above, the source information used in constructing global or international IO tables differs. In contrast to some of the other initiatives, notably GTAP, the existing OECD I-O database uses official statistics, where the quality should be greater.

- ***Coverage***: In addition, there are also important differences in terms of broad global coverage. For example, whilst WIOD includes China and Indonesia, it does not include Chinese Taipei, Malaysia, Singapore, Thailand, and Vietnam, which are included in the OECD database. IDE-JETRO includes these countries but excludes most of the rest of the World. GTAP covers significantly more countries than any of the other initiatives but as noted above much of its information is not derived from official sources.

Over the longer term, perhaps the most important aspect of the OECD proposal concerns its potential for future production of trade in value-added estimates. The OECD would be well-placed to provide a long-term home for estimates of trade in value-added based on official statistics; reflecting its ability to tap into its institutional and policy networks and its in-house national accounts, input-output and trade specialists; which will be an important issue as countries move to the new 2008 SNA and BPM6 recommendations; (where changes to the treatment of goods for processing, merchanting and indeed the recognition of R&D as capital, - if flows of trade in income and those related to intellectual property are pursued in the future - will need to be accommodated in IO tables), and indeed new industrial classification systems such as ISIC Rev 4 and NACE Rev 2.

The OECD and WTO are currently working on the development of a strategy that would strengthen the ties between both organisations in developing this work, which includes an exploration of the possibility of formalising this relationship under a joint initiative. With this in mind both organisations are also actively engaged in discussions with other important players and potential partners in this collaborative effort, including IDE-JETRO, USITC and the World Bank.

(i). The Fragmentation of Global Production and Trade in Value-Added - Developing New Measures of Cross Border Trade, World Bank Conference, June 9-10, 2011

IV. Scope of OECD project

19. The OECD project can be broken down into 6 distinct sub-projects (some stretching beyond the time-line of the project), as shown below:

(i) Continue to improve the coverage of input-output tables (geographically and time-wise)

(ii) Improve the quality of the assumptions used to allocate imports to users by:

(a) constructing bilateral trade data of goods by end-use;

(b) disaggregating input-output industries into sub-groups of industries categorised by export and import intensity;

(c) constructing improved estimates of bilateral trade of services.

1. Considering extending the scope of the analysis to track income flows (especially those related to the use of intellectual property not considered as produced assets in the System of National Accounts Production boundary) by:

2. Decomposing value-added into its core components and tracking these flows

3. Identifying flows of operating surplus split by domestic and foreign owned firms

4. Producing estimates of trade in value-added balances for OECD countries and other major economies

20. The sub-projects (i), (ii) (iv) and (vi) form the core of the proposed activity to be conducted over the 2011-12 period, and (iii) and (v) reflect sub-projects where the work is centred on developing concepts over the 2011-2012 period, with a view to empirical results being produced after the biennium depending on the success of the other sub-projects and potential additional funding. Sub-project (ii) (c) reflects on-going work and research undertaken in all three Directorates involved in the project and is expected to continue beyond 2012. The following provides additional detail on each of the six sub-projects listed above.

(i) Improving the coverage of input-output tables

21. As noted above the OECD has long been in the business of producing and maintaining an input-output database. A positive spill-over of the work on measuring trade in value-added flows will be the ability to continue to undertake this activity, which has until now been funded via short-term non recurrent voluntary contributions. In this context it should be noted that positive spill-overs occur in other policy domains too. Input-output tables, and in particular a global input-output table, are central, for example, to the OECD's work on measuring carbon-dioxide emissions embodied in trade and domestic consumption; one of the indicators included in OECD's Green Growth Indicators, (STD/CSTAT/BUR(2010)12). The ability to expand the coverage and frequency of input-output tables will naturally be of benefit to this work too; and many others like it, such as measuring the diffusion of technology.

22. Indeed, developing policy relevant statistics such as trade in value-added flows, that are dependent on input-output tables, may motivate more secure funding for the input-output activity within the OECD in the future. Certainly, depending on the success of the project and the quality of the results produced, an additional objective of the project is to develop the statistical infrastructure that will allow the

calculation and dissemination of trade in value-added estimates to be produced on a systematic basis within the OECD beyond the end of the project financing in 2012.

(ii) (a): Improving the quality of the assumptions used to allocate import to users: - by constructing bilateral trade data by end-use

23. This activity has already begun, and is being carried out in the Science Technology and Industry Directorate, financed by voluntary contributions (see also STD/TBS/WPTGS(2011)16). The key objective is to develop a *Bilateral Trade Database by Industry and End-Use Category* (BTDIxE), 1988-2009, derived from the OECD's International Trade by Commodities Statistics (ITCS) database and the United Nations Statistics Division (UNSD) UN COMTRADE database, where values and quantities of imports and exports are compiled according to product classifications and by partner country.

24. The OECD International Trade by Commodities Statistics (ITCS) database is updated on the basis of annual data submissions received from OECD Member Countries and, in some cases, from EUROSTAT. Due to the convergence of OECD ITCS and UNSD COMTRADE[4] updating processes, data sharing and other related co-operation between the two organisations, tables can also be computed for non-OECD members as declaring countries, notably the countries which belong to the OECD Enhanced Engagement Programme, namely Brazil, China, India, Indonesia and South Africa.

25. In ITCS and COMTRADE, data are classified by declaring country (*i.e.* the country supplying the information), by partner country (*i.e.* origin of imports and destination of exports), and by product (*i.e*. according to Harmonized System (HS)). In both data sources, trade flows are stored according to the product classification used by the declaring country at the time of data collection. In general, source data are held according to Standard International Trade Classification (SITC) Rev. 2 for the time period 1978-1987, the Harmonized System (1988) for 1988-1995, HS Rev. 1 (1996) for 1996-2001, HS Rev. 2 (2002) for 2002-2006 and HS Rev.3 (2007) from 2007 onwards.

26. To generate estimates of trade in goods by industry and by end-use category, 6-digit product codes from each version of HS from ITCS and COMTRADE need to be assigned to a unique ISIC Rev.3 industry and a unique end-use category according to the Broad Economic Categories (BEC) classification - and hence SNA basic classes of goods, (see Table 2 below). Thus, 8 sets of conversion keys have been estimated using classification correspondence tables, developed internally by the OECD Science Technology and Industry Directorate, and available classification correspondence tables published by UNSD.

[4] **http://unstats.un.org/unsd/comtrade/.**

Table 2. Current BEC and SNA classes of goods

Classification by Broad Economic Categories	SNA: Use class
1 Food and beverages	
11 Primary	
111 ***Mainly*** for industry	Intermediate
112 ***Mainly*** for household consumption	Final Consumption
12 Processed	
121 ***Mainly*** for industry	Intermediate
122 ***Mainly*** for household consumption	Final Consumption
2 Industrial supplies not elsewhere specified	
21 Primary	Intermediate
22 Processed	Intermediate
3 Fuels and lubricants	
31 Primary	Intermediate
32 Processed	
321 Motor spirit	***Intermediate/Final Consumption***
322 Other	Intermediate
4 Capital goods (except transport equipment), and parts and accessories thereof	
41 Capital goods (except transport equipment)	Capital
42 Parts and accessories	Intermediate
5 Transport equipment and parts and accessories thereof	
51 Passenger motor cars	***Capital/Final Consumption***
52 Other	
521 Industrial	Capital
522 Non-industrial	Consumption
53 Parts and accessories	Intermediate
6 Consumer goods not elsewhere specified	
61 Durable	Consumption
62 Semi-durable	Consumption
63 Non-durable	Consumption
7 Goods not elsewhere specified	***Not classified***

Source: UNSD, ESA/STAT/AC.124/8, New York, April 2007

27. A provisional BTDIxE database has recently been completed but the project envisages on-going research in a number of difficult areas:

- **Confidential trade:** There is currently a different treatment in ITCS and UNSD COMTRADE. Standard conversion keys from HS do not account for confidential trade, although if defined at 2-digit HS *chapter* level (*e.g.* the difference between reported 2-digit data and sum of 6-digit components) it can be allocated to ISIC and BEC codes.
- **Re-exports:** Adjustments are required for **re-exports** which are significant for major continental trading hubs. Sufficient data are available in order to adjust for reported trade between China and the rest of the world via *Hong Kong*, but not currently for other major hubs such as Belgium, Netherlands and Singapore, and this will need to be investigated.
- **Identifying used/second-hand capital goods**: HS codes, and thus reported trade in ITCS and COMTRADE cannot differentiate between new and old capital goods (such as second-hand aircraft and ships). Estimating international trade in these flows in a value-added context requires an elaboration of the input-output framework that allows these flows to be recorded in a way that aligns with total global value-added produced in a given period.
- **Final consumption goods as intermediates**: Goods identified as consumer goods in the BEC/SNA classes may be used as intermediates in service activities *e.g.* pharmaceuticals (medical

services) and various foodstuffs (catering services), and it will be important to fine-tune the estimation here using feedback loops with input-output data.

- **Unidentified scrap and waste:** Certain types of waste and scrap do not have separate 6-digit HS codes – *e.g.* PCs and other electrical equipment exported (often to developing countries) for recycling.

28. The development of this database is however only the first step. Integrating the results of this database into a global input-output table will form the major and relevant part of this work for the project. The database will provide the basis for a finer allocation of imports by exporting country to users (intermediate consumption, household final demand, and investment) and greatly improve the quality of inter-industry trade flows in the global input-output matrix and therefore the trade in value-added results.

(ii) (b): Improving the quality of the assumptions used to allocate imports to users: disaggregating industries into sub-groups categorised by export and import intensity

29. The TEC (Trade by Enterprise Characteristics) exercise[5] is a joint project of the OECD and Eurostat which disaggregates trade values (imports and exports) according to the characteristics of trading firms. This is achieved by linking customs data and business statistics at the level of the firm and covers virtually the entire population of a country's business and (internationally) trading population. Customs data provide volume and value and HS codes of the products traded at the 6 digit level together with the identification of the business entities involved in the international transaction. This information is then matched with company level information available in countries' business registers; which contain information on firm size and turnover, activity (industry) and ownership. Linking these two sources of firm-level information provides a mechanism, via links to the underlying firm micro-data, to calculate firm-level value-added and so uncover the characteristics of firms engaged in value-added creation through exports and/or imports. A pilot study in this regard has been conducted with data made available by the Turkish Statistics Office (see also STD/TBSWPTGS(2011)15).

30. As such, the TEC database provides a unique opportunity to further refine the quality of the import data used in the input-output tables but also to create sub-categories of industry groups that discriminate between export intensive, import intensive, import/export intensive firms and other firms, allowing for a more detailed understanding of international production networks.

31. One of the challenges in using the TEC database in this way relates to fact that many exporting and importing companies are classified to the wholesale sector, even if the wholesaler just reflects the distribution or purchasing arm of a manufacturer. Linking these wholesalers to the manufacturing part of the company therefore will form an important part of the work programme. This activity is already envisaged in the work programme of the TEC database, reflecting a long-standing objective to improve the relevance of the database in this area, indeed some studies have already begun to evaluate the scope for creating these links. That said, notwithstanding this development, for those companies that import and export directly, the work described above that defines companies by input-output industry broken down by export/import intensity will proceed, (see also STD/TBS/WPTGS(2011)14).

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5 More information on the TEC exercise can be found in the OECD Statistics Brief n. 16 (2011) and the Eurostat website: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/International_trade_by_enterprise_characteristics. The resulting database, which displays aggregate trade values due to confidential rules, is accessible through the OECD website: http://stats.oecd.org/Index.aspx >> Globalisation >> Trade by Enterprise Characteristics.

(ii) (c): Constructing improved estimates of bilateral trade in services

32. This is perhaps one of the most challenging statistical issues faced in the construction of a global input-output table, as bilateral raw trade in services data are generally only available for most countries (in a comparable way) at the total services level. Some countries are able to provide breakdowns of trade in services using the Extended Balance of Payments (2002) breakdown (which has recently been revised, EBOPS 2008) but not typically on a bilateral basis. The OECD plans to investigate the scope for using raw data as the basis of the construction of a Bilateral Trade in Services database by creating links between the detailed EBOPS data and the aggregated bilateral trade data. Some work in this area using Gravity modelling has already been conducted by the Trade Directorate (see TAD/TC/WP(2009)1/FINAL). The aim is to explore how this work could be refined and indeed automated for future assimilation into a global input-output table. The work of the Task Force on Statistics in International Trade in Services will also motivate and potentially accelerate improvements in this area as will any developments of the TEC database in the measurement of service activities. In the interim the provisional results from the earlier work and standard methods, such as RAS[6], for allocating international trade in services between industries will be used in constructing global input-output tables.

(iii) Investigation into the feasibility of tracking income flows

33. Estimating trade in value-added is clearly of high policy interest. But arguably equally important is trade in income to get a fuller picture of balance of payments flows. In this context there are two important, albeit related, issues that merit consideration. The first reflects payments for the use of intellectual property and the second reflects value-added or income generated by foreign owned firms.

34. Dealing with intellectual property first. The System of National Accounts makes a distinction between intangible assets that can be considered as produced assets and those that can be considered as non-produced non-financial assets and the rationale for doing so is often based on what is practically and realistically measureable across countries in a comparable way, with intangible assets that can be measured in a comparable way generally treated as produced assets and those that can't be (yet) treated as non-produced. The distinction is important as it impacts directly on the measurement of value-added. In principle if a company or affiliate pays for the use of a non-produced non-financial asset, for example a brand name, to its owner, the payment is not recorded as intermediate consumption of the using company, instead the payment is recorded as property income (although what happens in practice is difficult to ascertain). To reinforce the importance of this issue, the 2008 SNA recently introduced a change that recognised research and development for the first time as a produced asset. Australia is the only country to have moved to this standard so far. Many other developed economies are expected to do so in 2014-15 but input-output tables currently in existence will naturally not reflect this change.

35. As a number of multinationals try to reduce their tax liabilities by transferring ownership of their intellectual property to tax-friendly jurisdictions, it is possible that tracking only value-added flows may not provide the full picture of economic reality. Getting some handle on these flows, which are not typically included in general trade statistics, but are included in balance of payments statistics, is a logical next step in the work that starts with trade in value-added.

36. This requires a not inconsiderable investment in data mining and cooperation from National Statistics Institutes. Measuring these flows properly requires a reorganisation of current input-output tables that treat these flows as if they were transactions in produced assets; and as such is unlikely to be considered within the 2011-2012.

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6 See for example, Parikh, A. (1979), "Forecasts of Input-Output Tables using the RAS Method", Review of Economics and Statistics, 61 (3), 477-481.

37. However some insight into the phenomenon could be provided by the UNECE-led Task Force on Global Production (see also the "Action plan arising from the Handbook on Globalisation and the National Accounts to be presented under item 2 of the 2011 WPNA). And notwithstanding these developments there are also a number of initial steps that could be undertaken that could shed some light on the issue envisaged in sub-projects (iv) and (v).

(iv) Decomposing value-added into its core components and tracking these flows

38. In theory (in prefect markets), because the operating surplus reflects the return for the use of produced and non-produced capital, operating surplus provides some indication of the potential size of flows in income related to non-produced assets (or intellectual property products) once produced assets are accounted for. The first concrete step in the OECD's work therefore will be to decompose value-added flows in this way. Many national input-output tables contain a decomposition of value-added in this way, for those that do not links to other datasets, such as the OECD's National Accounts and Structural Analysis Databases, will be created. The work will also be useful in providing a simple measure of the importance of trade to employment (via compensation of employees).

(v) Identifying flows of operating surplus split by domestic and foreign owned firms

39. Another way of getting some handle on the potential size of income flows is by breaking down input-output tables on the basis of foreign/domestic ownership, building on the TEC work described in sub-project (ii) (b) above. This addresses the issue of transactions in non-produced non-financial assets, albeit in a more holistic way, as it recognises that the operating surplus generated by foreign owned enterprises can be returned to the parent company. Indeed the System of National Accounts explicitly recognises this in recommending that earnings not returned to a foreign parent are treated as reinvested earnings in the accounts (FDI). This work is however unlikely to be undertaken in the 2011-12 biennium.

(vi) Results

40. The final output of the project will be the production of bilateral trade in value-added flows that remove the double counting of trade recorded in gross flows of imports and exports. An additional output of the project will be the estimation of employment dependent on trade; which can be readily calculated by replacing the value-added vector with an employment vector (see Annex 1); but this will be subject to good quality data on employment by industry being obtained.

41. It's important to recall that there will be a number of important spill-overs in reaching these ultimate goals, including:

(i) Improved estimates of imports by industry and category of end-use using detailed trade data.

(ii) Estimates of value added embodied in trade *by sectors* that capture the direct and indirect effects relating to international production processes.

(iii) A range of indicators describing global value chains, highlighting interdependencies between countries.

(iv) A sustainable I-O oriented statistical framework for regular updating and dissemination of measures of trade in value added to inform policy debates in the longer term.

(v) More precise international I-O tables reflecting the structural difference between exported *vs.* domestically sold production, based on TEC micro-data.

(vi) Estimates of firm value added broken down by destination of production (domestic *vs.* foreign markets) and by ownership (domestic *vs.* foreign).

(vii) Improved estimates of bilateral trade in services.

V. Project timetable

Period	2011		2012			
Statistical Capacity Building - by Principal Directorate	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
Finalisation of the Bilateral Trade Database by Industry and End-Use Category (BTDIxE) database (STI)						
Incorporation of BTDIxE results into global input-output database (STI/STD)						
First preliminary results (STI/STD)						
Breakdown of value-added into SNA components (STI/STD)						
Refinement of TEC database to reallocate wholesalers to affiliated domestic firm (STD)						
Construction of 'quasi' (IO) sectors using TEC data disaggregating firms by import/export intensity (STD)						
Incorporation of results from TEC work into global input-output database (STI/STD)						
Production of final results and continued refinement of the global input-output table (STI/STD).						
On-going improvement in coverage of national input-output tables (STI)						
Development of improved estimates of bilateral trade in services (TAD/STI/STD)						
Investigation into the feasibility of measuring income flows and flows based on foreign/domestic ownership (STD)						

VI. Long-term strategy

42. Despite the short-term nature of the funding of the proposal at hand, the intention, subject to the success of the project, is to seek more secure funding arrangements such that trade in value-added statistics, and their related counterparts, such as global value-chains, become a core statistical output of the OECD; recognising the fact that globalisation continues apace, and the statistics needed to measure it need to keep pace.

43. Much of the work involved in this two- year proposal should be seen in the context of providing and demonstrating 'proofs of concept'. This is why the development of methods supporting statistical infrastructure will be built in a way that facilitates the potential for work to continue in this area in the future; especially because the construction of a global input-output database provides analytical capabilities beyond just measuring trade in value-added flows.

44. The OECD and WTO are currently working on the development of a strategy that would strengthen the ties between both organisations in developing this work, which includes an exploration of the possibility of formalising this relationship under a joint initiative. With this in mind both organisations are also actively engaged in discussions with other important players and potential partners in this collaborative effort, including IDE-JETRO, USITC and the World Bank. Any follow-up to this proposed project however would need to be considered in the 2013-14 CSTAT Programme or Work and Budget and submitted for consideration and prioritisation along with other projects.

ANNEX 1

PROPOSED METHODOLOGY TO MEASURE TRADE IN VALUE-ADDED FLOWS

45. Conceptually (ignoring taxes and subsidies for now for simplicity) it is possible to decompose any particular product with value V^p into the value-added generated in country *i* such that the total value of

$$V^p = \sum_i VA_i^p \quad \text{(I)}$$

46. This is relatively clear and simple. However complications can arise when aggregating up for a whole industry group or for a whole economy, as shown in the example below.

47. Consider an economy *i* that produces only two products *a* and *b* for export, with product *a* exported to country *j* for further processing before being re-imported into country *i* for use in the production of *b*. Let's assume that 100 units of *a,* with value 200, are produced and exported and then used in the production of 100 units of product *c,* with value 300, that are in turn used in the production of 100 units of *b* with value 400. Let's further assume, for simplicity, that each unit of *a* is produced entirely in country *i;* in other words no intermediate inputs are directly or indirectly sourced from abroad. Let's also assume that apart from the intermediate imports referred to above all the value-added in *b* is also generated in country *i* only.

48. Following (I) above, it is at least, in theory, possible to show that the 100 units of *a* generated 200 monetary units of domestic value-added and the 100 units of *b* generated 300 monetary units of domestic value-added. We know that total gross exports in the economy were equal to 600 monetary units, which to some extent overstates the contribution of overall trade to the economy, but simply summing the value-added contribution at the product level (the value-added generated by *a* and the value added generated by *b)* will also overestimate the significance of trade in this context, as the overall value-added generated in the economy through the sale of both *a* and *b* is only 300; reflecting the fact that of the 300 units of value-added generated through the production of b, 200 units reflect the embodiment of product *a*, whose value-added is separately shown under the production of *a.*

49. In this context, it is important to note that the level of detail through which information is presented makes a difference; a point that is developed below. In practice of course it is unlikely that the level of detail needed to conduct a value-added decomposition for all products in the way theorised above will be available and, so, in practice, it will be necessary to use aggregated data. The ideal approach to doing this is input-output tables, which are readily available in many (and all OECD) economies.

50. In an input-output framework the relationship between producers and consumers can be simply described as follows:

$$g = A*g + y \qquad \text{where:}$$

g: is an n*1 vector of the output of n industries within an economy.

A: is an n*n matrix describing the interrelationships between industries (known as the technical coefficients matrix); where a_{ij} is the ratio of inputs from domestic industry *i* used in the output of industry *j*.

y: is an n*1 vector of final demand for domestically produced goods and services, including exports.

51. Assuming that all goods produced by any particular industry are homogenous, total imports embodied within exports can be shown as:

$$\text{Embodied imports} = m*(I-A)^{-1}*e, \text{ where:}$$

m: is a 1*n vector with components m_j (the ratio of imports to output in industry *j*)

e: is a n*1 vector of exports by industry.

52. In the same way, one can estimate the total indirect and direct contribution of exports to value-added by replacing the import vector *m* above with an equivalent vector that shows the ratio of value-added to output (v). So, the contribution of exports to total economy value-added is equal to:

$$v*(I-A)^{-1}*e \quad \text{(II)}$$

53. At the whole economy level this works fine, both for imports, if we accept the fact that they are measured gross, and importantly for value-added. Returning to the example above the approach would accurately record the 300 contribution exports made to value-added.

54. However, policy makers are equally interested in understanding the contribution that specific sectors make to whole economy value-added, both direct and indirect. Because imports may often themselves embody some value-added that was indirectly generated in the importing economy a global input-output table is needed; a table that, in effect, reallocates imports and exports to intermediate consumption or final domestic demand (household, NPISH and government final consumption, capital formation).

55. Let *G* be a global input-output table with dimensions *n*c*n*c*, where *c* is the number of countries and *n* is, as before, the number of industries. Further let the table be structured so that rows 1 to *n* reflect the industries of country 1, and rows *n*+1 to 2*n* the industries of country 2 and so on, and v^k_i is the direct value-added produced by industry *i* in country *k*, as a share of its total output. It can be shown that the total direct and indirect domestic value-added produced by industry j in country *k* is equal to:

$$\sum v^k_i * L_{(kn+i)(kn+j)}, \quad \text{(III)}$$

where: L_{ij} is the *ij*th element of the global Leontief inverse $(I-G)^{-1}$.

Similarly,

$$\sum v^k_i * L_{(hn+i)(hn+j)} \quad \text{(IV)}$$

reflects the total value-added generated in country *k* for unit output of industry *j* in country *h*. And

$$v^k_i * L_{(hn+i)(hn+j)} \text{(V)}$$

reflects value-added generated by industry *i* in country *k* for unit of output of industry *j* in *h,* providing a mechanism that shows the contributions made across different sectors of the economy.

56. For any given export therefore by an industry, it should be possible to decompose the entire value into:

(i) the domestic value-added generated in its production, both directly from the main producing industry, and indirectly via transactions between domestic industries and via transactions between domestic and foreign industries; and

(ii) the imported value-added generated in producing the imports used in production (not including any part of the import value that reflects domestic value-added)

57. As such a global input-output table will allow users and policy makers to decompose the entire value of any good in the following way:

Direct domestic value-added from the final producer	Indirect domestic value-added by producing industry	Indirect imported value-added by produced country and industry

58. The ability to generate data such as this is, in and of itself, of benefit to policy makers interested in the real contribution industries make to economic growth and indeed employment (as the flows above can be reformulated to show employment contributions and not just value-added), since they can be used to assess the national content of both imports and exports. Estimating overall trade balances however will necessarily need to be made at a higher (whole economy) level to remove the double counting that occurs as goods and services criss-cross national boundaries during the production process. But the approach described above will allow meaningful measures of overall bilateral trade balances to be constructed; which will allow for the systematic estimation of results such as that reported in a recent WTO report that calculated that the US-China trade balance in 2008 would be about 40 percent lower if calculated in value-added terms[7].

7. Maurer and Degain (2010).

ANNEX 2

AVAILABLE DATA

Input-Output tables

59. OECD's Science Technology and Industry Directorate has been updating and maintaining harmonised I-O tables, splitting intermediate flows into tables of domestic origin and imports, since the mid-1990s - usually following the rhythm of national releases of benchmark I-O tables. The process of compiling OECD's I-O database greatly depends on cooperation with national statistical institutes. Ideally, national authorities would provide the latest Supply-Use tables and benchmark symmetric input-output tables (SIOTs) at the most detailed level of economic activity possible; with a basic price valuation; and, preferably, separating domestically produced and imported intermediate goods and services,. However, few countries can meet such requirements. Therefore, in order to maximise country coverage, all relevant *partial* data is used. It should be noted that one of the main reasons that I-O analysis has benefited from renewed attention in recent years is the improved availability and quality of I-O tables and related statistics from national sources.

60. The first edition of the OECD I-O Database dates back to 1995 and covered 10 OECD countries with I-O tables spanning the period from early 1970 to early 1990. The first updated edition of this database, released in 2002, increased the country coverage to 18 OECD countries, China and Brazil, and introduced harmonised tables for the mid-1990s. Since 2006 this tradition of growth has continued so that there are now tables available for 46 countries[8] (33 OECD and 13 non-OECD countries) with tables for the mid-2000s (mainly 2005) now available for most of them (Table A1).

Table A1. Country coverage of OECD Input-Output 2009 edition (As of May 2011)

OECD	mid-90s	early-00s	mid-00s	OECD	mid-90s	early-00s	mid-00s	Non-OECD	mid-90s	early-00s	mid-00s
Australia	1994/95	1998/99	2004/05	Japan	1995	2000	2005	Argentina	1997	-	-
Austria	1995	2000	2005	Korea	1995	2000	2005	Brazil	1995	2000	2005
Belgium	1995	2000	2005	Luxembourg	1995	2000	2005	China	1995	2000	2005
Canada	1995	2000	2005	Mexico	-	-	2003	Chinese Taipei	1996	2001	2006
Chile	1996	-	2003	Netherlands	1995	2000	2005	India	1993/94	1998/99	2006/07
Czech Republic	1995	2000	2005	New Zealand	1995/96	2002/03	-	Indonesia	1995	2000	2005
Denmark	1995	2000	2005	Norway	1995	2000	2005	Romania	-	2000	2005
Estonia	1997	2000	2005	Poland	1995	2000	2005	Russia	1995	2000	-
Finland	1995	2000	2005	Portugal	1995	2000	2005	South Africa	1993	2000	2002
France	1995	2000	2005	Slovak Republic	1995	2000	2005	Thailand	-	-	2005
Germany	1995	2000	2005	Slovenia	-	2000	2005	Viet Nam	-	2000	-
Greece	1995	2000	2005	Spain	1995	2000	2005				
Hungary	1998	2000	2005	Sweden	1995	2000	2005				
Iceland	-	-	-	Switzerland	-	2001	-				
Ireland	1998	2000	2005	Turkey	1996	1998	2002	*not published - internal use only*			
Israel	1995	-	2004	United Kingdom	1995	2000	2005	*Malaysia*		*2000*	
Italy	1995	2000	2005	United States	1995	2000	2005	*Singapore*	*1995*	*2000*	*2005*

Available year, -: not available

61. The input-output tables show transactions between domestic industries but as a complement to these tables are supplementary tables which break down total imports by user (industry and category of final demand). Some countries provide these import tables in conjunction with their input-output tables but in some cases they are derived by the OECD Secretariat in producing input-output tables directly from

[8] For more details, see also www.oecd.org/sti/inputoutput.

supply-use tables; which requires the use of assumptions that will have a significant impact on the results of trade in value-added analysis; particularly at the industry level. The main assumption used is the 'proportionality' assumption, which assumes that the share of imports in any product consumed directly as intermediate consumption or final demand (except exports) is the same for all users. Indeed this is also an assumption that is widely used by national statistics offices in constructing input-output tables. Improving the way that imports are allocated to users will form a central part of the work-plan going forward. But an important part of the work-plan will be the attempt to gain an improved understanding of how countries estimate their import-flow matrices and indeed an attempt to motivate better methods of allocation, at the national level, where possible.

Industry classification

62. The industry classification used in the current version of the I-O database is based on ISIC Rev.3 (Table A2), meaning that it is compatible with the other OECD industry-based analytical data sets such as the Structural Analysis database (STAN), based on SNA by activity, and bilateral trade in goods by industry (derived from merchandise trade statistics via standard Harmonised System to ISIC conversion keys. The system by necessity (*i.e.* to maximise cross country comparability) is relatively aggregated. Differentiating between types of companies within a given sector is essential however to improve the quality of trade in value-added results (particularly in the context of exporting and non-exporting companies), and, so, part of the work-programme will be to explore ways, using micro-data that could improve the quality of results.

Table A2. OECD Input-Output industry classification

ISIC Rev.3 code		Description
1+2+5	1	Agriculture, hunting, forestry and fishing
10+11+12	2	Mining and quarrying (energy)
13+14	3	Mining and quarrying (non-energy)
15+16	4	Food products, beverages and tobacco
17+18+19	5	Textiles, textile products, leather and footwear
20	6	Wood and products of wood and cork
21+22	7	Pulp, paper, paper products, printing and publishing
23	8	Coke, refined petroleum products and nuclear fuel
24ex2423	9	Chemicals exluding pharmaceuticals
2423	10	Pharmaceuticals
25	11	Rubber and plastics products
26	12	Other non-metallic mineral products
271+2731	13	Iron & steel
272+2732	14	Non-ferrous metals
28	15	Fabricated metal products, except machinery and equipment
29	16	Machinery and equipment, nec
30	17	Office, accounting and computing machinery
31	18	Electrical machinery and apparatus, nec
32	19	Radio, television and communication equipment
33	20	Medical, precision and optical instruments
34	21	Motor vehicles, trailers and semi-trailers
351	22	Building & repairing of ships and boats
353	23	Aircraft and spacecraft
352+359	24	Railroad equipment and transport equipment n.e.c.
36+37	25	Manufacturing nec; recycling (include Furniture)
401	26	Production, collection and distribution of electricity
402	27	Manufacture of gas; distribution of gaseous fuels through mains
403	28	Steam and hot water supply
41	29	Collection, purification and distribution of water
45	30	Construction
50+51+52	31	Wholesale and retail trade; repairs
55	32	Hotels and restaurants
60	33	Land transport; transport via pipelines
61	34	Water transport
62	35	Air transport
63	36	Supporting & auxiliary transport activities; activities of travel agencies
64	37	Post and telecommunications
65+66+67	38	Finance and insurance
70	39	Real estate activities
71	40	Renting of machinery and equipment
72	41	Computer and related activities
73	42	Research and development
74	43	Other Business Activities
75	44	Public administration and defence; compulsory social security
80	45	Education
85	46	Health and social work
90-93	47	Other community, social and personal services
95+99	48	Private households and extra-territorial organisations

Bilateral trade in goods and services

63. Central to the construction of a global input-output database is the estimation of flows between countries. At present this is done in a relatively crude way by assuming that for any imported product by any user the share of imports from any country is proportional to that country's overall share of imports of that same product. Improving on this assumption will also form part of the work plan going forward.