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Draft Chapter 9
Measuring Trade in Value-Added

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1. Introduction

1. Global value chains (GVCs) have become a dominant feature of today's global economy. This growing process of international fragmentation of production, driven by technological progress, cost, access to resources and markets, and trade policy reforms, has challenged our conventional wisdom on how we look at and interpret trade and, in particular, the policies that we develop around it. Indeed traditional measures of trade, that record gross flows of goods and services each and every time they cross borders, alone, may lead to misguided decisions being taken.

2. In practice, two main approaches (micro and macro) have been used to shed light on this issue. The former is perhaps best characterised by the well known Apple iPod example (Dedrick et al, 2010), which 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 much of the rest coming from the US and Korea.

3. But this stylised approach can generally only be conducted for specific products and, even then, only reveals part of the story related to who benefits from trade and how global value chains work; as it is typically unable to reveal how the intermediate parts are created. For example the message would be significantly different if, for sake of argument, the imported parts from Japan used to make the iPod required significant Chinese content. To deal with the bigger picture and also to capture all of the upstream effects, a number of studies have adopted a macro approach, based on the construction of inter-country or world input-output tables (Hummels et al. (2001), Daudin et al. (2006, 2009), Johnson and Noguera (2010) and Koopman et al. (2011)). And a number of pioneering initiatives, such as those of GTAP, the WTO with IDE-JETRO and also the WIOD (World Input-Output Database), have helped accelerate improvements in the underlying statistics used to construct the results.

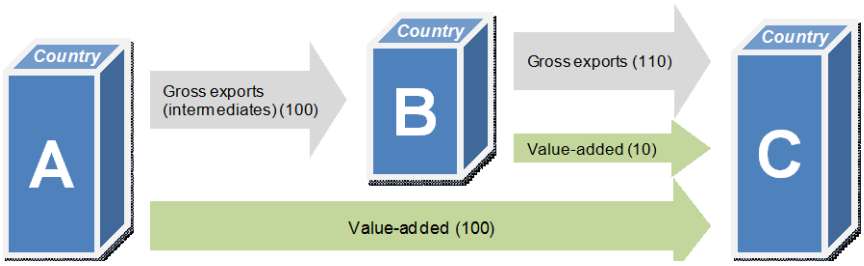
4. But these studies and initiatives have generally been one-off in nature and often require the use of non-official statistical data. What has been lacking thus far has been a systematic attempt to mainstream the development of statistics in this area. In response to this need, on 15 March 2012, the OECD and WTO joined forces to develop a database of Trade in Value-Added (TiVA) indicators and to mainstream their production within the international statistics system. The first preliminary results from this intiative were released on 16 January 2013 and some highlights from this first release are presented below. But, as described in this chapter, further work is needed (and can be done) in order to improve the quality of the estimates produced under the ' trade in value-added' umbrella.

5. This chapter in some respects demonstrates the importance of all the preceding chapters. Ultimately the chapter acts as a clarion call, in conjunction with the previous chapters, to statistics agencies, that the world is increasingly interconnected and that conventional approaches used to understand how economies work can no longer rely solely on national statistics. Increasingly, in order to understand how economies work, and how to target and create industrial policies targeting competitiveness for example (not withstanding trade policies and the implications and importance of trade), it is necessary to see the whole. National statistics build pictures based on inter-relationships between producers and consumers and the rest of the world. But these relationships, particularly those with the rest of the world have become increasingly more complex, and, as such, there is an increasing need to consider global production within a global accounting framework. This implies a departure from the traditional role of international organisations as compilers of internationally comparable national statistics, such as national input-output or supply-use tables. Instead it requires that they bring together these national tables to create a global table and also act as conduits to resolve on-going differences in mirror statistics.

6. The remainder of this chapter describes the policy drivers and needs for such a framework, and the underlying methodology and assumptions used to estimate trade in value-added, before finalising on the implications for statistics offices, data collection and national input-output tables in particular. The chapter also considers, in detail, a number of issues concerning the recording (and classification) of factoryless firms and intellectual property flows within national supply-use tables. The chapter ends by describing future longer term future avenues of research.

2. What is Trade in Value-Added?

7. The Trade in Value-Added initiative addresses the double counting implicit in current gross flows of trade, and instead measures flows related to the **value** that is **added** (labour compensation, other taxes on production and operating surplus, or profits) by a country in the production of any good or service that is exported.



8. The simple example above illustrates this. Country A exports $100 of goods, produced entirely within A, to country B that further processes them before exporting them to C where they are consumed. B adds value of $10 to the goods and so exports $110 to C. Conventional measures of trade show total global exports and imports of $210 but only $110 of value-added has been generated in their production. Conventional measures also show that C has a trade deficit of $110 with B, and no trade at all with A, despite the fact that A is the chief beneficiary of C's consumption.

9. If instead we track flows in value-added, one can recalculate C's trade deficit with B on the basis of the value-added it "purchases" from B as final demand, which reduces its deficit on this basis, to $10, and apply the same approach to A's value-added to show C running a deficit of $100 with A. Note that C's overall trade deficit with the world remains at $110. All that has changed is its bilateral positions. This simple illustration reveals how output in one country can be affected by consumers in another and by how much (for example C's consumers driving A's output) but it can also reveal many other important insights into global value-chains. For example it shows that B's exports depend significantly on intermediate imports from A, and so reveals that protectionist measures on imports from A could harm its own exporters and hence competitiveness. Indeed, by providing information at the level of specific

industries, it is possible to provide insights in other areas too, such as the contribution of the service sector to international trade.

3. Motivation – Why?

10. While the literature on trade in value-added is quite technical, it has attracted a lot of attention from policymakers. What initially seemed a concern for trade statisticians is now understood as a key issue for the policy debate. For example, Pascal Lamy, the DG of the WTO noted that "the statistical bias created by attributing commercial value to the last country of origin perverts the true economic dimension of the bilateral trade imbalances. This affects the political debate, and leads to misguided perceptions".[1] Recently, the French Senate devoted a special seminar to the related statistical and policy issues. [2]

11. There are a number of areas where measuring trade in value-added terms brings a new perspective and is likely to impact on policies:

- **Trade, growth and competitiveness*:*** Better understanding how much domestic value-added is generated by the export of a good or service in a country is crucial for development strategies and industrial policies. Some countries have capitalised on global value chains by developing comparative advantages in specific parts of the value-chain. For example in China, much of its exports reflect assembly work, where the foreign content is high. Access to efficient imports therefore, and accessibility within global value chains, matters as much in a world of international fragementation as does access to markets. Conventional gross trade statistics however are not able to reveal the foreign content of exports and so there is a risk that policies to protect industries where gross statistics reveal a comaparative advantage may decrease the competitiveness of those very same domestic industries, and, so mercantilist-styled 'beggar thy neighbour' strategies can turn out to be 'beggar thyself' miscalculations.

- In addition domestic value-added is not only found in exports but also in imports: goods and services produced in one domestic industry are intermediates shipped abroad whose value comes back to the domestic economy embodied in the imports of other, and often the same, industries. As a consequence, tariffs, non-tariff barriers and trade measures –such as anti-dumping rights– can also impact on the competitiveness of domestic upstream producers (as well as the competitiveness of downstream producers as mentioned above) in addition to foreign producers. 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 revealed that EU value-added was in fact subject to the anti-dumping rights.[3]

- Looking at trade from a value-added perspective is also able to better reveal how upstream domestic industries contribute to exports, even if those same industries have little direct international exposure. Gross trade statistics for example reveal that less than one-quarter of

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1 . *Financial Times*, 24 January 2011.

2 WTO and Commission des Finances du Sénat, (2011) "Globalization of industrial production chains and measurement of trade in value added", Conference proceedings.

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", Kommerskollegium, National Board of Trade, Stockholm, 2007.

total global trade is in services. But in value-added terms the share is signficantly higher. Goods industries require significant intermediate inputs of services (both from foreign and and also domestic suppliers). Looking at trade in value-added terms therefore can reveal that policies to encourage services trade liberalisation and more foreign direct investment, and so policies designed to improve access to more efficient services, can improve the export competitiveness of goods industries.

- **Global imbalances**: Accounting for trade in value-added (specifically accounting for trade in intermediate parts and components), and taking into account "trade in tasks", does not change the overall trade balance of a country with the rest of the world - it redistributes the surpluses and deficits across partner countries. When bilateral trade balances are measured in gross terms, the deficit with final goods producers (or the surplus of exporters of final products) is exaggerated because it incorporates the value of foreign inputs. The underlying imbalance is in fact with the countries who supplied inputs to the final producer. As pressure for rebalancing increases in the context of persistent deficits, there is a risk of protectionist responses that target countries at the end of global value chains on the basis of an inaccurate perception of the origin of trade imbalances. As shown below, the preliminary results from the OECD-WTO database point to significant changes.

- **The impact of macro-economic shocks**: The 2008-2009 financial crises was characterised by a synchronised trade collapse in all economies. Authors have discussed the role of global supply chains in the transmission of what was initially a shock on demand in markets affected by a credit shortage. In particular, the literature has emphasized the “bullwhip effect” of global value chains.[4] When there is a sudden drop in demand, firms delay orders and run down inventories with the consequence that the fall in demand is amplified along the supply chain and can translate into a standstill for companies located upstream. A better understanding of value-added trade flows would provide tools for policymakers to anticipate the impact of macro-economic shocks and adopt the right policy responses. Any analysis of the impact of trade on short-term demand is likely to be biased when looking only at gross trade flows. This was again more recently demonstrated in the aftermath of the natural disaster that hit Japan in March 2011. [5]

- **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. What the value-added figures can tell us is where exactly jobs are created. Decomposing the value of imports into the contribution of each economy (including the domestic one) can give an idea of who benefits from trade. The EU shoe industry example given above can be interpreted in terms of jobs. Traditional thinking in gross terms would regard imports of shoes manufactured in China and Viet Nam by EU shoe retailers as EU jobs lost and transferred to these countries. But in value-added terms, one would have to account for the EU value-added and while workers may have indeed lost their job in the EU at the assembly stage, value-added based measures would have highlighted the important contribution made by those working in the research, development, design and marketing activities that exist because of trade (and the fact that this fragmented production process keeps costs low and EU companies competitive). When comparative advantages apply to “tasks” rather than to “final products”, the skill composition of labour imbedded in the domestic content of exports reflects the relative development level of participating countries. Industrialised countries tend to specialise in high skill tasks, which are better paid and capture a larger share of the total value added. A WTO and IDE-JETRO study on global

4. See Escaith *et al.* (2010) and Lee *et al.* (1997).

5 See an application of international IO on "Japan's earthquake and tsunami: International trade and global supply chain impacts", VoxEU, April 2011 at http://www.voxeu.org/index.php?q=node/6430

value chains in East Asia shows that China specializes in low-skill types of jobs. Japan, on the contrary, has been focusing in export activities intensive in medium and high skill labour, while importing goods produced by low-skilled workers. The study also shows that the Republic of Korea was adopting a middle-of-the ground position (in 2006), but was also moving closer to the pattern found in Japan. [6]

- **Trade and the environment*:*** Another area where the development of a global input-output table would support policymaking is in the assessment of the environmental impact of trade. For example, concerns over greenhouse gas emissions and their potential role in climate change have triggered research on how trade openness affects CO2 emissions. The unbundling of production and consumption and the international fragmentation of production require a value-added view of trade to understand where imported goods are produced (and hence where CO2 is produced as a consequence of trade). Various OECD studies note that the relocation of industrial activities can have a significant impact on differences in consumption-based and production based measures of CO2 emissions (Ahmad *et al*., 2003, Nakano *et al.*, 2009).

4. Early evidence from the OECD-WTO database[7]

12. At the time of writing the database is based on a global input-output table that brings together national input-output tables for 57 economies, combined with bilateral trade data on goods and services, with a breakdown into 37 industries (see below). The following provides an overview of the key messages provided by the data.

Exports require imports

13. The data reveals that the import content of exports (the share of value added by the export of a given product that originates abroad) is significant in all countries for which data is presented (40 at the time of writing, all 34 OECD countries, Brazil, China, India, Indonesia, Russian Federation and South Africa), see Figure 1, which shows the domestic content of exports, as a per cent of total exports.

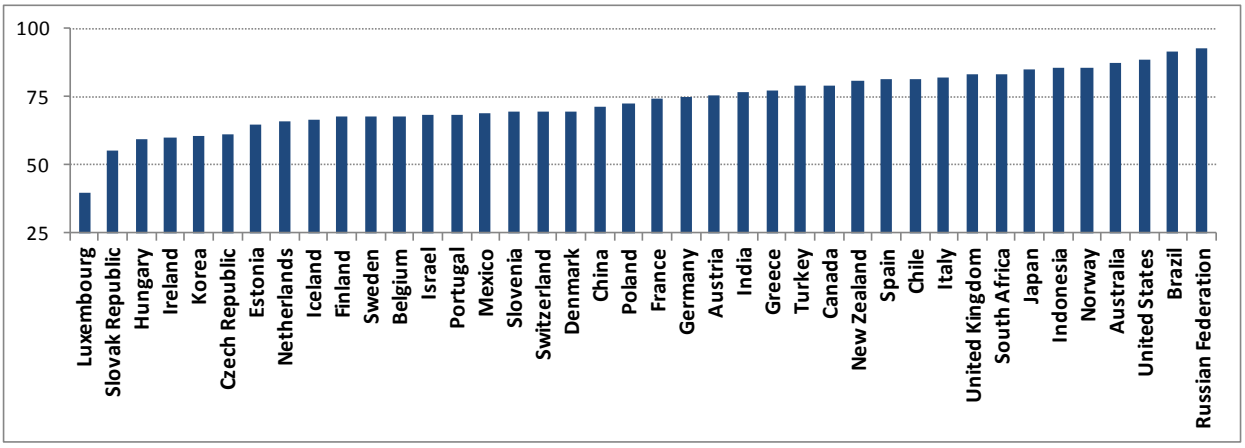
14. Typically the larger a country the lower the overall foreign content, reflecting in part scale and cost. But a number of smaller economies also have relatively low foreign content in their exports, such as Australia, Chile, and Norway, reflecting their high share of exports of natural resource goods (such as ores, oil and copper, which have not surprisingly a low foreign content). Geography also plays a role too, which helps to explain New Zealand's relatively low ratio, as well as its relatively high dependency on agricultural exports, which also have a relatively low foreign content. For mid-size economies however, particularly those in Eastern Europe, the norm is for around one-third of the value of exports to reflect foreign content.

15. Notwithstanding some of the interpretative caveats above, the ratio is perhaps the single most digestible indicator of the propensity of a country to engage in GVCs. It reveals the existence of European, Asian and North American production hubs and also the significant dependency many countries have on imports to generate exports. In Mexico, with its maquilladores, and China with its processors/assemblers, about one-third of overall exports reflect foreign content (and, as described below, these are considered to be conservative estimates).

6 See WTO and IDE-JETRO (2011).

[7] For more information on the database see www.oecd.org/trade/valueadded

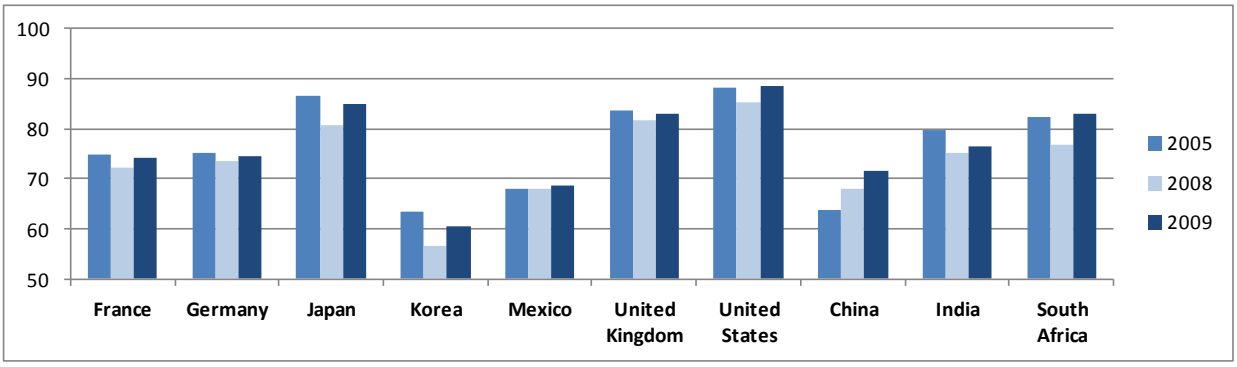
Figure 1: Domestic content of Exports (Domestic Value-Added exports, % of total gross exports), 2009



Source: OECD-WTO Trade in Value Added (TiVA) indicators, Preliminary Results, OECD January 2013

16. Some care is needed in interpreting the results however: 2009 was an exceptional year, the year that signified perhaps the nadir of the recent financial crisis, and which was partly characterised by an unprecedented slowdown in global trade. Although the database only provides data as far back as 2005, illustrative data going back to 1995 suggests that international fragmentation of production, (the import content of exports) had been steadily rising in most countries over recent decades, which continued over the period 2005-2008 (Figure 2); despite the slowdown that began to occur in many countries in 2008. But 2009 saw falls in the import content of exports, and, so, rises in the domestic content, suggesting that the greater the fragmentation of a good or service, the more likely it was to be affected by the synchronised slowdown in trade. In most countries therefore, the import content of overall exports in 2009 returned to around the ratios seen in 2005 but in China the data points to a steady fall in its foreign content over the period, suggesting developments that saw China begin to move up the value-added chain.

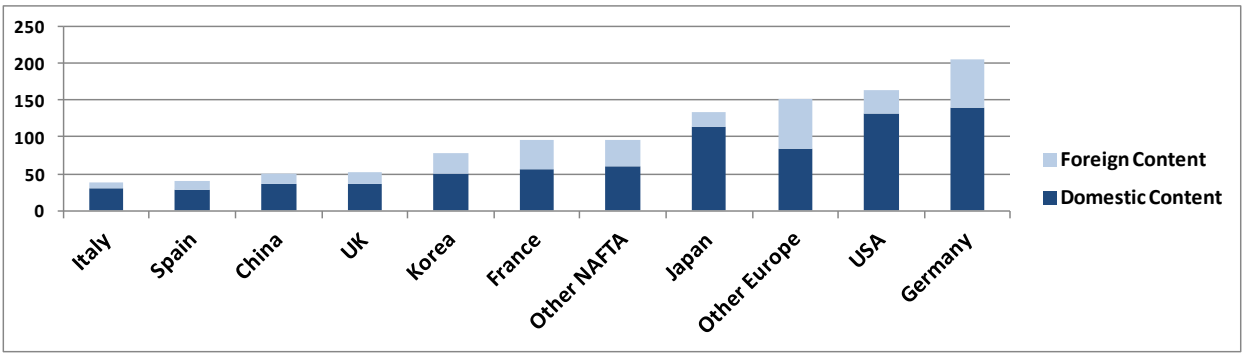
Figure 2: Domestic content of Exports (Domestic Value-Added exports, % of total gross exports), 2005-09



Source: OECD-WTO Trade in Value Added (TiVA) indicators, Preliminary Results, OECD January 2013

17. Tangible evidence of the scale of global value chains emerges more clearly when considering specific sectors. For example between one-third to half of the total value of exports of transport parts and equipment by most major producers originated abroad in 2009 (Figure 3), driven by regional production hubs. In the US and Japan, the shares were only about one-fifth, reflecting their larger scope to source inputs from domestic providers but this was also the case for Italy, possibly reflecting efficient upstream domestic networks of small and medium enterprises. Interestingly, in 2009, Germany exported 25% more than the United States in gross terms but only 5% more in value-added terms.

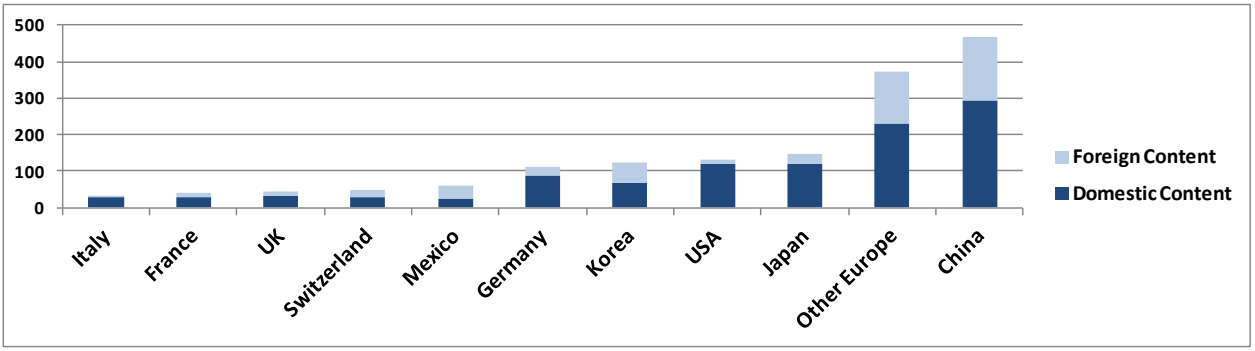
Figure 3: Transport equipment, gross exports decomposed by source , USD billion, 2009



Source: OECD-WTO Trade in Value Added (TiVA) indicators, Preliminary Results, OECD January 2013

18. Similar patterns emerge in other sectors with a high degree of international fragmentation. For example in China and Korea, in 2009, the foreign content of exports of electronic products was about 40% (Figure 4) and in Mexico, the share was over 60%.

Figure 4: Electronic equipment, gross exports decomposed by source , USD billion, 2009



Source: OECD-WTO Trade in Value Added (TiVA) indicators, Preliminary Results, OECD January 2013

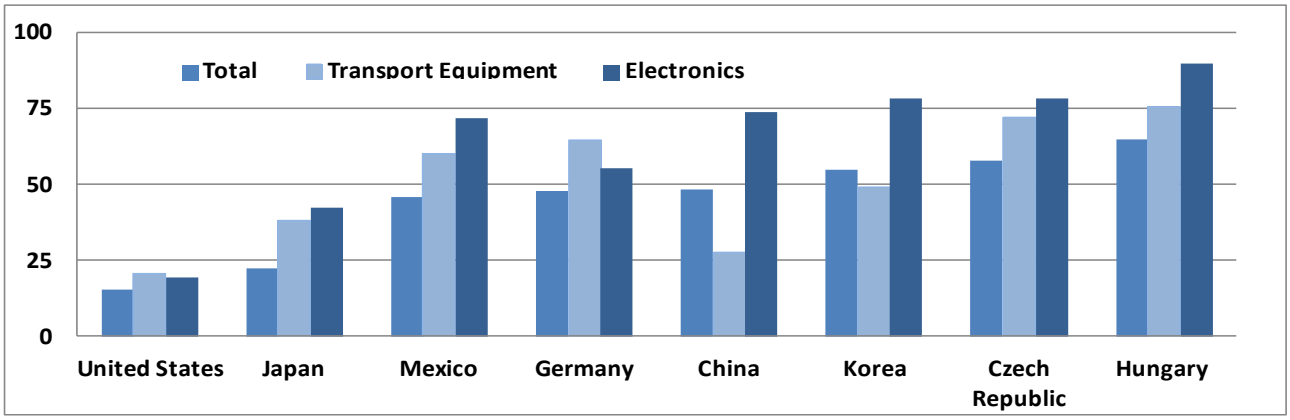
High shares of intermediate imports are used to serve export markets

19. The figures above reveal that exporting firms require access to efficient imports in order to be competitive, and, so, highlight the potential counter-productive effects of protectionist measures. But an alternative way of indicating the adverse effects of such policies can be seen when looking at the overall share of intermediate imports that are used to serve export markets.

20. In most economies, around one-third of intermediate imports are destined for the export market. Not surprisingly, typically, the smaller the economy the higher the share, but even in the United States and Japan these shares are 15% and 20% respectively at the total economy level, with a higher incidence of intermediate imports in some highly integrated industries (Figure 5). In Japan for example nearly 40% of all intermediate imports of transport equipment end up in exports.

21. In many other countries, the share of intermediate imports embodied in exports is significantly higher. In Hungary, for example two-thirds of all intermediate imports are destined for the export market after further processing, with the share reaching 90% for electronic intermediate imports. In China, Korea and Mexico around three-quarters of all intermediate imports of electronics are embodied in exports. The database also shows that close to 85% of China's intermediate imports of textile products end up in exports.

Figure 5: Intermediate Imports embodied in exports, % of total intermediate imports, 2009



Source: OECD-WTO Trade in Value Added (TiVA) indicators, Preliminary Results, OECD January 2013

Open and efficient services markets matter

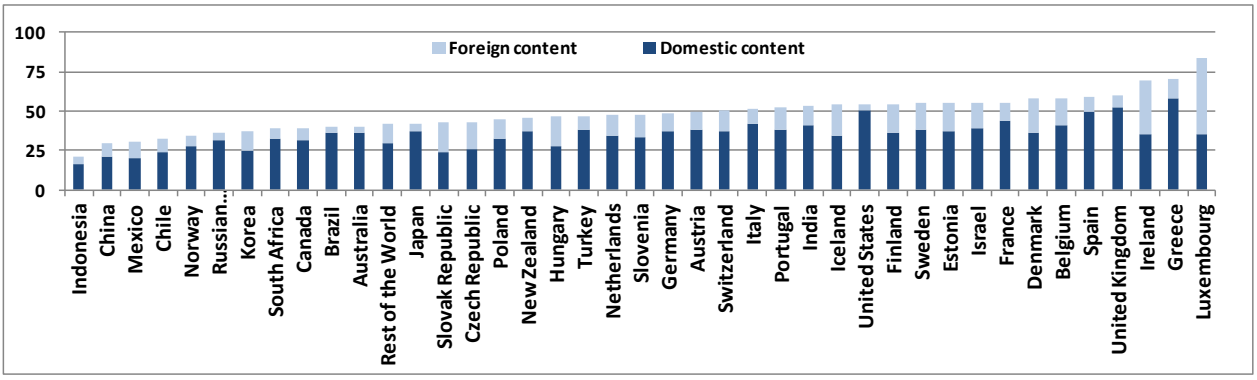
22. Services comprise about two-thirds of GDP in most developed economies. However, based on gross terms, trade in services typically account for less than one-quarter of total trade in most countries. This partly reflects the fact that significant shares of services output are generally not tradeable, e.g. government services, many personal services and imputations such as those made in GDP calculations to reflect the rent homeowners are assumed to pay themselves (between 6-10% of GDP in most developed economies). But it also reflects the fact that the service sector provides significant intermediate inputs to domestic goods manufacturers.

23. Accounting for the value added produced by the services sector in the production of goods shows that the service content of total gross exports is over 50% in most OECD economies, approaching two-thirds of the total in the United Kingdom (Figure 6). Canada, with significant exports of natural resources, which have typically low services content, has the lowest services content of its exports in the G7 but even here the share is close to 40%.

24. Typically, emerging economies and other large exporters of natural assets, such as Norway, Chile and Australia, have the lowest shares of services. But in India over half of the value of its gross exports originates in the service sector. Indonesia has the lowest share of the 40 countries in the database at around 20%.

25. Part of the explanation for the difference between OECD countries and emerging economies reflects the relatively higher degree of (largely domestic) outsourcing of services by manufacturers in OECD countries in recent decades, suggesting that a similar process could lead to improvements in the competitiveness of emerging economy manufacturers. Figure 6 also reveals a not insignificant contribution to exports coming from foreign service providers.

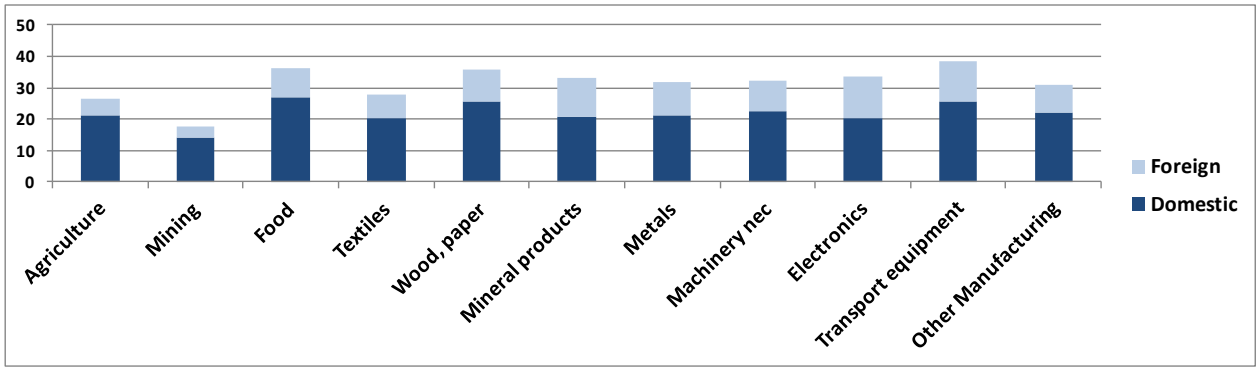
Figure 6: Services Value Added: % of total exports, 2009



Source: OECD-WTO Trade in Value Added (TiVA) indicators, Preliminary Results, OECD January 2013

26. Another, perhaps clearer way, of illustrating the importance of services to exports is to consider, the services content of specific exports in goods producing sectors. Figure 7 below, which takes an average of all 40 countries in the database, shows that services make a significant contribution (typically one-third) across all manufacturing sectors, with significant shares provided by both foreign and domestic service providers. For individual sectors in specific countries the importance of the service sector is often starker. In France, for example, the data reveals that over half of the domestic value-added generated in producing transport equipment originates in the French service sector.

Figure 7: Services Value Added: % of total exports of goods, 2009

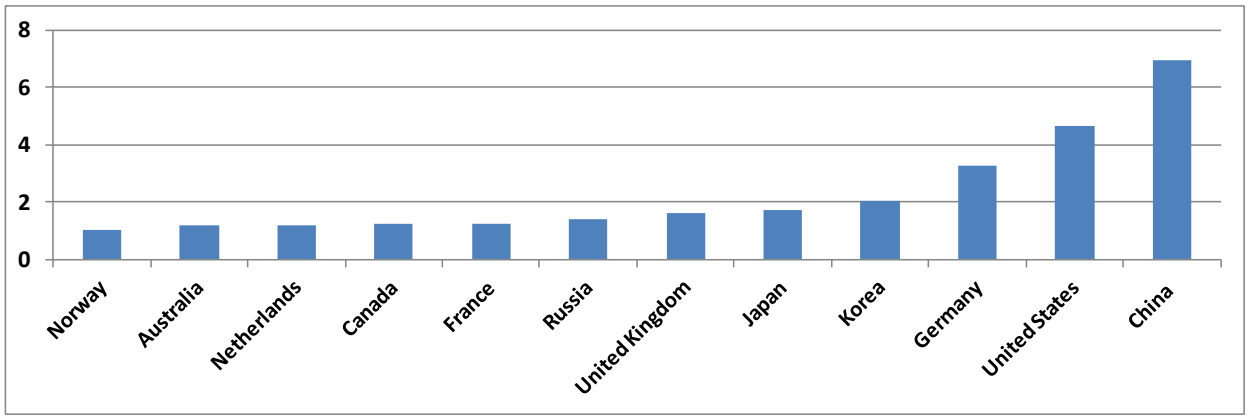


Source: OECD-WTO Trade in Value Added (TiVA) indicators, Preliminary Results, OECD January 2013

Intermediate imports often embody a country's own (returned) domestic value-added

27. Imports can also contain ‘returned’ value-added that originated in the importing country. The preliminary, and one should stress conservative, estimates show that in the United States, for example, nearly 5% of the total value of imported intermediate goods reflects US value-added (Figure 8) and in China the equivalent shares are close to 7%. For electronic goods, Chinese intermediate imports contain over 12% of “returned” Chinese domestic value-added, and Korean intermediate imports contain close to 5% of "returned" Korean domestic value-added.

Figure 8: Domestic content of imports: % of total intermediate imports, 2009



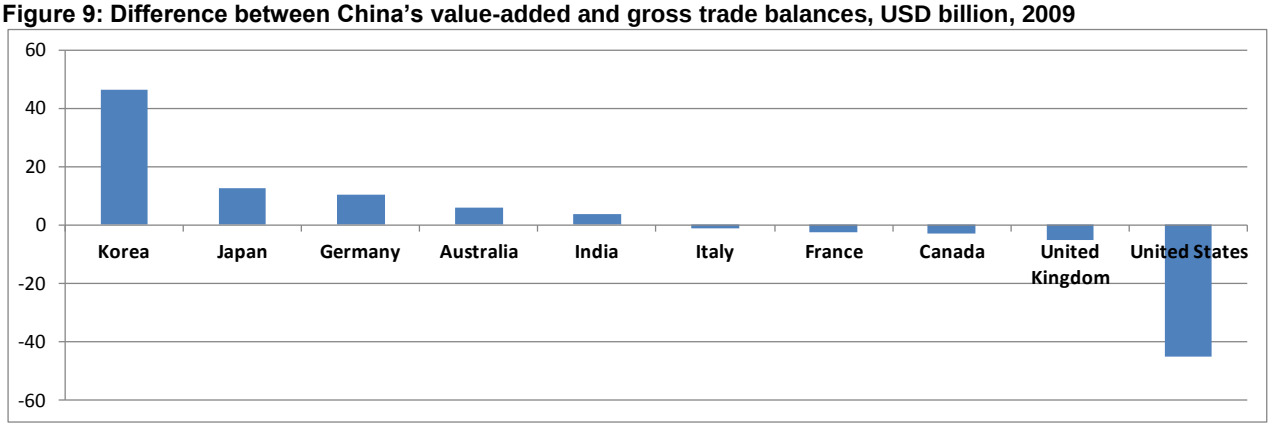
Source: OECD-WTO Trade in Value Added (TiVA) indicators, Preliminary Results, OECD January 2013

What you see is not what you get: Trade patterns change

28. Bilateral trade balance positions can change significantly when measured in value-added terms, although the total trade balance is unaffected. China's bilateral trade surplus with the United States was over USD 40 billion (25%) smaller in value-added terms in 2009 for example (and 30% smaller in 2005). This partly reflects the higher share of US value-added imports in Chinese final demand but also the fact that a significant share (one-third) of China's exports reflect foreign content - the “Factory Asia”

phenomenon. The data illustrates that significant exports of value-added from Korea and Japan pass through China on their way to final consumers, resulting in significantly smaller Chinese trade deficits with these countries but also typically higher Japanese and Korean trade surpluses with other countries. Similarly the database shows that Korea's significant trade deficit with Japan in gross terms almost disappears when measured in value-added terms

Figure 9: Difference between China's value-added and gross trade balances, USD billion, 2009



5. Estimating Trade in Value Added

5.1 How?

29. As mentioned above, several initiatives and efforts have tried to address the issue of the measurement of trade flows in the context of the fragmentation of world production.[8] The most commonly used approach to develop a macro picture is based on global input-output tables, using simple standard Leontief inverses, more detail can be found in OECD-WTO, (2012)[9] and in the Annex.

30. National input-output tables describe domestic interactions between domestic industries and between those same domestic industries and drivers of final demand (households, non-profit institutions serving households,government, investment and exports). They also reveal who purchases imports, and typically these show breakdowns by type of import.

31. Figure 10 below reveals a simple example ofan input-output table for an economy with two industries. A_{ij} reflects the intermediate consumption in basic prices of industry *j*'s outputs by industry *i*. Figure 11 below reveals how each of the entries for imports can also be split into an equivalent industry origin of the imports.

32. These national tables form the basis of the global IO table needed to analyse GVCs. Indeed on their own they can be used as the basis of 'screwdriver' type analyses that drill down one level to show how output in one domestic industry uses inputs from other domestic industries and also from imports. But what they cannot show is how the intermediate imports used by these industries are produced and what imports they in turn require. In addition national IO tables cannot be use to illustrate how much of the reporting country's own value-added is embodied in its imports. In order to do this one needs a global IO table.

33. Figure 12 depicts a global table for two countries and two industries in each country, which can be generalised for all countries: (In the current OECD global IO table the breakdown includes data for 57 economies and 37 industries with the Rest of the World (R.O.W) calculated using data on GDP for economies included in the R.O.W and total exports and imports of these economies. The table follows

[8] An OECD-World Bank workshop on "new metrics for global value chains" was organised on 21 September 2010. WTO hosted a Global Forum on Trade Statistics on 2-4 February 2011, in collaboration with Eurostat, UNSD and UNCTAD.

[9] Trade in value-added: concepts, methodologies and challenges, OECD-WTO, 2012.

the same notation as in Figures 10 and 11 except that A^2_{ij} reflects the intermediate consumption of industry *i* in country 2 of products produced by industry *j*. The notation for other entities follows the same logic. Note that all re-exports (*XM* in Figure 10) in the 'global' IO table are eliminated from the global table. Domestic Final Demand is equivalent to total Household Final Consumption, NPISH expenditures, General Government Final Consumption and Total Investment.

34. Note also that because all flows are recorded at basic prices there is an additional row ' taxes less subsidies on product' which reflects the taxes paid and subsidies received by industries and final demand consumers on their intermediate purchases and final purchases. For most industries these entries are in practice relatively minor. In most countries this item reflects VAT, which is mainly paid by final demand consumers, as most firms in most industries can reclaim the VAT paid on their purchases, although some industries, such as financial services and non-market producers also pay VAT on their inputs, as so firms below VAT thresholds. For convenience all flows recorded as value-added in the TiVA database allocate these payments to the Value-Added estimates of the industries.

Figure 10. A simplified national IO table

	Industry 1	Industry 2	Households	NPISH	Government	Investment	Exports
Industry 1	A_{12}	A_{11}	H_1	N_1	G_1	In_1	X_1
Industry 2	A_{21}	A_{22}	H_2	N_2	G_2	In_2	X_2
Imports	M_1	M_2	HM	NM	GM	InM	XM
Taxes less subidies on products	TP_1	TP_2	HTP	NTP	GTP	InTP	XTP
Value-Added at Basic Prices	V_1	V_2					
of which							
Operating surplus +mixed income	OS_1	OS_2					
Compensation of Employees	COE_1	COE_2					
Taxes less subsidies on production	TPr_1	TPr_2					
Output	O_1	O_2					

Figure 11. A simplified import flow table

	Industry 1	Industry 2	Households	NPISH	Government	Investment	Exports
Industry 1	M_{12}	M_{12}	MH_1	MN_1	MG_1	MIn_1	MX_1
Industry 2	M_{21}	M_{22}	MH_2	MN_2	MG_2	MIn_2	MX_2

Figure 12. A simplified two country (global) IO table

		Country 1		Country 2		Country 1	Country 2
		Industry 1	Industry 2	Industry 1	Industry 2	Domestic Final Demand	Domestic Final Demand
Country 1	Industry 1	A_{11}	A_{12}	M^2_{11}	M^2_{12}	D_1	MD^2_1
	Industry 2	A_{21}	A_{22}	M^2_{21}	M^2_{22}	D_2	MD^2_2
Country 2	Industry 1	M_{12}	M_{12}	A^2_{11}	A^2_{12}	MD_1	D^2_1
	Industry 2	M_{21}	M_{22}	A^2_{21}	A^2_{22}	MD_2	D^2_2
Taxes less subidies on products		TP_1	TP_2	TP^2_1	TP^2_2	DTP	D^2TP
Value-Added at Basic Prices		V_1	V_2	V^2_1	V^2_2		
Output		O_1	O_2	O^2_1	O^2_2		

5.2 National inputs - requirements

35. Constructing the global table is a data-intensive process and presents numerous challenges. The key challenge is to identify and create links between exports in one country and the purchasing industries (as intermediate consumption) or final demand consumers in the importing country.

36. Typically statistics offices are able to provide most of the blocks required to create a global input-output table (recalling that supply-use tables can be readily converted to the above format, and, moreover, that the above format can be initially constructed as a global supply-use table, which will form the long term approach to be used by the OECD). But, even though some countries are able to estimate the overall imports of a given product used by a particular industry, many are not and none are able to show, systematically, the source of that import (by originating country and industry) by the using industry (or final demand category).

37. Central to the construction of a global input-output table therefore is the estimation of trade flows between industries and consumers across countries. Indeed, these trade flows in intermediate goods and services are the glue which tie together the national individual input-output tables.

5.2.1 Bilateral Trade in Goods and Services

38. It is highly unlikely that countries will ever be able to collect statistics that systematically show the country source of any given import consumed by an industry nor does it seem likely that countries will be able to show which foreign industries consume their products.

39. But most countries are able to produce estimates of bilateral trade in goods and services showing the export of a given good or service to a given partner country and indeed most countries are able to further reveal whether any particular import or export of a good (for most imports and exports) was intermediate, investment, or a consumer good.

40. In constructing the import flows (and export flows) of its global IO table the OECD necessarily uses a number of assumptions. The main assumption used in creating these import matrices is the 'proportionality' assumption, which assumes that the (country) origin share of a given import consumed by a given industry in a given country is the same for all industries that in that country. For countries which are not able to provide any ' import-flow' matrices at all (i.e. the intermediate consumption of imports by product (or industry) by industries, the OECD necessarily assumes that the share of intermediate imports in total intermediate consumption for a given imported product is the same for all using industries (and is equivalent to the overall share of intermediate imports to total intermediates supplied for that product). In all cases the OECD has been able to significantly improve the quality of the assumptions it necessarily uses by creating a new database of bilateral trade (for goods) that breaks down imports (and exports) on the basis of the nature of the traded product (intermediate,

household, investment, other): *Bilateral Trade Database by Industry and End-Use Category*[10], (BTDIxE), derived from 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.

41. 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)). 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.

42. To generate estimates of trade in goods by industry and by end-use category, 6-digit product codes from each version of HS from COMTRADE are assigned to a unique ISIC Rev.3 industry and a unique end-use category- and hence SNA basic classes of goods, (see Table 1 below).

Table 1. Current BEC and SNA classes of goods

		End-use			
			Final demand goods		
		Intermediate	Household consumption	Industrial capital goods	Other
Products characteristics	Primary products	Food and beverages (111) Industrial supplies (21) Fuels and lubricants (31)			
			Food and beverages (112)		
	Processed unfinished		Food and beverages (122)		
		Fuels and lubricants e.g. gasoline (32)			
		Food and beverages (121) Industrial supplies (22) Parts and components of transport equipments (53) Parts and components of capital goods (42)			
	Processed finished	Packed medicaments (part of 63)			
			Non-industrial transport equipments (522) Non durable consumer goods (63) Semi-durable consumer goods (62) Durable consumer goods for households (61)		
			Durable personal consumer goods e.g. personal computers (part of 61), Mobile phones (part of 41) Passenger motor cars (51) Fixed line phones (part of 62)		
				Capital goods (41) Industrial transport equipments (521)	
	Other				Goods n.e.c (7)

Sources: http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=10&Lg=1
Note: Numbers are BEC code

43. Notwithstanding the known problems relating to the asymmetries that exist within bilateral trade statistics (i.e. global exports do not equal global imports) these bilateral statistics form the basis for populating the international flows shown in the tables above.

44. But only very few countries have a consistency between bilateral trade flows (imports and exports) by partner country and the corresponding flows shown in their supply-use table (the basis for the creation of national IO tables), reflecting the fact that, for goods at least, bilateral trade flows follow merchandise trade accounting standards.

45. As such there are a number of recommendations that follow:

- Countries should produce import flow matrices as a standard part of their supply-use tables.
- Producing bilateral trade flows that are consistent with underlying supply-use tables should form a high priority of national statistics offices in this regard.

[10] For more details, see www.oecd.org/sti/btd

- Confidential trade: In some countries disclosure rules suppress 6-digit HS components in COMTRADE and also higher 2-digit HS chapter levels. This should be avoided where possible with other forms of preserving confidentiality adopted, such as suppressing another 6-digit category..

- 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.

- Identifying used/second-hand capital goods: HS codes, and thus reported trade in 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.

- 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.

- Moreover, for services, countries are encouraged to provide more detail on partner countries and also to on the type of products (following EBOPS 2012).

- Greater efforts are needed to reconcile asymmetries in international trade flows.

5.3 Accounting issues for national IO tables

46. This is not designed to be a Handbook on IO or Supply-Use tables but it is clear that their importance in understanding and interpreting global production is crucial. In this context therefore, perhaps the most important starting point is that countries produce them as frequently as possible; as recommended in the 2008 SNA. These should be produced at as detailed as level as possible but, (as noted in Annex II) the conventional emphasis towards providing more information by creating more detailed industry groupings may be better focussed on providing breakdowns that target characteristics of firms engaged in international trade, as it is becoming increasingly clear that the conventional assumption of homogeneity between firms classified to a particular industry may no longer be applicable; as can be witnessed by the proliferation of global value chains, and the nature of businesses, processors, factoryless producers etc.

47. By way of a generality therefore, before considering some of the more detailed accounting issues, countries are strongly encouraged to give consideration to producing breakdowns in their SU or IO tables that focus on import or export intensities (whether that be through mechanisms that characterise firms on their share of imports/exports in intermediate consumption/output, or via characteristics such a processors, factory-less etc), and also ownership (foreign/domestic).

48. Four specific issues merit closer consideration for SU or IO purposes.

5.3.1 Factoryless Producers

49. Chapter 2 considers the various aspects central to discussions on factoryless producers. The key issue from an input-output or supply-use perspective is their industry classification. As Chapter 2 demonstrates, two options prevail: the first is that factoryless producer is classified to the industry related to the final product being produced via its global value-chain; the second is that it is classified to the distribution sector.

50. The recommendation given in this Handbook is that countries adopt a slightly broader interpretation of economic ownership when considering the classification of a given firm to a given industrial sector. At present a strict interpretation of ISIC guidelines on ownership mean that a factoryless

firm that does not own (purchase) any of the physical inputs used to produce the good (or service) it coordinates the production of should be classified to the distribution sector. This immediately raises questions about the classification of firms that own services used in the production process (such as R&D, software etc, and that are discussed in Chapter 2) and which may indeed form most of the value of any produced good; a point that is emphasised by the early results emerging from the OECD-WTO TiVA database.

51. ISIC says the following on this issue:

> 140. If only part of the production process is outsourced, the principal is classified to the class that corresponds to the activity representing the complete production process, i.e., it is classified as if it were carrying out the complete process, including the contracted work, itself.
>
> 141. This applies not only to the outsourcing of support functions in the production process, such as accounting or computing activities, but also to the outsourcing of parts of the core production process, such as parts of a manufacturing process.
>
> 142. In general, if the principal outsources the complete production process of a good or service, it is classified as if it were carrying out the production process itself. This applies in particular to all service-producing activities, including construction. In the case of manufacturing, however, the following special considerations apply.
>
> 143. In manufacturing, the principal provides the contractor with the technical specifications of the manufacturing activity to be carried out on the input materials. The input materials (raw materials or intermediate goods) can either be provided (owned) by the principal or not.
>
> 144. A principal who completely outsources the transformation process should be classified into manufacturing if and only if it owns the input materials to the production process—and therefore owns the final output.
>
> 145. A principal who completely outsources the transformation process but does not own the input materials is in fact buying the completed good from the contractor with the intention to re-sell it. Such an activity is classified in section G (Wholesale and retail trade), specifically according to the type of sale and the specific type of good sold.

52. What is interesting from the ISIC recommendations is the implicit difference between companies that outsource the complete production process for a service and those that outsource the complete production process of a good. For the former, the company (principal) is allocated to the service sector that forms the output of the production process, which is not necessarily the distribution sector, and this is the case irrespective of whether or not any 'material inputs' used in the production process are owned or otherwise by the principal. For production processes of goods however, the principal is allocated to the same sector as the final good being produced only if some material inputs are owned by the principal and irrespective of the value of any services provided, and their underlying activity (distributive or otherwise). In this sense a company selling its design services to a manufacturer of a good would be classified in the design industry but the same company that decided to manage a production process itself would be a distributor if it owned none of the material inputs and a manufacturer of the final good being produced if it owned the material inputs. The fact that the design services may have contributed 99.99% of the value of the good appears not to matter if one follows the ISIC guidelines above to the letter.

53. Recorded in a supply-use table this would mean that significant value added flows in the distribution sector would have little to do with core 'distribution' activities, namely getting a product from a producer to a consumer, potentially rendering the wholesale-retailer sector classification

meaningless from an analytical perspective, and potentially meaning that ISIC is in contradiction with itself as it defines wholesalers and retailers as entities engaged in the sale of goods without transformation.

54. Given the increasing tendency of companies to fragment their production along these lines, with different processes outsourced depending on relative specialisations (and developed economies increasingly generating much of their value through IPPs), the current restrictive recommendation in ISIC appears untenable. Taken to its logical conclusion, a country entirely specialised in the production of IPPs, where all firms managed physical production processes that were offshored, would be characterised in ISIC as a nation of shopkeepers.

55. To illustrate some of the difficulties within the current ISIC recommendations, consider a principal that provides a contractor with its underlying IPP for a fee (X). The contractor uses the IPP to produce goods (where it owns all of the material inputs) that it sells to the principal (Y) before the principal sells the goods on to households in its economy (for value Z). Following ISIC the following flows would be recorded in supply-use tables in the principal's economy:

Case 1: ISIC treatment of Factoryless Producers with IPP sales

Supply table					Use table		
	Principal	Import	Margin	Total	Principal	HHFC	Exports
Goods		Y	Z-Y	Z		Z	
Output of IPP	X			X			X
Output of margin	(Z-Y)		-(Z-Y)	0			
Total output/import/final demand	X+(Z-Y)	Y		Z+X	X+(Z-Y)	Z	X

56. In ISIC the classification of the producer in this case would be dependent on the value of X (output of IPP) relative to (Z-Y) (the margin), or on the relative value-added contributed by the two activities. Arguably it would be classified to the industry related to the IPP production.

57. Now consider the flows if the principal did not sell its IPP to the contractor but provided it as an input to the production process (and assuming, for simplicity, that the processing fee charged by the contractor is Y-X), which is often the case.

Case 2: ISIC treatment of Factoryless Producers without IPP sales

Supply table					Use table		
	Principal	Import	Margin	Total	Principal	HHFC	Exports
Goods		Y-X	Z-Y+X	Z		Z	
Output of IPP							
Output of margin	(Z-Y)+X		-(Z-Y+X)	0			
Total output/import/final demand	X+(Z-Y)	Y-X		Z	X+(Z-Y)	Z	

58. In this case the principal would always be recorded as a distributor according to ISIC guidelines. But all that differentiates Case 1 from Case 2 is that the principal records an explicit transaction for IPPs in the first instance and not the second; the value-added and the underlying origin (task performed) is identical in both cases. In the first case the non-transformative distribution margin is (Z-Y) but in the second case it is (X+Z-Y). This clearly illustrates that the addition of the IPP is transformative and, so, following ISIC, 'factoryless' manufacturers with IPP inputs cannot be treated as wholesalers or retailers, which appears to contradict ISIC recommendations for factoryless producers.

59. That is not to say that it necessarily follows that all of these factoryless firms, in particular those that have some IPP content provided by the principal, should be classified simply as manufacturers of the products they produce without some further elaboration in ISIC. The distinction between goods and services producers continues to have merit for policy makers and also analysts (indeed this is partly why the guidelines in ISIC have evolved in the way they have) but whilst it makes sense to classify factoryless producers (with IPP inputs) to the goods producing industry that best reflects the final product requiring their IPP input, this should be done as a separate and new sub-class of each relevant ISIC industry. The

alternative would be to classify the principal to the sector where most if its value-added is generated, for example ISIC Rev 4, sector 72, *Research and Experimental Development.* But this in turn would require an expansion of the sub categories to better reflect the underlying product being produced, and in any case would prove challenging when one considers the many additional activities (and value-added) provided by the principal, such as brand management for example. Whichever approach is favoured, the need to create these additional distinctions within ISIC matters for structural analyses that require an understanding of where competitive advantages in an economy lie.

60. There are a myriad of additional reasons to support this recommendation but a very simple example brings the matter into stark relief. ISIC is a little unclear on how many material inputs need to be owned by the principal in order to be classified as a manufacturer and not a distributor - it merely states 'if and only if it owns the material inputs' . One could take a very restrictive view here and interpret this as meaning 'all material inputs' but this is clearly impractical - in practice all processors will include some of their material inputs, even if only marginal, to the production process. And so it is clear that within ISIC there is a potential (albeit unwritten) threshold applicable; namely that 'most' of the material inputs should be owned by the principal. This can quickly become complicated however. Material inputs are defined as ' raw material and intermediate goods'. So for a processor that generates all of its electricity on-site using oil say, the oil would be included in total material inputs but in the case where the processor acquired its electricity through the grid, total material inputs would be lower. Importantly one should note that even if the concept of ' material inputs' was extended to include all intermediate inputs, including services, the issue concerning the level of input required to be classified as a manufacturer rather than a distributor would remain.

61. One additional issue worth reflection concerns a potential need for tighter drafting in the SNA or ISIC. Consider for example a factoryless company in economy A with an offshore manufacturing subsidiary in economy B that sold all of its products in economy C. Leaving aside all of the issues related to intellectual property etc, the principal (parent) would be classified as a distributor in ISIC (assuming that, for convenience it managed (purchased) the output from B and handled the sale in C). But one could also argue that the principal should be classified as a head office: ISIC Rev 4, 7010 if the 'purchase' from the affiliate was merely convenient for accounting purposes. And, when one considers intellectual property, following the arguments made above, the principal could also be classified as a manufacturer.

62. Additional complications can arise when one considers the underlying general principles reflected in ISIC; which determine a company's industrial classification on the basis of the activity where its principal activity is derived:

- A firm for example that purchases all of the inputs used in the production of a shoe, and outsources all of the services work required too, would be classified as a shoe manufacturer, even if it also outsourced the management of the entire production process to another firm. In such cases, where very little labour or produced capital is used by the firm to produce shoes, and instead value is added largely using financial capital, the firm would derive most of its value-added via the distribution activity, which, following the general principles given in ISIC would mean that the firm would be classified as a distributor; which contradicts the detailed guidance given in ISIC for such firms and also (at least implicitly) in the 2008 SNA, as the accounts for the firm would record a transformative process (as the firm would be recorded as having purchased the material inputs and other inputs as its intermediate consumption)
- A firm that purchases the physical inputs and outsources the production of a shoe for which it created the design (R&D say) would also be classified as a shoe manufacturer. But, following the general ISIC guidelines, one could argue that the primary activity in this case was R&D activity. Similarly, as already described above, the same firm that did not own the physical inputs would be classified as a distributor, according to the detailed ISIC guidelines for factoryless firms but again as an R&D producer following the general guidelines. This latter firm would also not be classified as a distributor in the 2008 SNA as there is clearly a transformative process.

63. The bottom line from all of the above is that clearer guidance is needed concerning the classification of factoryless producers, and ideally new sub-sectors to reflect their nature. Some general guidelines are given below:

- Factoryless firms that outsource the entire production process of a good but own some of the inputs (goods and services) used by the contracted processors should be classified to manufacturing as a separate and new sub-set of existing classifications that highlights the factoryless nature of the firm.
- Factoryless firms that produce the intellectual property used in the production process of a good that is produced by processing firms, and some of the inputs (goods and services) are owned by the factoryless firm, should be classified to manufacturing as a separate and new sub-set of existing classifications that highlights the factoryless nature of the firm.
- Factoryless firms that produce the intellectual property used in the production process of a good that is produced by processing firms, and none of the other inputs (goods or services) are owned by the factoryless firm, should be classified to manufacturing as a separate and new sub-set of existing classifications that highlights the factoryless nature of the firm. If separate accounts are available for the unit producing the IPP and the unit involved in managing the production process, then the former should be classified to the appropriate sector.
- Factoryless firms that outsource the entire production process of a good but own none of the inputs (goods and services) used by the contracted processors should be classified to the distribution sector.
- Large retailers are increasingly adopting factoryless approaches to produce the goods and services they sell, in particular via own-brands. There is a possibility therefore that many of these firms could see their classification move from retail to manufacturing. But any change in classification should only occur if the value-added (in basic prices) from any given manufacturing (factoryless) activity formed the principal activity of the firm. This calculation should separately consider the value that is added (also in basic prices) via the distribution (margin) activities of the retailer (whether on-line or through retail establishments). In most cases the firm will remain in the distribution sector, particularly as the brand, or other IPP, value is typically worth less than non-generic brands. However, notwithstanding the fact that the unit may remain within the distribution sector, supply-use tables should properly reflect any factoryless activities of this unit by recording secondary activities on the off-diagonal entire in the make matrix and intemediate consumption in the use matrix. This means that any inputs the unit (classified as a distributor) owns (and that are processed by contractors) must be recorded as intermediate consumption of that unit (reflecting the intemediate inputs of its secondary activity of 'manufacturing'). At the same time these secondary activities should also be recorded in supply (or make) tables. An example of these flows is shown below for a retailer that contracts the production of a shoe to an offshore manufacturer with the retailer purchasing all of the material inputs and the design. In the example the retailer purchases: material inputs of value 10; the design with value 20; the processing services with value 5, to create a shoe with value 36 (reflecting coordination inputs (all labour) of value 1 provided by the retailer). The shoe is then sold via the retailer's shops with value 50, and for simplicity it is further assumed that there is no intermediate consumption associated with the provision of distribution margins.

Supply table						Use	
	Retailer	Import	Margin	Total		Retailer	HHFC
Raw materials for shoes		10		10		10	
Shoes (and processing services)	36	5	14	55		5	50
IPP		20		20		20	
Distribution margin	14		-14	0			
Value-added						15 (1+14)	
Total output/import/final demand	50	35	0	85		50	50

64. In summary, for supply-use tables none of the above necessarily implies any unconventional complications. Those factoryless producers that are classified as manufacturers will record intermediate consumption of the outsourced production (processing fees recorded in the appropriate product sector), with total output reflecting, amongst other things, the value of the processing fee and the principal's own value-added (which would incorporate any return on the principal's IPP assets). For a factoryless producer (owning none of the material inputs, and none of the IPPs or other service inputs) classified as a distributor, the principal should be recorded in a supply-use table like any other conventional distributor.

5.3.2 Intellectual Property Products

65. From the above it follows that some care is needed when considering how to determine the main activity of a firm. IPP products are increasingly embodied in the value of goods. In many cases the main value of a good reflects the value of the IPP. As such there is a risk, following the general ISIC guidelines that many firms will be classified to the IPP producing sector, as this is the underlying activity that generates most of the value-added. Whilst this may, arguably, accurately reflect the principal underlying activity where the value is created, this is likely to significantly reduce the analytical usefulness of ISIC classifications - particularly as the IPP content of goods increasingly forms a significant (often largest) part of the value of the good. It will mean for example that many units engaged in the production of a good (factoryless or otherwise) will be classified to the equivalent IPP activity. This is not the recommendation of this Handbook. Instead, as shown above, the recommendation of this Handbook is to follow the guidelines concerning factoryless producers (but with the proviso that a new sub-set of factoryless manufacturing is included) for the specific manufacturing category to which the unit is classified.

66. The broader issue concerning IPPs however and covered in Chapter 3 of this Handbook concerns the coverage of flows related to the use IPPs between affiliated enterprises, where the economic owner may be hard to establish. As described in Chapter 3, often a strict interpretation of the rules on economic ownership will indicate that some flows that are currently recorded as property income flows should instead be recorded as payments for services. These issues have fairly trivial consequences for supply-use tables and so are not further elaborated here.

5.3.3 Goods for Processing and Merchanting

67. The implications of the 2008 SNA and BPM6 changes on the treatment of goods for processing and merchanting were fully described in the Handbook on Globalisation in the National Accounts and so are not considered further here.

5.4 Accounting Extensions for (going beyond) Trade in Value-Added Beyond

68. Looking at trade in value-added terms provides a valuable insight into broader notions of competitiveness (in addition to providing insights into trade policies) by illustrating interlinkages between countries and also by illustrating those activities (or tasks) that generate the most value.

69. But additional indicators and insights can be gained by considering extensions to the accounting framework.

5.4.1 Trade in Jobs

70. One immediate area relates to jobs. This requires consistent estimates of employment measures (employment, employers, actual hours worked) with the underlying value-added estimates produced by national statistics offices in their supply-use tables.

71. Countries have already begun to make improvements in this area, driven by a need to produce coherent productivity estimates (by industry), and it is hoped highlighting the important insights that can be gained by looking at trade in jobs will reinforce and support these national initiatives aimed at improving coherence. Going a step further, particularly because international fragmentation has meant industries across countries are less comparable than they used to be (as countries specialise in those stages

of the underlying activity where they have comparative advantage) it is increasingly becoming necessary to link jobs statistics to skills statistics.

72. The OECD's ANSKILL database provides information on employment and skill composition at the industry level. The database matches industry data at the 2-digit level (classified according to the International Standard Industrial Classification [ISIC] Revision 3) to occupations at the 2-digit level (classified according to the International Standard Classification of Occupations [ISCO] – 88). It also includes an additional proxy for skills, in the form of data on educational attainment of employees (classified on the basis of the International Standard Classification of Education [ISCED-97]). The database covers 26 countries, mostly for 1997-2005 although coverage of seven of the countries is much more limited.

73. For ANSKILL, the ISCO-88 occupation classification maps to high, medium and low skill levels, as follows:

- Categories 1 (Legislators, senior officials, managers), 2 (Professionals) and 3 (Technicians and associate professionals) are regarded as high-skilled.
- Categories 4 (Clerks), 5 (Service workers and shop and market sale workers), 6 (Skilled agricultural and fishery workers) and 7 (Craft and related trade workers) are regarded as medium-skilled.
- Categories 8 (Plant and machine operators and assemblers) and 9 (Elementary occupations) are regarded as low-skilled.

74. The ISCED-97 educational classification maps to high, medium and low skill levels in ANSKILL as follows:

- Categories 1 (Primary education) and 2 (Lower secondary/second stage of basic education) are regarded as low-skilled.
- Categories 3 (Upper secondary education) and 4 (Post-secondary non-tertiary education) are regarded as medium-skilled.
- Categories 5 (First stage of tertiary education) and 6 (Second stage of tertiary education) are regarded as high-skilled.

5.4.2 Trade in Income

75. The difficulties raised by the recording of payments related to the use of intellectual property products in the national accounts, international trade statistics and balance of payments highlight the importance of beginning to think about broader accounting frameworks that can adequately capture who really benefits from trade.

76. But this is not merely a measurement issue related to the quality of statistics on international trade in IPPs. Consider for example an affiliate enterprise, recognised as the economic owner of an IPP that it uses to produce goods it sells. The affiliate's value-added would reflect in part the return on this underlying asset, realised as profits. These profits would subsequently be recorded as reinvested earnings whether or not any actual flows occur between the parent and its affiliate. Ultimately therefore it is the parent (often the entity that finances the underlying IPP) that benefits from the use of the IPP. In cases where these flows are incorrectly recorded as primary income flows and not payments (by the affiliate) of an IPP owned by the parent, the situation is the same. It is the parent that benefits from the flow of trade but an analysis of trade in value-added terms cannot reveal this.

77. But the flows merely illustrate a wider issue. Such interpretations extend beyond looking only at the conventional set of assets recognised as such in the SNA. Other knowledge based assets, such as brands and organisational capital can also increase an affiliate's value-added and even though these assets are not recognised in the SNA the profits recorded by the affiliate compensate for their use, and which is manifested as reinvested earnings flows in the accounts. But these flows are typically not available on a bilateral partner country basis let alone partner country-industry basis; which is what is needed for analyses of trade in income in an analogous way to trade in value-added.

78. Recording these flows therefore is crucial. Part of the solution lies in producing supply-use tables (or indicators) that capture foreign ownership. Clearly it is unlikely to be feasible to produce supply-use tables that capture foreign ownership by (the affiliate's owner's) country. But a separate breakdown of activities in a supply-use table that differentiates between foreign and domestic owned firms can be done.

79. By supplementing this with bilateral trade in primary income (from whom-to-whom) statistics (broken down by type of income (in particular reinvested earning and interest) it should be possible to create extensions to the trade in value-added accounting framework by treating the primary income flows (and components) as if they were services produced by artificial industries in the host country of the parent company.

80. Some of the tools to do this already exist. Foreign Affiliate Trade statistics can be combined for example with information in supply-use tables that shows breakdowns based on ownership. And there is also scope to link this further to BoP data flows. The OECD is looking at developing a more detailed accounting framework and set of recommendations in this area.

5.4.3 Trade in CO2 (and other emissions)

81. One additional extension that follows from the accounting framework for trade in value-added (and trade in jobs) is carbon footprints. Carbon footprint calculations are typically estimated using IO tables. Clearly any improvements in underlying SU or IO table as described above will lead to improvements in estimates of emissions (CO2 and others) based on footprints.

5.4.4 Incorporating capital flows

82. Other areas where extensions to the accounting framework would be desirable include the contribution made by capital more generally. Because of the way capital (gross fixed capital formation) is recorded in the accounting system (as gross fixed capital formation) analyses that look at trade in value-added do not fully capture how production across countries is linked and how capital goods (and services) produced in one country contribute to the value-added in another. For example all the value-added exported by Japan in producing machinery for manufacturers in China will be recorded as Chinese imports from Japan. But arguably the capital service values embodied in the goods produced and exported by China should show Japan as the beneficiary. This requires high quality capital flow (and capital stock) matrices.

5.4.5 Distribution sectors and trade

83. One final area of work that merits attention concerns the value added by distributors via sales of final imported goods. This will require that countries produce estimates of margin rates for all products in a use table.

ANNEX I: INDICATOR DESCRIPTIONS AND DEFINITIONS

In the first release of the OECD-WTO TiVA database, the following indicators were provided for 40 countries (OECD countries, Russian Federation, Brazil, China, India, Indonesia, and South Africa) with a breakdown into 18 industries.

Gross Trade Indicators

Variable Name	Variable Description	Comments
EXGR	Gross Exports by Industry, USD	All variables are consistent with official National Accounts estimates of total gross exports and total gross imports and GDP estimates. Estimates by Industry are based on the balanced pattern of trade derived within the global input-output database (see below). *Bilateral gross trade flows (between partner countries) of exports and imports are not shown as current official statistics on bilateral trade are not globally coherent. The global input-output table underlying the TiVA database imposes coherence in bilateral gross flows, which may be released in future database releases after consultation with national statistics institutes (NSIs).* The underlying gross bilateral trade statistics used to arrive at the balanced picture of trade in the TiVA database are however available for both goods (OECD's *Bilateral Trade by Industry and End-Use database* BTDIxE) and services (OECD's *Trade in Services by Partner Country database*, TISP) and can be found on the OECD's statistics portal OECD.Stat.
IMGR	Gross Imports by Industry, USD	
EXGR_GDP	EXGR as a per cent of GDP	
IMGR_GDP	IMGR as a per cent of GDP	
TSGR	Bilateral Trade balances by Partner Country, USD	TSGR is equivalent to EXGR minus IMGR. Bilateral trade positions in TSGR are also shown in the TiVA database. These bilateral trade balances broadly align with 'official' bilateral trade balances produced by NSIs. However there are often differences between TiVA estimates and these 'official' estimates'. These reflect: • Treatment of re-exports and transit trade through e.g. Netherlands, Hong Kong, China, Singapore and NAFTA. • Global inconsistencies between exports and imports of trade in goods and services between partner countries, reported in official statistics. • Coverage and quality issues, particularly in official bilateral trade in services statistics, such as missing data. The main focus for bilateral trade balances in the TIVA database should be on differences between TSGR and TSVAFD (see TSVAFD-TSGR).
TSGR_GDP	TSGR as a per cent of GDP	

Gross Trade Decomposition (Value-Added embodied in Gross Trade Flows)

Variable Name	Variable Description	Comments
EXGRDVA	Total Domestic Value-Added embodied in gross exports (by Industry), USD	Total Domestic value-added content of exports is broken down into three components, described below as EXGR_DDC, EXGR_IDC and EXGR_RIM).
EXGRDVA_EX	EXGRDVA as per cent of EXGR (by Industry), %	This reflects the domestic value-added embodied in exports as a per cent of exports. It provides a simple measure that illustrates how much value-added is generated throughout the economy for a given unit of exports. The lower the ratio the higher the foreign content and so the higher the importance of imports to exports.
EXGR_DDC	Direct Industry Value-Added (by Industry), USD	This reflects the direct contribution made by an industry in producing a good or service for export.
EXGR_IDC	Indirect Domestic Value-Added (by Industry), USD.	This reflects the indirect contribution of domestic supplier industries made through domestic (upstream) transactions.
EXGR_RIM	Re-imported Domestic Value-Added (by Industry), USD	This reflects the domestic value-added that was exported in goods and services used to produce the intermediate imports of goods and services used by the industry in question.
EXGR_FVA	Foreign Value-Added share of gross exports, by country of origin (USD)	This reflects the foreign value-added embodied in imports broken down by country of origin.
EXGR_DDCSH	EXGR_DDC as a % of EXGR (by Industry).	The share reflects how much value-added is generated in an industry per unit of its total gross exports.
EXGR_IDCSH	EXGR_IDC as a % of EXGR (by Industry).	The share reflects the value-added created in upstream industries providing domestic inputs to the exporting industry.
EXGR_RIMSH	EXGR_RIM as a % of EXGR (by Industry).	The share reflects the value-added created in upstream domestic industries providing indirect intermediate inputs, via international, as opposed to domestic, value-chains to the industry in question. The indicator provides a measure of how protectionist measures may impact on domestic industries that provide inputs to imports.
EXGR_FVASH	EXGR_FVA as a % of EXGR (by Industry).	This is equivalent to 1 minus EXGRDVA_EX

Intermediate Imports

Variable Name	Variable Description	Comments
REI	Intermediate Imports embodied in Exports, as a per cent of total intermediate imports, (by Industry, %).	This reflects the share of intermediate imports that are used (indirectly and directly) in producing goods and services for export, as a per cent of total intermediate imports (by import category). The indicator provides a measure of the importance of intermediate imports to produce goods and services for export and their role as a source of international competiveness.

Value-Added embodied in Final Domestic Demand

Variable Name	Variable Description	Comments
FDDVA	Domestic Value-Added embodied in Foreign Final Domestic Demand, by importing country and exporting industry, USD	Value-Added embodied in Foreign Final Domestic Demand shows how industries export value both through direct final exports and via indirect exports of intermediates through other countries to foreign final consumers (households, charities, government, and as investment). They reflect how industries (upstream in a value-chain) are connected to consumers in other countries, even where no direct trade relationship exists. The indicator illustrates therefore the full upstream impact of final demand in foreign markets to domestic output. It can most readily be interpreted as 'exports of value-added'.
FDDVASH	FDDVA by importing country and exporting industry as a per cent of total FDDVA, %	
FDDVA_GDP	FDDVA as a per cent of GDP, by importing country and exporting industry	
FDFVA	Foreign Value-Added embodied in Final Domestic Demand, by origin country and origin industry, USD	Foreign Value-Added embodied in Final Domestic Demand shows for a final good or service (purchased by households, government, non-profit institutions serving households, or as investment) where foreign value-added originates. It is the 'import' corollary of FDDVA and shows how industries abroad (upstream in a value-chain) are connected to consumers at home, even where no direct trade relationship exists. It can most readily be interpreted as 'imports of value-added'
FDFVASH	FDDVA by origin country and origin industry as a per cent of total FDDVA, %	
FDFVA_GDP	FDDVA as a per cent of GDP, by origin country and origin industry	
TSVAFD	Bilateral Trade balances in value-added by Partner Country (FDDVA minus FDFVA), USD	The bilateral trade position in value-added terms.
TSVAFD_GDP	Bilateral Trade balances in value-added by Partner Country (FDDVA minus FDFVA), % GDP	

Services

Variable Name	Variable Description	Comments
SERV_VAGR	Total Domestic Value-Added of the services sector (only) embodied in gross exports (by Industry), % of total exports.	This reflects the services domestic value-added embodied in exports as a per cent of exports. It provides a simple measure that illustrates the real underlying contribution made by services to exports and can be broken down into three components, described below as EXGR_DDC_SV, EXGR_IDC_SV and EXGR_RIM_SV.
EXGR_DDC_SV	Direct Services Value-Added (by Industry), USD	This reflects the direct services value-added made by an industry in producing a good or service for export. By definition it will be zero for all non-services industries.
EXGR_IDC_SV	Indirect Domestic Services Value-Added (by Industry), USD.	This reflects the indirect contribution of domestic service suppliers made through domestic (upstream) transactions, for exports.
EXGR_RIM_SV	Re-imported Services Domestic Value-Added (by Industry), USD	This reflects the domestic services value-added that was exported in goods and services used to produce the intermediate imports of goods and services used by the industry in question.
EXGR_FVA_SV	Foreign Services Value-Added share of gross exports, by country of origin (USD)	This reflects the foreign services value-added embodied in imports broken down by country of origin.
SERV_VAFD	Domestic Services Value-Added embodied in Foreign Final Domestic Demand, by origin country and origin industry, as % of total final demand in the importing country	

The following provides an algebraic description of each of the indicators described above:

Gross exports:

Country c's gross exports for a given industry i can be directly calculated from the underlying global IO table by summing up exports in intermediate goods and services and exports in final demand.

$$\mathrm{EXGR_{c,i}} = \sum_{\mathrm{p}} \mathrm{EXGR_{c,p,i}} = \sum_{\mathrm{p}} (\mathrm{EXGRI_{c,p,i}} + \mathrm{EXGRF_{c,p,i}})$$

$\mathrm{EXGRI_{c,p,i}}$ represents gross exports in intermediates from domestic industry i in country c to p. $\mathrm{EXGRF_{c,p,i}}$ is gross exports in final demand, where c and p $\in$[1,..,N] and c $\neq$ p.

Gross exports as a % of GDP (total value added):

Final demand in OECD's ICIO framework has been benchmarked with each country's GDP from its National Accounts.

$$\mathrm{EXGR\_GDP_{c,i}} = \frac{\mathrm{EXGR_{c,i}}}{\mathrm{GDP_c}}$$

Gross imports:

$\mathrm{IMGRI_{c,p,i}}$ is gross imports in intermediates from country c to p in a given industry i; and $\mathrm{IMGRF_{c,p,i}}$ is gross imports in final demand. Total imports of country c are measured as:

$$\mathrm{IMGR_{c,i}} = \sum_{\mathrm{p}} \mathrm{IMGR_{c,p,i}} = \sum_{\mathrm{p}} (\mathrm{IMGRI_{c,p,i}} + \mathrm{IMGRF_{c,p,i}})$$

Gross imports as a % of GDP (total value added):

$$\mathrm{IMGR\_GDP_{c,i}} = \frac{\mathrm{IMGR_{c,i}}}{\mathrm{GDP_c}}$$

Gross trade surplus:

$$\mathrm{TSGR_{c,p,i}} = \mathrm{EXGR_{c,p,i}} - \mathrm{IMGR_{c,p,i}}$$

Gross trade surplus as a % of GDP (total value added):

$$\mathrm{TSGR\_GDP_{c,i}} = \frac{\mathrm{TSGR_{c,i}}}{\mathrm{GDP_c}}$$

Gross exports by industry can be broken down into domestic and foreign value added contents, where domestic value added content of gross exports can be further split into three components, direct domestic industry value added, indirect domestic value added and re-imports.

Direct domestic industry value added content of gross exports

$$\mathrm{EXGR\_DDC_c} = \mathrm{V_c EXGR_c}$$

Indirect domestic content of gross exports (originating from domestic intermediates)

$$\mathrm{EXGR\_IDC_c} = \mathrm{V_c}(\mathrm{I} - \mathrm{A_c})^{-1}\mathrm{EXGR_c} - \mathrm{EXGR\_DDC_c}$$

Re-imported domestic value added content of gross exports

$$\mathrm{EXGR\_RIM_c} = \mathrm{V_c B_{c,c} EXGR_c} - \mathrm{EXGR\_DDC_c} - \mathrm{EXGR\_IDC_c}$$

Foreign value added content of gross exports

$$\mathrm{EXGR\_ICE_{c,p}} = \mathrm{V_p B_{p,c} EXGR_{c,p}}$$

Where $\mathrm{EXGR\_DDC_c}$, $\mathrm{EXGR\_IDC_c}$, $\mathrm{EXGR\_RIM_c}$ and $\mathrm{EXGR\_ICE_{c,p}}$ are K x 1 vectors and K represents the total number of industries.

$\mathrm{V_c} = \begin{bmatrix} \mathrm{v_{c1}} & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & \mathrm{v_{cK}} \end{bmatrix}$ is a K x K matrix with domestic value added shares of each industry i in country c on the diagonal.

$\mathrm{EXGR_{c,p}}$ is a K x 1 vector of gross exports from country c to country p for any given industry i, where $c \neq p$. $\mathrm{EXGR_c}$ is total exports of country c.

$\mathrm{A_c}$ is the IO coefficient matrix from country c's national IO table and $(\mathrm{I} - \mathrm{A_c})^{-1}$ is the corresponding Leontief inverse.

$\mathrm{B} = (1 - \mathrm{A})^{-1}$, is the global Leontief inverse matrix with NK x NK dimensions, and A is the corresponding global IO coefficient matrix. $\mathrm{B_{c,c}}$ is a K x K diagonal block matrix of B, and it represents the total requirements in gross output for one unit increase of country c's final domestic demand. $\mathrm{B_{p,c}}$ is also a K x K block matrix, and it represents total requirements in gross output from country p for a one unit increase in country c's final demand.

The four components of gross exports are also presented as a share of total gross exports.

Direct domestic industry value added share of gross exports

$$\mathrm{EXGR\_DDCSH_{c,i}} = \frac{\mathrm{EXGR\_DDC_{c,i}}}{\mathrm{EXGR_{c,i}}} \times 100$$

Indirect domestic share of gross exports (originating from domestic intermediates)

$$\mathrm{EXGR\_IDCSH_{c,i}} = \frac{\mathrm{EXGR\_IDC_{c,i}}}{\mathrm{EXGR_{c,i}}} \times 100$$

Re-imported domestic value added share of gross exports

$$\mathrm{EXGR\_RIMSH}_{c,i} = \frac{\mathrm{EXGR\_RIM}_{c,i}}{\mathrm{EXGR}_{c,i}} \times 100$$

Foreign value added share of gross exports

$$\mathrm{EXGR\_ICESH}_{c,i} = \frac{\sum_p \mathrm{EXGR\_ICE}_{c,p,i}}{\mathrm{EXGR}_{c,i}} \times 100$$

$\mathrm{EXGR\_DDC}_{c,i}$ is the i-th element of the Kx1 vector $\mathrm{EXGR\_DDC}_c$, and gives direct domestic value added context of gross export of a given industry i. The same rule applies to indirect domestic value added and re-import shares of gross exports. Foreign value added shares of gross exports are summed for all partners in the current database (16 January 2013).

Domestic value added embodied in gross exports:

$$\mathrm{EXGRDVA}_c = \sum_p \mathrm{EXGRDVA}_{c,p} = \sum_p \mathrm{V}_c \mathrm{B}_{c,c} \mathrm{EXGR}_{c,p}$$

Foreign value added embodied in gross imports:

$$\mathrm{IMGRFVA}_c = \sum_p \mathrm{IMGRFVA}_{c,p} = \sum_c \mathrm{V}_c \mathrm{B}_{c,c} \mathrm{EXGR}_{p,c}$$

$\mathrm{EXGRDVA}_{c,p}$ and $\mathrm{IMGRDVA}_{c,p}$ are both K x 1 vectors, representing country c's domestic value added embodied in gross exports to country p and country p's value added embodied in country c's imports respectively, for any given industry i. Both variables are aggregated for all partners in the current database.

Domestic value added embodied in foreign final demand

$$\mathrm{FDDVA}_{c,p} = \mathrm{V}_c \sum_s \mathrm{B}_{c,s} \mathrm{EXGRF}_{s,p}$$

$\mathrm{FDDVA}_{c,p}$ and $\mathrm{EXGRF}_{s,p}$ are K x 1 vectors. $\mathrm{EXGRF}_{s,p}$ representing final demand produced in country s that is finally consumed in partner country p . $\mathrm{B}_{c,s}$ is the off diagonal block matrix of global Leontief inverse matrix B, first defined as in category B. When s = p, $\mathrm{EXGRF}_{p,p}$ is final demand in country p.

Domestic value added embodied in foreign final demand – partner shares, % of total domestic value added embodied in foreign final demand

$$\mathrm{FDDVASH_{c,p,i}} = \frac{\mathrm{FDDVA_{c,p,i}}}{\sum_{\mathrm{p}} \mathrm{FDDVA_{c,p,i}}} \times 100$$

$\mathrm{FDDVA_{c,p,i}}$ is the i-th element of the K x 1 vector $\mathrm{FDDVA_{c,p}}$.

Domestic value added embodied in foreign final demand as a % of GDP (total value added)

$$\mathrm{FDDVA\_GDP_{c,p,i}} = \frac{\mathrm{FDDVA_{c,p,i}}}{\mathrm{GDP_c}} \times 100$$

Foreign value added embodied in domestic final demand

$$\mathrm{FDFVA_{c,p}} = \mathrm{V_p} \sum_{\mathrm{s}} \mathrm{B_{p,s}EXGRF_{s,c}}$$

$\mathrm{FDFVA_{c,p}}$ and $\mathrm{EXGRF_{s,c}}$ are K x 1 vectors. $\mathrm{EXGRF_{s,c}}$ represents final demand produced in s that is finally consumed in c.

Foreign value added embodied in domestic final demand – partner shares, % of total foreign value added in domestic final demand

$$\mathrm{FDFVASH_{c,p,i}} = \frac{\mathrm{FDFVA_{c,p,i}}}{\sum_{\mathrm{p}} \mathrm{FDFVA_{c,p,i}}} \times 100$$

$\mathrm{FDFVA_{c,p,i}}$ is the i-th element of the K x 1 vector $\mathrm{FDFVA_{c,p}}$.

Foreign value added embodied in domestic final demand as a % of GDP (total value added)

$$\mathrm{FDFVA\_GDP_{c,p,i}} = \frac{\mathrm{FDFVA_{c,p,i}}}{\mathrm{GDP_c}} \times 100$$

Value added in final demand, surplus

$$\mathrm{TSVAFD_{c,p,i}} = \mathrm{FDDVA_{c,p,i}} - \mathrm{FDFVA_{c,p,i}}$$

Value added in final demand, surplus as a % of GDP (total value added)

$$\mathrm{TSVAFD\_GDP_{c,p,i}} = \frac{\mathrm{TSVAFD_{c,p,i}}}{\mathrm{GDP_c}} \times 100$$

Difference in trade surpluses (value added in final demand minus gross trade)

$$\mathrm{TSVAFD\_TSGR_{c,p}} = \sum_{i} \mathrm{TSVAFD_{c,p,i}} - (\sum_{\mathrm{i}} \mathrm{EXGR_{c,p,i}} - \sum_{\mathrm{i}} \mathrm{IMGR_{c,p,i}})$$

Direct domestic service industry value added content of gross exports

$$\mathrm{EXGR\_DDC\_SV_{c,i}} = \mathrm{V_{c,j}EXGR_{c,i}}$$

Indirect domestic services content of gross exports (originating from domestic intermediates)

$$\mathrm{EXGR\_IDC\_SV_{c,i}} = \sum\nolimits_{j\in S} \mathrm{V_{c,j}}(\mathrm{I} - \mathrm{A_c})^{-1}{}_{ji}\mathrm{EXGR_{c,i}} - \mathrm{EXGR\_DDC\_SV_{c,i}}$$

Re-imported domestic services value added content of gross exports

$$\mathrm{EXGR\_RIM\_SV_{c,i}} = \sum\nolimits_{j\in S} \mathrm{V_{c,j}}\left(\mathrm{B_{c,c}}\right)_{ji}\mathrm{EXGR_{c,i}} - \mathrm{EXGR\_DDC\_SV_{c,i}} - \mathrm{EXGR\_IDC\_SV_{c,i}}$$

Foreign services value added content of gross exports

$$\mathrm{EXGR\_ICE\_SV_{c,i}} = \sum\nolimits_{p}\sum\nolimits_{j\in S} \mathrm{V_{p,j}}\left(\mathrm{B_{p,c}}\right)_{ji}\mathrm{EXGR_{c,p,i}}$$

$\mathrm{EXGR\_DDC\_SV_{c,i}}$ represents the direct domestic service industry value added content of country c's gross exports in industry i. $\mathrm{EXGR\_IDC\_SV_{c,i}}$, $\mathrm{EXGR\_RIM\_SV_{c,i}}$ and $\mathrm{EXGR\_ICE\_SV_{c,i}}$ are defined similarly.

$\mathrm{V_{c,j}}$ is value added share of service industry j in home country c, where $j \in S$; otherwise, $\mathrm{V_{c,j}} = 0$.

$(\mathrm{I} - \mathrm{A_c})^{-1}{}_{ji}$ is the ji-th element of local Leontief inverse matrix.

$\left(\mathrm{B_{c,c}}\right)_{ji}$ and $\left(\mathrm{B_{p,c}}\right)_{ji}$are the ji-th element of $\mathrm{B_{c,c}}$ and $\mathrm{B_{p,c}}$ respectively.

Services value added embodied in gross exports by source country, as % of gross exports

$$\mathrm{SERV\_VAGR_{c,p,i}} = \sum\nolimits_{j\in S} \mathrm{V_{p,j}}\left(\mathrm{B_{p,c}}\right)_{ji}\mathrm{EXGR_{c,p,i}}/\mathrm{EXGR_{c,p,i}}$$

$\mathrm{SERV\_VAGR_{c,p,i}}$ represents the share of services value added in gross export of country c that sourced from partner country p for any given sector i.

Services value added embodied in foreign final demand , as % of foreign final demand

$$\mathrm{SERV\_VAFD_{c,p,i}} = \sum\nolimits_{j\in S} \mathrm{V_{p,j}}\left(\mathrm{B_{p,c}}\right)_{ji}\mathrm{EXGRF_{c,p,i}}/\mathrm{EXGRF_{c,p,i}}$$

$\mathrm{SERV\_VAFD_{c,p,i}}$ represents the share of services value added in export in final demand of country c that sourced from partner country p for any given sector i.

Re-exported intermediates as a % of total intermediate imports

$$\mathrm{REI}_{c,i} = \left(\sum\nolimits_{p} \mathrm{A}_{p,c}\mathrm{B}_{c,c}\mathrm{EXGR}_{c}\right)_{i} / \left(\sum\nolimits_{p} \mathrm{IMGRI}_{c,p}\right)_{i}$$

$\mathrm{A}_{p,c}$ is the K x K IO coefficient matrix, giving c's requirements in imported intermediate products sourced from country p.

$\mathrm{A}_{p,c}\mathrm{B}_{c,c}\mathrm{EXGR}_{c}$ is also a K x 1 vector and refers to intermediate goods and services absorbed in country c that originated from p for c' total exports. $\left(\sum_{p} \mathrm{A}_{p,c}\mathrm{B}_{c,c}\mathrm{EXGR}_{c}\right)_{i}$ refers to the i-th element of the vector and gives total intermediate goods and services absorbed by country c that originated from foreign countries in industry i.

$\left(\sum_{p} \mathrm{IMGRI}_{c,p}\right)_{i}$ is the i-th element of the K x 1 vector with aggregated intermediate imports of country c for each industry I, where $\mathrm{IMGRI}_{c,p}$ is a vector giving c's intermediate imports from P for each industry.

Value added export ratio total domestic value added share of gross exports, %

$$\mathrm{EXGRDVA\_EX}_{c,i} = \frac{\mathrm{EXGRDVA}_{c,i}}{\mathrm{EXGR}_{c,i}} \times 100$$

Value added export ratio total domestic value added in foreign final demand as % of gross exports

$$\mathrm{FDDVA\_EX}_{c,p} = \frac{\sum_{i} \mathrm{FDDVA}_{c,p,i}}{\sum_{i} \mathrm{EXGR}_{c,p,i}} \times 100$$

Revealed comparative advantage based on gross exports, manufacturing goods

$$\mathrm{RCA\_EXGR}_{c,i} = \frac{\sum_{p} \mathrm{EXGR}_{c,p,i} / \sum_{p,i} \mathrm{EXGR}_{c,p,i}}{\sum_{c,p} \mathrm{EXGR}_{c,p,i} / \sum_{c,p,i} \mathrm{EXGR}_{c,p,i}}$$

Revealed comparative advantage based on domestic value added embodied in gross exports, manufacturing goods

$$\mathrm{RCA\_EXGRDVA}_{c,i} = \frac{\sum_{p} \mathrm{EXGRDVA}_{c,p,i} / \sum_{p,i} \mathrm{EXGRDVA}_{c,p,i}}{\sum_{c,p} \mathrm{EXGRDVA}_{c,p,i} / \sum_{c,p,i} \mathrm{EXGRDVA}_{c,p,i}}$$

Where i is restricted to manufacturing sectors only.

$\mathrm{EXGRDVA}_{c,p,i}$ is the i-th element of $\mathrm{EXGRDVA}_{c,p}$.

ANNEX II: EXPANDING NATIONAL IO AND SU TABLES TO MEASURE GLOBAL VALUE CHAINS

Indicators created via input-output techniques are limited by the degree of industry disaggregation provided by the tables. The national input-output tables used by the OECD are based on a harmonised set of 37 industries. In simple terms, therefore, any given indicator for a particular industry assumes that all consumers of that industry's output purchase exactly the same shares of products produced by all of the firms allocated to that industry.

This boils down in practice, (but is not the same thing) to assuming that there exists only one single production technique for all of the firms (and all of the products) in the industry grouping. We know that this is not true and that different firms, even those producing the same products, will have different production techniques, and, so, technical IO coefficients, and we also know that different firms in a given industry produce different products and that these products will be destined for different types of consumers and markets.

Of chief concern in this respect is the evidence that points to exports having very different coefficients from those for goods and services produced for domestic markets, particularly when the exports (typically intermediate) are produced by foreign owned affiliates in a global value chain. Because exporting firms are generally more integrated into international value-added chains they will typically have higher foreign content ratios, particularly when they are foreign owned. Generally, therefore, an inability to account for this heterogeneity in producing trade in value-added estimates will result in lower shares of foreign content than might be recorded if more detailed input-output tables were available.

It is important to note, however, that more detail does not necessarily translate into more disaggregated industries. What is important for developing indicators on global value chains is more detail on firms trading internationally. In this sense given a choice between doubling the number of industries available within current national IO or SU tables or providing a split of existing industries into a group of exporting firms and non-exporting firms, the latter may arguably be preferable.

Ideally therefore countries should attempt to construct Supply-Use or Input-Output tables that better respond to the challenges presented by GVCs. In a project coordinated by the Chinese Ministry of Commerce, in collaboration with the Chinese National Bureau of Statistics and the OECD, an input-output table for China was created that split all of its industrial sectors into three categories - processing firms, other exporting firms, and all other firms.

Ideally countries could adopt similar approaches in constructing their IO and/or SU tables, with splits based on national circumstances. Processing firms form a significant part of China's exporters and so such a classification made sense but this may not be optimal for all countries. But achieving changes to national IO or SU tables may take some time to achieve for most countries.

Other, potentially simpler, approaches however could be used to significantly improve the quality of the information IO tables are able to produce in analysing GVCs however.

In October 2012 the OECD and Eurostat launched one such approach by building on the OECD-Eurostat TEC (Trade by Enterprise Characteristics) data collection. The TEC exercise collects information on the turnover generated through exports broken down by size class, industry and partner country. For imports similar information is provided but with a more limited breakdown on the importing industry. But these indicators only begin to scratch at the surface of the potential, if links to structural business statistics can be made (see Ahmad, Araujo, Lo Turco, Maggioni,2001). With these further links, information on the direct value-added of exporting firms can be created, as can information on employment. In addition indicators broken down by whether the firms are foreign or domestically owned can also be created; the need for which is described below and in Chapter 3. Moreover information that linked the information on importing firms with those of exporting firms can provide vital information on the nature of global production chains. Importantly, for those countries that already produce TEC statistics, this information, albeit on the basis of turnover flows, could be developed without necessarily using links to structural

business statistics. This information could form the basis for disaggregating IO or SU industries into characteristics required to better measure GVCs.

The questionnaire circulated to test the feasible and practical level of detail that could be collected bearing in mind disclosure rules follows below.

QUESTIONNAIRE ON THE ECONOMIC PERFORMANCE OF FIRMS ENGAGED IN INTERNATIONAL TRADE

Motivation and Background

The dynamics of globalisation poses new challenges for economic and policy analysis. The liberalisation of trade policies and capital controls, coupled with the reduction in transport, communication and information costs has led to an important reduction of trade costs and allowed a reorientation or firms' production strategies in recent decades. As a result, production processes are increasingly fragmented and each production stage is assigned to the most cost-effective location, while 'service links' (transportation and communication services) ensure the co-ordination among the several stages of internationally integrated production process, a phenomena which has became known as international fragmentation of production. Vertical fragmentation of production can occur within the firm, as the firm internalises countries' and regions' comparative advantages and establishes subsidiaries abroad. Another option is for the firm to outsource certain parts of the production process to non-affiliated companies located overseas.

Vertical fragmentation challenges the conventional way of compiling international trade statistics. Trade statistics record the full value of the good each time it crosses borders, including embodied intermediate goods and services. This leads to multiple counting which will be larger the more production processes are sliced into individual stages and with each stage occurring in a different country.

This multiple counting masks the value-added contribution made by exports as well as the identification of the products any country truly has a comparative advantage in. In order to capture this emergent feature of international trade and to gauge each country's real contribution of the goods and services it exports, there is an increasing recognition that measures of trade in the underlying value-added embodied in a product are needed to better reflect the actual contribution trade makes to an economy, in terms of GDP, employment, etc.

The development of these statistics is vital for many other policy dimensions and forms the basis of the OECD-WTO initiative to measure trade in value-added terms (www.oecd.org/trade/valueadded).

The use of Input Output tables to determine the foreign content of exports at the industry level is now widespread and has the great advantage of providing a comprehensive estimate, as both direct and indirect imports (embedded in domestic inputs) are included in the calculation of value-added. However, as currently developed, the use of official Input Output tables in analysis requires one to assume homogeneity in firms allocated to a particular industry. But global production chains challenge this assumption. It is clear that firms engaged in global production networks, particularly processing firms, have typically higher intermediate consumption of imports than those engaged in production for domestic markets. As such conventional input-output tables can lead to biased estimates of the contribution made by exports to overall economic growth and employment.

Firm-level (micro) data can overcome some of the limitations of industry level analyses by providing a finer level of detail of the sectoral aggregation in input-output tables, particularly (in the context of the analysis of trade in value-added) if the finer level focuses on creating new levels of 'homogeneity' centred around the export and import intensity of firms.

But notwithstanding the incentives to produce better quality and more disaggregated input-output tables, additional information and indicators on the nature and economic characteristics of firms engaged in international trade would provide a significant boost to trade analysts. For example, many countries, as

part of the OECD-Eurostat TEC (Trade by Enterprise Characteristics), already produce some indicators on the characteristics of importing and exporting firms. This exercise collects information on the turnover generated through exports broken down by size class, industry and partner country. For imports similar information is provided but with a more limited breakdown on the importing industry.

But these indicators only begin to scratch at the surface of the potential, if links to structural business statistics can be made. With these further links, information on the direct value-added of exporting firms could be created, as could information on employment, and further down the line, skills. In addition indicators broken down by whether the firms are foreign or domestically owned would also be useful. Moreover information that linked the information on importing firms with those of exporting firms would provide vital information on the nature of global production chains – importantly, for those countries that have already produced TEC statistics, this information, albeit on the basis of turnover flows, could be developed without using links to structural business statistics.

The purpose of this questionnaire therefore is to establish what can **realistically** be produced, bearing in mind disclosure rules, at the national level by capitalising on (and encouraging links between) the trade registers, business registers and structural business statistics or otherwise (for example Foreign Affiliate Trade Statistics).

The attached questionnaire is an outcome of discussions at the 2011 OECD Working Party on International Trade in Goods and Services, where there was strong support from Delegates to begin to develop new indicators. The work will be conducted in parallel and feed into a similar project envisaged under the auspices of the OECD's Working Party on Globalisation and Industry (see the attachment). There are two parts of the questionnaire. The first part reflects the metadata content, and is included at the end of this note. The second part is in the form of an Excel document, which accompanies this note.

The Questionnaire

Dealing with Disclosure

Naturally what can be produced in theory is not the same thing as what can be disseminated because of disclosure rules. The questionnaire sets outs a maximum information set.

Its primary purpose is to categorise firms on the basis of their **share of output generated by exports** (export intensities). Three different levels of breakdown are presented in the worksheet:

1. Firms that export (more than 0% of output is made up by exports) and firms that don't (0% of output is exported)

2. A breakdown of firms by export-intensity quartiles: (0%, >0- 25%; >25-50%, >50-75%; and 75% plus)

3. A more aggregated breakdown of export intensity (0, >0-50%; 50% plus).

It is only necessary to complete one of the three breakdowns presented above. Ideally information at the most detailed level will be made available.

Seven variables, described below, are requested in this exercise. Each of them asks for a further breakdown by industry, size class and ownership.

Recognising that disclosure rules will restrict what can realistically be produced for public consumption, the following describes how the information should be prioritised:

- Priority 1: **Industries (Preferably, ISIC rev. 4)**

- Priority 2: **Export intensities (exports as a per cent of output)**

- Priority 3: **Ownership (breakdowns into foreign/domestic ownership)**

- Priority 4: **Size Class breakdowns (preferably by number of employees)**

Please note that the breakdowns and classifications presented above should not be considered to be overly prescriptive. The primary purpose of the exercise is to establish what can be achieved in a feasible and comparable way across countries. If you prefer to provide different size-class breakdowns or necessarily use a different industrial classification system, you are encouraged to provide information on that basis. Please also do not feel restricted to providing information exactly as specified in the questionnaire worksheets.

In completing the questionnaire countries may deliver information that includes confidential cells. The OECD Secretariat will not disseminate this information. If confidential data is provided it should be clearly marked by highlighting that cell in red and underlined. If you choose not to provide the data for confidential cells, please highlight this by completing the cell with a **'C'** entry.

The Variables

Worksheet *'Table I'* requests information on **the number of statistical units participating or otherwise in exports.** Ideally the statistical unit concept used should be consistent with that used in preparing supply-use and input-output tables in the national accounts and structural business statistics. This may not however be practical in all countries. **As such the choice of statistical unit is at your discretion**.

Worksheet '*Table II'* requests information on **the value-added generated by firms in national currency units**. The valuation of value-added should follow the basic price concept.

Worksheet '*Table III'* requests information on **the value of exports generated by firms in national currency units**. The valuation of exports should ideally be at f.o.b (free on board) prices.

Worksheet '*Table IV'* requests information on **the output generated by firms in national currency units**. The valuation of output should follow the basic price concept.

Worksheet '*Table V'* requests information on **the total employment of firms.** The valuation of headcounts should ideally be on a Full Time Equivalent basis.

Worksheet '*Table VI*' requests information on **the total Compensation of Employees of firms.**

Worksheet '*Table VII'* requests information on the **direct imports of firms in national currency units.** The valuation of imports should follow the c.i.f. concept.

METADATA QUESTIONNAIRE

- What is the basis of the statistical unit you have used in completing the attached Excel questionnaire? (e.g. enterprise, establishment, other, please specify)

- What source information have you used? (Trade registers, business registers, structural business statistics, other)

- What is the representativeness of the various sources you have used? (e.g. are there their thresholds in the various sources that exclude some units)

- Is the information on value-added, exports, imports, output and compensation of employees consistent with the principles of the 1993 SNA/BPM5 or the 2008 SNA/BPM6? Please specify which standard is used for each measure.

- What is the price basis that you have used for estimates of value-added?

- Are the value-added estimates consistent with those produced in your national accounts (and supply-use, input-output tables)? Please comment on the differences and their nature if these exist.

- What is the price basis that you have used for estimates of exports?

- Are the export estimates consistent with those produced in your national accounts (and supply-use, input-output tables)? Please comment on the differences and their nature if these exist.

- What is the price basis that you have used for estimates of output?

- Are the output estimates consistent with those produced in your national accounts (and supply-use, input-output tables)? Please comment on the differences and their nature if these exist.

- What is the price basis that you have used for estimates of imports?

- Are the import estimates consistent with those produced in your national accounts (and supply-use, input-output tables)? Please comment on the differences and their nature if these exist.

- Are the measures of employment based on Full Time Equivalent measures? If not please specify

- Do the measures of Employment include own-account workers and the self-employed or employees only? Please specify

- Are the implicit estimates of employees in the employment figures consistent with the compensation of employee data provided? Please comment on the differences and their nature if these exist.

- What industrial classification system have you used?

- What is the basis for your size class breakdown – employment or employees?

- How have you defined and identified foreign owned firms? Are the definitions consistent with Foreign Affiliate Trade Statistics?

Table I: Number of statistical units participating or otherwise in exports (broken down by industry and size class)

Year			Statistical Units: Thousands									
Ownership[1]			Total									
			Exports as per cent of Output strata									
Flow:	Industry	Size Class	0%	more than 0%	Between 0% and less than and equal to 25%	Between more than 25% and less than and equal to 50%	Between more than 50% and less than and equal to 75%	More than 75%	Less than and equal to 50%	More than 50%	*Unknown*	Total
Total												
ISIC rev.4	A (01-03)	Total										
		0-9										
		10-49										
		50-249										
		250+										
		Unknown										
	01	Total										
		0-9										
		10-49										
		50-249										
		250+										

Note 1: this table is illustrative only. It shows the worksheet for the variable, 'number of units'. The original tables circulated as part of the questionnaire included further breakdowns for ownership (i.e. foreign owned and domestic owned). Tables for all other variables, described above follow the same format and are not repeated here for convenience.

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