"European Framework for Measuring Progress"

e-Frame

www.eframeproject.eu

SP1-Cooperation
Coordination and support actions (Coordinating actions)
FP7 SSH-2011-3

Grant Agreement Number 290520
SSH.2011.6.2-1

Deliverable D6.1

Dissemination level: PU

Title: Report on New Measures of International Trade

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Date 15 03 2013

EUROPEAN COMMISSION
European Research Area

SEVENTH FRAMEWORK PROGRAMME

Funded under Socio-economic Sciences & Humanities

Deliverable 6.1

Report on New Measures of International Trade

Summary

The segmentation of production between countries inflates the value of trade because imported intermediates goods and services are counted several times, namely each time they cross borders. To reduce multiple counting in trade statistics and answer the question “who produces for whom in the world economy?”, one needs a new measure of international trade based on the value added produced by each country taking part in the production process of a good or service. This report aims at stocktaking the recent initiatives to compile a measure of trade in value added, both by the academic community and international organisations. The main outcome of this report is that this new measure is essential to assess trade competitiveness or equilibrium exchange rates, to understand trade interdependencies between countries and bilateral imbalances or to gauge the impact of macroeconomic shocks and measure environmental footprints. However, this measure cannot replace standard trade statistics, which describe the “physical” flow of goods and services and help in calculating transport and insurance costs.

The compilation of value added trade statistics does not require new data collection, but would benefit from improvements in the quality of existing data. First of all, strengthening the quality, frequency and timeliness of national input-output tables would improve our understanding of production processes across the world. Second, linking trade and business statistics at the firm level would help analysing the specific production patterns of exporting firms in contrast to domestically selling firms. Third, international cooperation and the implication of international organisations will be essential to tackle the well-known issue of asymmetry of trade statistics. Finally, a new statistical tool in form of a satellite account could be developed to complement national accounts. This tool would bring together a country's foreign activities with respect to trade, investment and labour in one presentation – similar to tourism satellite accounts.

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Introduction

The expansion of international trade since the end of the 1980s has largely been caused by the emergence of a new international production scheme based on cross-border production. Different stages of production are spread across a range of sites in multiple countries. The segmentation of production (by off shoring and global outsourcing in services) is becoming increasingly subtle, in order to make the best of the "kaleidoscope" of each country's comparative advantages. The emergence of this global value chains has deeply changed the landscape in the world trade and whole sectors are exposed to this new trade competition.

This new international division of labour has induced an acceleration of trade flows as a growing number of inputs cross borders several times. Trade ratios have risen and developing countries play an increasing role in the global market. South-South trade, in particular, has more than quadrupled over the past fifteen years. This leads to a multiple counting of intermediate goods and services that inflates the gross value of trade flows. There is a need to distinguish between the "domestic value added content" and the "foreign content" of a country's exports.

Several studies have illustrated the concept of value-added trade using Apple's emblematic devices: first the iPod[1] and then the iPhone[2] and the iPad [3]. All these hi-tech products are assembled in the People's Republic of China and so make a significant contribution to China's gross exports. But Chinese value-added represents only a small share of the value of these electronic devices that incorporate components from Germany, Japan, Korea and other economies that manufacture intermediate inputs. These countries are "first level suppliers" and just above China on the global value chain ("processing countries" are by definition at the bottom of the international supply chains).

However, this does not tell the full story. The intermediate inputs produced by the German, Japanese and Korean firms will themselves have used intermediate imports in their production or sourced intermediate goods from domestic suppliers who in turn would have used intermediate imports. Identifying these flows is equally important, particularly, in the context of the example above, because some of those imports may have originated in China.

To fully decompose the value added of the iPhone and ascribe it to individual countries, one cannot rely on a list of component suppliers. Information on all of the suppliers and their suppliers, and their suppliers' suppliers, and so on, is needed. What is needed therefore is a dataset that is able to link production processes within and across countries; in other words a set of international input-output tables with bilateral trade links (a global input-output table).

Last year, the OECD and the WTO have launched the "Made in the world" initiative (link) "*to support the exchange of projects, experiences and practical approaches in measuring and analysing trade in value* added". Because today, companies divide their operations across the world, from the design of the product and manufacturing of components to assembly and marketing, more and more products are "Made in the World" rather than "Made in the UK" or "Made in France". "*The statistical bias created by attributing the*

[1] LINDEN, G. ET AL. (2009).
[2] XING, Y. AND N. DETERT (2010)
[3] LINDEN, G., K ET AL (2011).

full commercial value to the last country of origin can pervert the political debate on the origin of the imbalances and lead to misguided, and hence counter-productive, decisions. The challenge is to find the right statistical bridges between the different statistical frameworks and national accounting systems to ensure that international interactions resulting from globalization are properly reflected and to facilitate cross border dialogue between national decision makers."

On 16 January 2013, the OECD and the WTO released in Paris the first version of the "OECD-WTO Trade in Value Added (TIVA) database" (link) that has been compiled by linking trade statistics with international input-output tables. The new global input-output tables (GIOs), developed by the OECD, describe interactions between industries and consumers for 58 economies, reflecting 95% of global output. The new tables and the measurement methodology draw on earlier work by the OECD and the WTO as well as other organizations active in this field, such as the Institute of Developing Economies (IDE-JETRO), the US International Trade Commission (USITC) and the World Input-Output Database (WIOD). The WIOD is part of the outcome of the FP7 SSH programme of the European Commission and can be consulted on the WIOD website (www.wiod.org).

This report aims at stocktaking the recent initiatives carried out to come up with the "Trade in Value Added" measures. The first section will focus on why it is important for policy purposes and describe the needs and requirements of different stakeholders. The second section will address topics related to the definition and measurement of the indicators, as well as data availability. The third section will report on the main problems still unsolved, construction hypothesis that impair the quality of the data and future statistical needs to improve the accuracy of the data. The last section will summarize recommendations for stakeholders and statisticians on the use of the indicators and suggestions for data improvements.

1. Why it is important to decompose trade flows into value added components?

There is an increasing recognition that a focus on flows of value-added embodied in trade flows provide more meaningful measures of the importance of trade to economic growth. There is a widespread agreement that this concept reflects, for a given export, the percentage or amount of domestic value-added that is generated by the exporter, throughout the production chain. In other words any given export can be decomposed into value-added contributions from different domestic industries and different foreign industries. Measuring trade in value added closes the gap between research and official statistics by tackling the issue of trade in tasks.

A particular challenge is to disentangle domestic and foreign value-added in the context of highly fragmented production networks where circular trade takes place: inputs are shipped abroad and then come back as more processed products. Circular trade is particularly important in North America (especially between Mexico and the USA) and in Eastern Asia. Traditional National Accounts do not provide a measure of domestic and foreign value-added in trade flows. Therefore, researchers often "harmonize" Input-Output (I-O) tables from different countries and link them with bilateral trade data in order to estimate the share of domestic value-added both in exported and imported goods and services.

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 notes 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.

What can we expect from developing these new statistics on international trade? There are several areas where measuring trade in value-added brings a new perspective and is likely to impact policy choices:

a- **Using accurate value-added trade data would improve exchange rate assessments.** Real effective exchange rates based on value-added trade weights would reveal more accurate measures of competitiveness of a country than those based on gross trade weights. Switching to value-added trade weights could have potentially important implications; for example, some exchange rates that might be considered "misaligned" using gross trade weights may no longer be so using value-added trade weights (or vice-versa).

b- **Real effective exchange rates based on value-added trade would improve estimates of the impact of changes in relative prices, including that on global rebalancing.** For instance, the IMF[4] finds that a downstream (as opposed to upstream) position in a supply chain cushions the impact of relative price changes on both exports and imports. This reflects the higher foreign content in the downstream country's exports, which mitigates the impact of exchange rate changes.

c- **Decomposing foreign value added (FVA) in exports by source country would help understand how disruptions to supply chains can have spillover effects.** Disruptions of trade flows could be either policy induced, such as preferential/regional trade agreements, or naturally caused, such as the

[4] RIAD, NAGWA ET AL., (2012)

recent earthquake in Japan. In either case, being able to track FVA by source would help understand the impact of disruptions in supply chains. Disruption of imports from a trading partner (e.g., Japan) does not necessarily mean that gross exports of a country (e.g., China) will fall by the share of that trading partner's value added in the country's exports (e.g., by Japan's value added share in China's gross exports). The extent of the impact would depend on the nature of the shock and the availability of substitutes. Hence the analysis needs to be supplemented by more disaggregated and higher frequency data than input-output data. Nevertheless, using value-added trade data would be a good starting point.

d- **Bilateral balances, if discussed for political economy considerations, are better measured with value-added, rather than gross, trade data** (see Box 1). 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 is exaggerated because it incorporates the value of foreign inputs. A WTO report calculated that the US-China trade balance in 2008 would be about 40 percent lower if calculated in value-added terms. The true imbalance is therefore also with the countries who have 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 would target countries at the end of global value chains on the basis of an inaccurate perception of the origin of trade imbalances.

e- **Measuring trade in value added sheds new light on today's trade reality, where competition is not between nations, but between firms.** Competitiveness in a world of global value chains means access to competitive inputs and technology. Optimum tariff structure in such a situation is flat (little or no escalation) and reliable (contractual arrangements within supply chains, especially between affiliated establishments, tend to be long term). Outsourcing and offshoring of elaborated parts and components can only take place in situations where intellectual property is respected. However, domestic value-added is not only found in exports but also in imports: some goods and services are intermediates shipped abroad whose value comes back to the domestic economy embodied in the imports of the foreign products. As a consequence, tariffs, non-tariff barriers and trade measures –such as anti-dumping rights– are likely to impact domestic producers 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 Viet Nam. An analysis in value-added terms would have pointed out that EU value-added was in fact subject to the anti-dumping rights[5].

f- **The impact of macro-economic shocks would be better assessed.** The 2008-2009 financial crisis was characterised by a synchronised trade collapse in all economies. What role did global supply chains play in the transmission of a demand shock in markets affected by a credit shortage? 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.

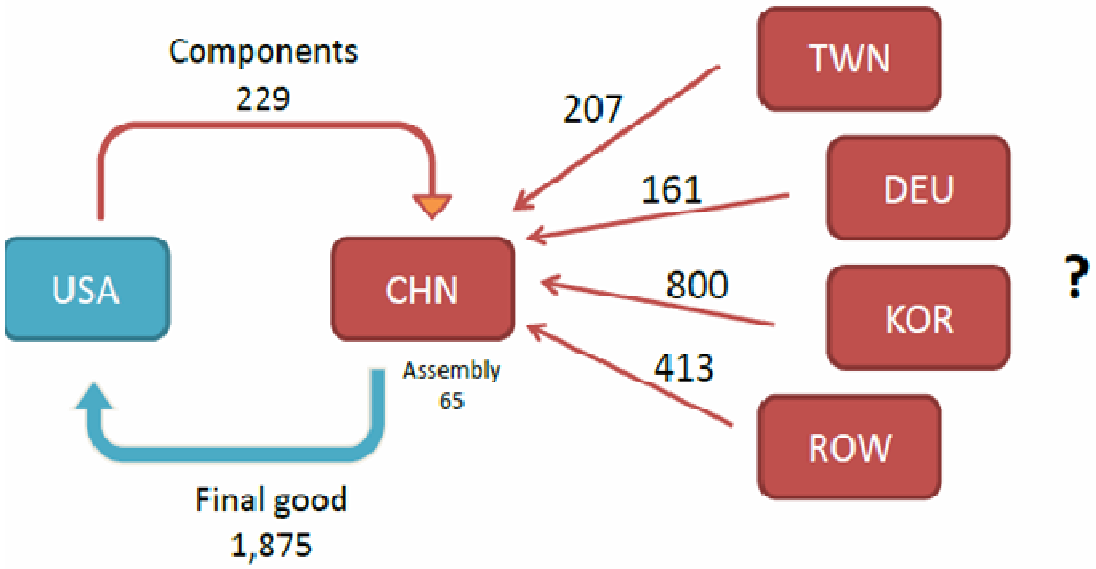
[5] NATIONAL BOARD OF TRADE, 2007.

Box 1: an illustration of the measurement of trade in value added on the bilateral balance

Assuming that 10 million iPhones are exported from China to the US, the iPhone trade represents a trade deficit of USD 1,646 million for the US economy. In gross terms, there is only a deficit between China and the US.

In (relatively crude) value-added terms, however, China adds only a small share of domestic value-added to the iPhone corresponding to the value of the assembly work. The US trade deficit is not only with China but also with Chinese Taipei, Germany, Korea and the rest of the world. The overall trade deficit (vis-à-vis the world) stays unchanged at USD 1,646 million.

The references to ' relatively crude' above reflect the fact that no account is made in the example for the suppliers of the suppliers. The above calculation would have to be adjusted to fully take into account the value-added by each country in the supply chain. This is why we need to add on the above figure upstream input suppliers and why the calculation can only be done if we have all the information about all the producers involved.



US trade balance in iPhones with:	CHN	TWN	DEU	KOR	ROW	World
Gross	-1,646	0	0	0	0	-1,646
Value added	-65	-207	-161	-800	-413	-1,646

Source: Ahmad. N., Escaith. H., Miroudot. S., Webb. C., Yamamo. N., (2011) " Trade in Value-Added: Concepts, methodologies, and Challenges" OECD/WTO

g- **The estimation of the "job content" of trade is only relevant when using the concept of value-added embedded in trade.** Value-added figures can tell us exactly where 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 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, there is a higher number of jobs 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***. In the context of the E-frame project, issues related to child labour could be tackled by allocating "well-being" indicators in the labour market to every industry in each country.***

h- The measurement of trade flows in value-added terms would support policymaking in the assessment of the environmental impact of trade. 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 concept of trade to understand where imported goods are produced (and hence where CO2 is produced as a consequence of trade). An OECD study notes that the current relocation of industrial activities has a high impact on differences in consumption-based and production based measures of CO2 emissions[6]. ***Other environment indicators could be processed by linking data on deforestation, land-use, fresh water uses and depletion of natural resources to specific industries in each country of the global input-output table.***

i- Indicators of competitiveness such as "revealed comparative advantages" are affected by the measurement of trade in gross terms. Going back to the iPhone example, China seems to have a comparative advantage in producing iPhones on the basis of traditional trade statistics while its comparative advantage is in assembly work. Having in mind development strategies and the concerns of policymakers to identify export sectors and promote industrial policies, the analysis of the export competitiveness of industries cannot ignore the fragmentation of production and the role of trade in intermediates.

The above points make a compelling case for the production of trade statistics in value-added terms. There is no doubt that such analysis is highly relevant from a policy perspective. The challenge and indeed difficulty relates to the international dimension of the statistics; in other words those related to the construction of a global, or multi regional, input-output table. While national statistical institutes have an important role to play here, as providers of underlying national data, there is clearly a role and need for an international organisation to coordinate and harmonise national statistics in order to create a multi-regional research tool. As such, international organizations should be encouraged to invest resources in the development and improvement of the underlying bilateral trade statistics, in co-operation with national statistics offices and research projects.

[6] NAKANO, S. AND AL. (2009).

2. Definition and measurement of trade in value added

Intermediate goods are used to produce further refined intermediate goods or final goods and services. Within a global production network, which encompasses several countries, intermediate inputs cross borders several times. While this process leads to a multiple counting of intermediate inputs that inflates the gross value of trade flows, these intermediates are the physical support of "trade in tasks" and hence the exchange of value added. Therefore, keeping track of them should remain a priority objective in any intent to measure trade in value added. For example, the value of an intermediate good or service provided by an enterprise of country A in the global supply chain, which exports this intermediate input to country B, is embedded in products which are further exported by B to country C, either as an intermediate input with some added value or as a final good or service. In the gross value recorded by official trade statistics, the accumulated value of all intermediate inputs plus the value added at each crossing of the frontier is recorded; however, for an analysis of macroeconomic consequences only the value added created in each country is of relevance.

To illustrate this, we can report to figure 1 which breaks down each flow of exports between countries in value added data (VA) and a measure of vertical specialization or double counting process of intermediates' values in traditional statistics (VS).

Definition: The value added components of gross exports

To help understand the concept of value added embedded in trade, figure 2 is very useful. Gross exports are broken down into several value added components, according to the geographical origin and the use of the exported product. To begin with, one has to separate "domestic" and "foreign" value added content. Typically, the domestic value added content of exports is made of the following three elements:

(i) The domestic value added, embodied either in final or in intermediate goods/services, directly absorbed and consumed by the importing country. This represents a one-to-one country transfer of value added, with exported goods/services crossing borders only once.

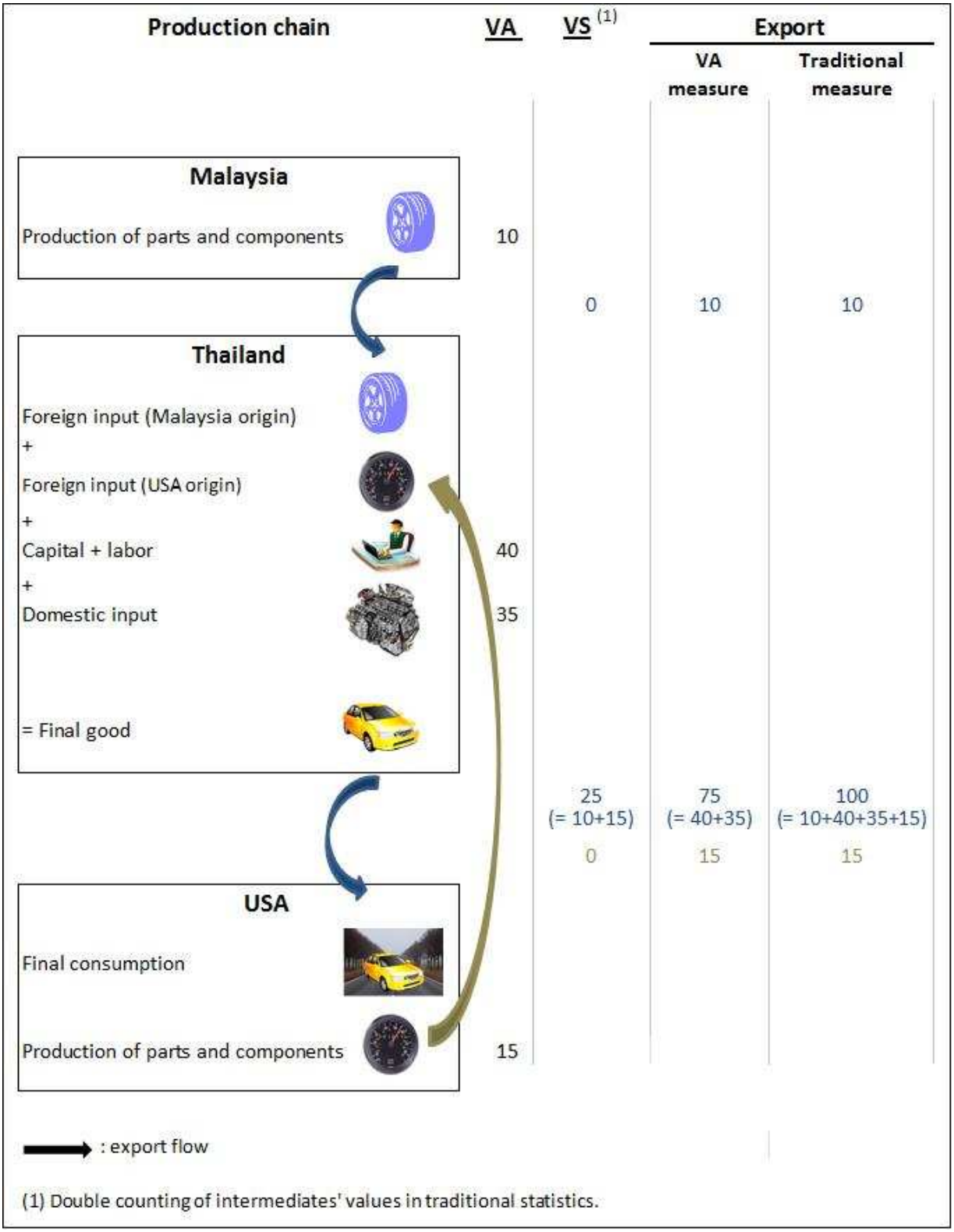
(ii) The domestic value added contained in intermediates exported to a first country which re-exports it to a third country as embodied in others goods/services. It represents a one-to-many country transfer of value added, when exported goods/services cross borders more than once. This illustrates the new "trade in tasks" and the multiple value added exchanges taking place among international production (Baldwin and Robert-Nicoud, 2010).

(iii) The domestic value added of exported goods/services which is sent back to the country of value added origin. Such a value added round-trip between two countries highlights the domestic value added content present in a country's imports.

Then, the foreign value added content of exports, which are imported inputs, is broken down into value added embedded into intermediate products on one side, and final products on the other side.

The above value added elements give a full breakdown of gross exports. Thus, the sum of their shares in gross trade is equal 100%.

Figure 1: the trade in value added between three countries and its measurement in export statistics



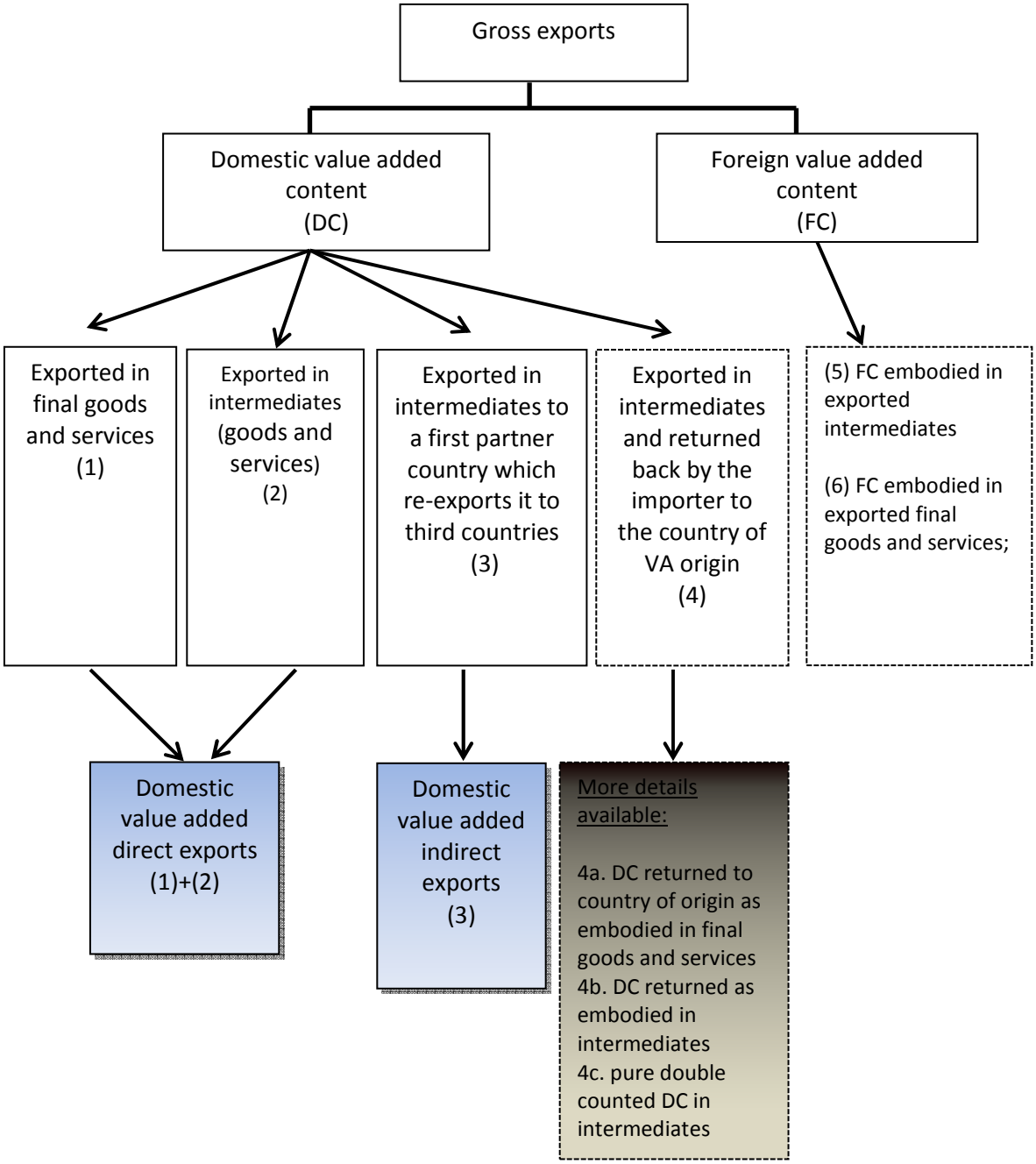
Source: WTO Comparison of methodologies to estimate trade in value added terms.

It is also possible to determine whether the value added exported has been *directly* or *indirectly* absorbed by the importer:

(i) Direct value added exports means that the value added sent abroad is directly absorbed by the importing country;

(ii) The indirect value added exports represent the case where the importing country incorporates the received value added in another good and sends it to a third country for its consumption. To some extent, this illustrates the length and characteristic of the path of value added within international production chains.

Figure 2: the decomposition of gross exports into value added components



An expert debate on two approaches addressing two different topics

Behind this decomposition of gross exports in value added, a debate has been launched between two different measures of trade in value added, each one addressing a different topic. The '*Value added in trade*' approach estimates the domestic and foreign value added contained in the products to be exported, whereas the '*Trade in value added*' approach estimates a country's value added induced by its partners' final demand.

The Trade in Value Added approach (TiVA) (WIOD approach)

It can be defined as "Foreign value added embodied in a country's domestic final consumption". We refer it as the "Final Demand" approach. It tackles the issue from the "absorption" angle. "Value Added in Final Domestic Demand" could be used for the final demand approach.

According to Stehrer (2012) "Trade in value added" is the value added of one country directly and indirectly contained in final demand of another country. This approach provides an answer to the question "How much of value added of a particular country is contained in the final demand of the country under examination?". It is referred to as "Global value chain (GVC)" perspective by Los et al. (2012).

In this definition, the domestic content in a country's exports corresponds to (1)+(2)+(3)+(4) in figure 2.

The Value Added in trade (VAiT) (Hummels [i], US ITC)

It refers to "the domestic value added embodied in a bilateral trade flow". It is based on the method of decomposition of gross exports as explained in figure 2, and aims at answering the question: "How much of value added from other countries is contained in the gross imports of one country?"

In this approach, value added in trade calculates the value added contained in gross trade flows between two countries. It corresponds in its conceptual approach to the decomposition as introduced in the VS measures. It allows capturing the domestic and foreign value added content in a country's gross exports and imports.

In this context, the country's value-added exports are equal to (1)+(2)+(3) in figure 2.

The main difference with the TiVA measure is that it does not discount for the potential domestic content of the imports embodied in the value of the exported product (cf. *Maquiladoras*). The export values are either equal or bigger to values derived from the TiVA approach as they refer to domestic content rather than domestic value added, i.e., include value added that returns back to the country of origin (circular trade).

To conclude,

- the domestic value added direct exports
- the domestic value added indirect exports
- the domestic value added exported in intermediates and returned back to the country of VA origin (which makes the difference between the approach in flows and the approach in final demand)
- and the foreign value added content of exports (what corresponds to the vertical specialization as defined by Hummels et al. (2001))

provide a full decomposition of gross exports. Thus, the sum of their shares in gross trade should equal 100%. Both measures result in the same overall net trade of a country which equals its trade balance in gross terms which however does not hold for bilateral relations.

Measuring trade in value added: a historical perspective

The first indicator which has been developed to assess the supply-side approach of production chains on trade is the vertical specialisation trade, defined by Hummels et al. (2001) as the value of imported intermediates embodied in a country's exports. So doing, different authors[ii],[iii] have introduced decompositions of trade flows which are referred to as a benchmark for the analysis of trade in value added terms.

A methodology based on statistical and evaluation tools

Current estimates of trade in value added rely on ***international input-output (I-IO) tables***, which integrate national accounts and ***bilateral trade statistics*** by gathering sectoral data on the supply and use of goods and services and trade in one accounting framework. International or inter-country input-output tables (ICIO) tables, combined with the ***Leontief inverse model***, allow to capture not only direct linkages and exchanges between countries and sectors but also indirect linkages among the global production network such as the "spillover effect", describing multiple country transfers of products or the "feedback effect" where products having gone through different countries are finally sent back to their country of origin as embedded in other products or modified.

Table 1 Gross trade, trade in value added and value added in trade in bn US-$, 2005

	Gross trade			Value added in trade			Trade in value added			in %
Reporter	Exports	Imports	Net	Exports	Imports	Net	Exports	Imports	Net	of GDP
China	836.7	669.8	166.9	813.9	643.0	170.9	592.0	421.1	170.9	7.57
European Union	4619.9	4372.0	247.9	4266.8	4114.0	152.8	2988.5	2836.5	152.0	1.24
Japan	653.7	530.6	123.1	645.7	513.4	132.3	553.9	421.6	132.3	2.92
Russia	226.9	137.6	89.3	214.7	129.7	85.0	196.9	111.9	85.0	12.98
Canada	416.2	355.3	60.8	395.8	343.9	51.9	296.6	244.7	51.9	4.91
Korea	327.9	281.6	46.3	302.7	274.1	28.5	195.7	167.1	28.5	3.75
Brazil	134.0	96.8	37.2	118.4	93.0	25.3	105.5	79.4	26.1	3.33
Taiwan	226.7	200.8	25.9	215.5	194.7	20.7	117.8	97.1	20.7	6.01
Indonesia	93.9	78.2	15.7	92.5	75.8	16.7	76.4	59.7	16.7	6.03
Australia	149.3	151.4	-2.1	142.9	145.7	-2.9	123.1	126.0	-2.9	-0.43
Mexico	218.3	219.7	-1.4	207.3	211.7	-4.4	145.8	150.2	-4.4	-0.55
India	157.7	169.9	-12.1	147.0	165.3	-18.3	116.7	135.0	-18.3	-2.34
Turkey	83.9	112.7	-28.8	75.7	106.6	-30.8	55.8	86.6	-30.8	-7.36
Rest-of-world	1992.1	2113.5	-121.4	1966.2	2011.5	-45.3	1388.4	1433.8	-45.3	-4.77
USA	1187.0	1834.3	-647.3	1169.9	1752.3	-582.4	927.7	1510.1	-582.4	-4.61

Note: EU-27 exports and imports include intra-EU trade

Source: WIOD database; author's calculations

Note: country's trade surplus or deficit is equal when either measured in terms of "trade in value added" or "value added in trade. These figures should equal net trade in gross terms but they are slightly different due to the fact that in the calculations value added is not exactly equal to gross output minus intermediate inputs which emerges from taking net taxes on products and international transport margins into account as done in the WIOT data.9
Source: Robert Stehrer, Trade in Value Added and the Value Added in Trade, WIOD Working Paper 8 (2012) 1–19

In addition to the interest to the geographical origin of value added, policy makers are equally interested in understanding the contribution that specific sectors make to the domestic content of exports, both directly and indirectly. In advanced industrialised economies, a large share of global GDP (and employment) accrues to services, while international trade remains largely dominated by goods. Yet, identifying backwards linkages from those export oriented sectors producing tradable goods (agriculture, manufacture) allows to map where the domestic value added was created. The break-up of domestic content by direct and indirect sectorial value added reveals that a large chunk of the value originates

indirectly from service sectors. This break-down is particularly important when identifying the sources of national competitiveness, which may rest in up-stream sectors which are not considered as exporters by traditional statistics, or measuring the employment impact of export production.

A large coordination at the international level

As emphasised in the previous section, measuring the value-added content of trade requires an international input-output table. Constructing such a table is a data-intensive process and the data issues faced by the OECD in this regard are similar to those confronted by other initiatives, such as IDE-JETRO (Asian Input-Output Tables) or the World Input Output Database project, with whom (as well as the US-ITC) the OECD and the WTO have been coordinating actively in order to share experiences and derive a set of best practices.

The WTO and the OECD have developed closed links with key players in this area. Those are:

- the Japanese Institute of Development Economies (IDE-JETRO)[iv],
- the US International Trade Commission (USITC),
- the World Input-Output Database project (WIOD).

The OECD and the WTO used their existing networks of international trade statisticians to raise the issue in the international statistical fora, such as the UN Statistical Commission, and promote a closer dialogue between trade and business statisticians.

In addition to the WTO and the OECD, many other contributors aim to improve statistical knowledge of trade, such as IDE-JETRO and the United States International Trade Commission.

In 2011, a publication, jointly produced by the WTO and the Institute of Developing Economies — Japan External Trade Organization (IDE-JETRO) focuses on the factors that have helped to shape global production. IDE-JETRO constructs international Input output matrices. A new statistical measure — *trade in value added* — is proposed to complement conventional trade statistics for a deeper and more comprehensive analysis of trade patterns. This methodology offers a new perspective for trade analysts, as it dramatically re-evaluates the importance of some economies as "countries of origin".

The OECD-WTO TiVA database

The most successful cooperation is that between OECD and WTO. On 15 March 2012, the OECD and WTO announced a joint initiative to develop a database of Trade in Value Added indicators and to mainstream their production within the international statistics system. International support for this project was subsequently expressed at the G20 Trade Ministers meeting in Mexico in April 2012 where the OECD Secretary General highlighted the importance of measuring trade in value added during his speech on Understanding Global Value Chains.

Finally, on 16 January 2013, the OECD and WTO released international trade data based on the approach on flows (TiVA) (link). The first release of OECD-WTO TiVA database present indicators for 40 countries (all OECD countries, Brazil, China, India, Indonesia, Russian Federation and South Africa) covering the years 2005, 2008 and 2009 and broken down by 18 industries. Indicators in the database include:

- Decomposition of gross exports by industry into their domestic and foreign content;
- The services content of gross exports by exporting industry (broken down by foreign/domestic origin);
- Bilateral trade balances based on flows of value added embodied in domestic final demand;
- Intermediate imports embodied in exports.

From these new insights on how global value chains impact trade relationships and business activity, the key findings are:

- China's bilateral trade surplus with the United States shrinks by 25% on a value-added basis, reflecting the high level of foreign-sourced content in Chinese exports.

- One-third of the total value of motor vehicles exported from Germany actually comes from other countries, while nearly 40% of the total value of China's electronics exports comes from foreign sources.

- While conventional trade data suggests that services represent less than one-quarter of total trade, on a value-added basis services trade reaches on average 50% of OECD countries' exports, and well above that in the United States, the United Kingdom, France, Germany and Italy – largely because services add significant value to manufacturing output.

- Bilateral trade surpluses of major commodity exporters like Australia, Brazil and Canada with their key trading partners shrink on a value-added basis, as their raw materials are further processed by trading partners and then re-exported – highlighting where these countries might "move up" the value chain.

3. Statistical pitfalls of the calculations and further research needs

Concerning the international input-output table, 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. Data issues faced by the OECD in this regard are similar to those confronted by other initiatives, such as IDE-JETRO (Asian Input-Output Tables) or the World Input Output Database project, with whom (as well as the US-ITC) the OECD and WTO have been coordinating actively in order to share experiences and derive a set of best practices.

Strong assumptions have to be made

In using IO tables for analysis, there is an *implicit assumption* that all consumers of a given industry's output purchase exactly the same shares of products produced by the firms in 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. Of chief concern in this respect is the evidence that points to exports having very different coefficients to goods and services produced for domestic markets, particularly when the exports (typically intermediate) are produced by foreign owned affiliates in a global value chain.

At the national level, the quantity and quality of information available to allocate specific imports to using industries varies. Some countries provide these import tables in conjunction with their I-O tables but in some cases they are derived by the OECD Secretariat. Where information is not available, countries and indeed practitioners necessarily use the ***Proportionality assumption***. This generally means that for a given product one assumes that the proportion of intermediates that an industry purchases from abroad is equal to the ratio of imports to total domestic demand in that product. Indeed this assumption is widely used by national statistics offices in constructing tables. This hypothesis is acceptable for industrialised countries, where there is little product differentiation between what is produced for export and what is produced for the domestic market. It is more stretching however for developing countries, as the import content of exports is usually higher (and much higher for processing) than the import content of products destined for domestic consumption.

The proportionality assumption creates an obvious limitation when drawing conclusions. For example, identification of intermediate and final products is still an issue. Bilateral flows of imported goods need to be complemented by bilateral flows in intermediate services, i.e. the imported goods matrix needs to be complemented with imported services. Although reporting has improved, this still requires an estimation of the bilateral trade flows.

Central to the construction of an international input-output database is the ***estimation of trade flows between countries***. Indeed, these trade flows in intermediate goods and services are the glue which tie together the individual input-output matrices derived from national accounts. As mentioned, national

sources on disaggregated bilateral trade flows show a high level of asymmetry, and are not always compatible with national account data.

The approach measures what happened rather than forecasts what will happen. The tool can of course be used for forecasting purposes but its central premise will be based on the idea that the ***technical-coefficients remain unchanged***, even if these coefficients allow for substitution effects between domestic and imported intermediate goods and services. Even in the short-term, simulation within an international IO framework should pay special attention to what part of final demand can be considered as exogenous (eg, household consumption) and what should be considered as endogenous (exports of intermediate --and even final products-- to another trade partner).

Other statistical pitfalls have to be addressed

During the Trade Workshop "The Fragmentation of Global Production and Trade in Value-Added - Developing New Measures of Cross Border Trade" that took place at the World Bank headquarters on 9 and 10 June 2011 (link), statistical pitfalls and avenues for further improvements have been identified by the various participants. **Ronald Jansen,** Chief of the Trade Statistics Branch at the United Nations Statistics Division, made a valuable effort to clarify various issues raised during the forum:

Issue 1: Collection of value-added trade data?

First of all, detailed trade statistics by product and partner countries in terms of gross values will remain necessary input for many analytical purposes including IO research. It is not desirable to collect trade statistics in other than gross values. Aside from the fact that such statistics are necessary for agriculture, energy, environment and transportation statistics, quality assurance frameworks of trade statistics are for a large part based on a consistent relation between the value and the quantity of the traded goods. This will hold true whether data is collected via enterprise surveys or through customs documents. But, to decompose the gross values into domestic and foreign content, or further refinements, additional information will need to be collected.

Issue 2: Customs records or enterprise surveys?

Both sources of data are needed. The most important source of trade data is and will be the customs data. The Trade community (traders and enterprises) puts pressure on the government to facilitate customs procedures, and have been successful in some ways. We should realize that enterprise surveys can be nowhere near as detailed or as timely as customs records. Enterprise surveys will cover necessarily fewer goods, give less detail on trading partners, and will be obtained less frequently. The greatest value of enterprise surveys will be as an addition to customs records. These surveys could then focus on specific questions, such as how much of the manufacturing processes of an enterprise are done under contract on behalf of foreign enterprises.

Issue 3: Linking trade and business statistics

Trade is not done between countries, but between businesses. An outcome of the Global Forum on Trade Statistics was to better link trade and business statistics by:

- Developing a common basis across all relevant national institutions to identify enterprises active in international trade, including multinational enterprises and their foreign affiliates;
- Developing and maintaining a statistical trade information system at micro-level around the enterprise register, including multi-national enterprises and their foreign affiliates; and
- Establishing this statistical information system – under observance of relevant confidential rules - by making optimal use of and connecting existing data sources, such as custom-based merchandise trade statistics, trade and business registers, economic census data, existing enterprise surveys, other administrative records, and possibly data sources for employment, environment, or energy.

Issue 4: Cross border trade and the Change of ownership principle

The main issue of contention between trade statisticians and national accountants has been the issue of "change of ownership". This controversy is the backdrop to the discussion on the international sourcing of production processes, better known as the issue of "goods for processing abroad" or "processing trade" (Mattoo, Wang and Wei) or "manufacturing services on physical inputs owned by others" (Balance of Payments Manual, 6th edition). In the context of Global production and global value chains, this issue is probably the most important one.

Issue 5: International sourcing of production processes

International trade has been at the centre of many recent discussions on globalization, be it through the off-shoring of the production process, operations of multinationals, foreign direct investments or trade negotiations. Production processes of garments, motor vehicles, televisions or computers are now often spread across several countries not only to reduce labor and capital costs but also, for instance, to benefit from investment incentives offered by the host countries. Even though treatment of goods for processing in the statistical sense is by no means a new discussion, it gained a lot of new attention because of its increasing economic importance, especially for economies like China and Mexico.

Some recommendations

We highlight here the main issues that were raised, focusing on the need for harmonization in statistics, international coordination and further work that could be useful with regards to the E-Frame objectives.

Needs for harmonization in statistics

According Andreas Maurer, Chief of the International Trade Statistics Section from the World Trade Organization and Nadim Ahmad, Head of the National Accounts Division from the OECD, integrating into a mutually consistent international framework national accounts and trade statistics is not an easy task, as the available data sources are often not compatible. Because of the well-known **issue of asymmetry**, trade statistics are one of the few official statistics where analysts are systematically confronted with two diverging but equally "official" data to measure a single flow between two partners. The choice to privilege a country's import or the partner's export data for one and the same flow can be justified on technical grounds, but remains always somewhat arbitrary.

The WTO highlighted the following two priority needs:

- Indicators such as **the imported inputs used in domestic production that are exported** to measure interconnectivity – at (world), regional and country level, by sector.

- **Trade flows by mode of transport** which would be useful information on the logistics required to maintain global supply chains and to derive trade and transport margins.

The release of the joint OECD-WTO database is an important step in the development of value added trade measurements, but further work is needed to improve the quality of the data:

A need of coordination for better international cooperation

OECD is part of the WIOD consortium and has long been in the business of producing and maintaining an input-output database. The organisation could in co-operation with other stakeholders and with the support of WTO build on WIOD experience in coordinating the efforts and expertise of a large network of experts and institutions, such as IDE-JETRO, to deliver long-term benefits beyond the life-time of WIOD. Provided adequate funding is mobilised, this accumulated experience could be used to develop additional data bases in regions such as Africa, Middle East or other developing countries not covered by existing initiatives.

OECD and WTO would also promote a closer dialogue between researcher and official statisticians. As countries move to the new 2008 SNA and BPM6 recommendations, as well as new industrial classification systems such as ISIC Rev 4 and NACE Rev 2, it will be important to tap into the expertise of national accounts, input-output, business and trade statisticians. Promoting such a dialogue would involve a close cooperation with important stakeholders such as the EUROSTAT, the UN Statistical Commission and all the relevant international agencies.

As the 2008 SNA, MSITS 2010 and IMTS 2010 are in place, international organizations have to jointly assist implementation of these concepts and definitions to develop data sets that are more apt to analysing globalization. As all statistical frameworks have undergone revision right now, no additional concepts and definitions can be defined. But, as there is a need for a new statistical instrument, **a new statistical tool in form of a satellite account could be developed to complement national accounts**. **This tool would bring together a country's foreign activities with respect to trade** (goods, services, intellectual property, capital and investment matrix (including FDI), labour (movement of persons)) in one presentation – similar to tourism satellite accounts."

Nadim Ahmad (OECD) is in favour of an internationally coordinated approach to the development of Trade in Valued Added (TVA) estimates and supports the idea that this could best be achieved with an Inter-Secretariat approach that brings together a number of international agencies. Statistics institutes could be encouraged to provide more detailed information on imports made by IO industries; which would significantly improve the quality of TVA estimates - as for many countries these are created using a simplistic proportionality assumption. Many developed economies could be encouraged to do this by tapping into firm-level data, in particular firm level data that links business and trade registers. Other countries should be encouraged to develop similar capacities, such that IO tables are able to reflect industry or product classifications in as homogeneous a way as is possible: particular attention in this regard should be made to classifications that are able to differentiate between 'ownership' - i.e foreign or domestic - and import-export intensities. In this context we should also retain some scope for differentiating between 'processors' and conventional producers; noting in particular the changes in the 2008 SNA - improvements and indeed potential data sources could be identified in the forthcoming deliberations of a Eurostat led Task Force looking at Goods For Processing. The TVA indicators we produce should be as detailed and useful as possible. In that sense the objective should be to produce estimates that reflect the whole economy and industries, broken down by factors of VA - i.e labor and capital or operating surplus.

Is the solution in firm-level information?

In response to this and in order to remove this proportionality assumption, a proposal is to link input-output data with additional firm-level information that identifies imports and exports at the firm level; thus providing more accurate measures of value-added and imports embodied in exports. It is needed to track imports by firm and industry[v].

Even within a given sector, there is not inconsiderable heterogeneity amongst firms in: the types of inputs used in producing products; the import content of those inputs; and the shares of output sold to domestic consumers and as exports. Clearly for measuring value-added embodied in trade, this matters and a risk exists that estimates of value-added embodied in trade will be structurally biased.

The TEC (Trade by Enterprise Characteristics) is a joint project of the OECD and Eurostat which disaggregates trade values (imports and exports) according to the characteristics of trading firms. This is achieved by linking customs data and business statistics at the level of the firm and covers virtually the entire population of a country‟s business and (internationally) trading population. Customs data provide volume and value and Harmonized System codes of the products traded at the 6 digit level together with the identification of the business entities involved in the international transaction. This information is then matched with company level information available in countries‟ business registers; which contain

information on firm size and turnover, activity (industry) and ownership. Linking these two sources of firm-level information allows calculating firm-level value-added and uncovering the characteristics of the firms engaged in value-added creation through exports and/or imports.

As such, the TEC database provides a unique opportunity to further refine the quality of the import data used in the input-output tables but also to create sub-categories of industry groups that discriminate firms by: size; foreign/domestically owned; export intensity, import intensity, import/export intensity etc; allowing for a more detailed understanding of international production networks.

The database therefore provides an ability to disaggregate each input-output column and row into more detail; which importantly focus on the most important firm characteristics relevant to trade in value-added estimates.

Proposal for measuring trade statistics in relation to international sourcing of production processes is as follows:

1. Link detailed merchandise trade statistics to the business register. This matching process may not be perfect, but is essential in deriving results;

2. Conduct a survey among enterprise of the manufacturing industries and determine the percentage of processing done under contract by enterprise and industry;

3. Link the enterprise survey to the merchandise trade statistics via the business register, and determine the volume and kind of imported and exported goods, which is associated to “processing under contract”.

The end result will be trade statistics broken down by product, industry and partner country, with a separate breakdown of processing under contract. BOP compilers could then use this information to adjust the trade in services and trade in goods statistics.

Ideally, an enterprise census is done at 5-year intervals in addition to a survey, as is – for instance – the case for the 2011 economic census to be conducted by Malaysia. This approach will give official statistics on intermediate goods processing by industry and product. (...)

Some ideas for further data deliveries

(1) Indicators focusing 1st level immediate export partners and 1st level intermediate import partners (eg, the "vertical specialization" indexes and their refinements);

(2) Indicators focusing on economic dimension of final expenditure, like VA created by country by industry and ultimately absorbed;

(3) Indicators focusing on primary inputs (skills, service sectors’ contributions, etc) (table 2; Stehrer, 2012)

(4) Indicators focusing on the topology of the supply chain (average length, upstream/downstreamness, etc.).

Table 2 Net trade by factor, 2005

	Value added and factor income						Physical inputs				
	Value	Factor income		Labor income			Factor input		Employment (in '000s)		
Reporter	added	Capital	Labor	High	Medium	Low	Capital	Empl.	High	Medium	Low
China	170.9	163.2	7.7	-56.9	-12.9	77.6	-47.7	136125.9	4598.3	40305.5	91222.1
European Union	152.8	-143.5	296.3	141.9	116.3	38.4	1294.9	-152226.1	-8503.0	-54622.2	-89101.0
Japan	132.3	29.4	102.9	44.1	89.6	-30.6	1131.7	-45560.2	-1525.1	-13110.8	-30924.3
Russia	85.0	47.7	37.3	2.1	46.6	-11.4	-158.9	-1420.5	402.5	6508.9	-8331.9
Canada	51.9	39.2	12.7	-14.5	43.9	-16.7	224.3	-11801.8	-580.7	-2788.6	-8432.5
Korea	28.5	-12.6	41.2	36.9	13.0	-8.6	182.0	-11388.5	814.8	-3616.3	-8587.0
Brazil	25.3	18.7	6.7	-0.3	-1.6	8.5	18.4	8381.2	424.3	1830.8	6126.1
Taiwan	20.7	10.7	10.1	1.4	-4.7	13.3	88.0	-3461.4	213.4	-1460.6	-2214.2
Indonesia	16.7	19.1	-2.4	-4.6	-6.5	8.7	-124.6	11703.1	193.0	1378.1	10132.0
Australia	-2.9	4.3	-7.2	-7.4	-8.0	8.2	122.2	-11116.3	-883.2	-4214.7	-6018.5
Mexico	-4.4	42.1	-46.5	-23.7	-16.9	-5.9	-163.1	-1259.3	-156.5	299.3	-1402.2
India	-18.3	-8.6	-9.7	0.1	-11.7	2.0	-0.2	42818.0	3776.1	12128.1	26913.8
Turkey	-30.8	-6.8	-24.0	-11.0	-16.9	4.0	-140.1	-3518.7	-377.5	-2002.9	-1138.3
Rest-of-world	-45.3	203.9	-249.2	-161.6	-132.1	43.4	-1359.4	187564.3	10854.6	72182.0	104527.6
USA	-582.4	-406.7	-175.7	53.6	-98.0	-131.0	-1067.4	-144839.6	-9251.1	-52816.7	-82771.8

Note: EU-27 exports and imports include intra-EU trade

Source: WIOD database; author's calculations

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