Accounting frameworks for Global Value Chains: Extended Supply-Use tables

1. Overview

The increasing international fragmentation of production that has occurred in recent decades driven by technological progress, reductions in trade costs, improved access to resources and markets, trade policy reforms, and indeed cost factors in emerging economies, has challenged our conventional wisdom on how we look at and interpret globalisation. Traditional measures of trade for example, record gross flows of goods and services each and every time they cross borders leading to what many describe as a 'multiple' counting of trade, which may lead to misguided policy measures in a wide range of policy areas. In response to this the international statistics community has begun to develop new measures of trade on a value added basis, for example the OECD-WTO Trade in Value-Added (TiVA) database, WIOD, APEC-TIVA and the European FIGARO initiative.

But important though such initiatives are, they are only able to respond to one aspect of the globalisation debate. Significant attention, for example, is focused on the role of multinationals in this new landscape, and, on this, with the exception of recent exploratory initiatives[1], current available statistics that follow the TiVA approach are silent. Of particular relevance in this context is the ability of multinationals to shift intellectual property products (IPP) from one economic territory to another, raising broader questions on the ability of GDP to accurately describe 'meaningful' economic activity , with concomitant impacts on other macro-economic statistics, including TiVA. For example trade in value-added measures purport to show how (in which industries) and where (in which territories) value is generated in the production of a good or service. The simple relocation of an IPP from one economic territory to another[2] can radically alter that view.

In addition the policy debate in recent years has increasingly focused on what has become referred to in many quarters as 'inclusive globalisation', referring to the growing realisation that the benefits of globalisation may not have accrued to all members of society equally; even if only as a process of transition. With traditional macro-economic statistics it is not immediately clear for example, which categories of workers in which countries benefit from globalisation (and how) and which may have been, even if only temporarily, left behind. This particular issue has gained particular prominence in recent years.

More fundamentally, there is a growing appreciation that the statistical compilation tools and accounting frameworks designed and developed over the last 60 years in various manifestations of the System of National Accounts, despite their significant advances, may reflect a world that no longer exists. These tools were originally designed in a world where production was largely self-contained within an economy, with trade reflecting exports and imports, typically, of finished or primary goods. But today much of global trade is in intermediate parts.

In the early days of the SNA, integration in a global factory was to some extent not a significant issue, and statistical information systems evolved in kind, with the Rest of the World (ROW) recorded as a separate institutional sector to and from which goods were sold and bought; and such a view was largely sufficient. But over the years as global production chains and interconnectedness grew, there was a growing realisation that additional information was needed to properly navigate around the economic landscape, which resulted in the development of new areas of statistics, such as Foreign Direct Investment measures and data collections focusing on inward and outward activities of foreign affiliates (FATS). More recently

[1] http://www.oecd.org/daf/inv/investment-policy/trade-investment-gvc.htm

[2] Albeit a relocation that satisfies the accounting rules regarding economic, as opposed to legal, ownership

new data collections, or rather compilations, have focused on linking trade and business registers to provide insights on which firms in which sectors engage in imports and exports (referred to as Trade by Enterprise Characteristics).

These more recent innovations have significantly improved our collective understanding of trade, and indeed investment, but they are still to a large extent only a partial solution to the statistical challenges presented by globalisation and international fragmentation of production: partial in the sense that they remain in many countries the poor relations of the core SNA economic accounting framework, with only limited compilation and collection. Moreover, the mechanisms for data collection are often outside of the conventional framework, meaning that differences may arise between the measures collected within these activities and their implicit equivalents included in the core estimates of GDP. For example FATS data are collected as separate exercises in many countries but information on the same firms is also collected[3] as part of GDP estimation, and the same results may not always arise from separate collections. And even in cases where the same survey information is used, subsequent adjustments made in the GDP accounting framework (whether reflecting concepts or statistical adjustments) are rarely replicated in the original source data; resulting in implicit inconsistencies in the eventual published datasets (GDP and FATS).

This largely reflects the stove-pipe approach that has evolved over time to respond to the statistical challenges of globalisation. Arguably a more radical approach is needed that fully reflects the need to have a better articulation of globalisation in the core accounting framework: one that doesn't, in extremis, relegate its role to the ROW institutional sector. Such an approach requires that the role of foreign affiliates in the economic territory and affiliates abroad are captured explicitly (and visibly) in the core accounts. It also requires improved information on the trade relationships of categories of firms (for example exporter and non-exporter), and indeed who those firms trade with. As important is the need to fully articulate income flows in and out of the economy and, in particular, from which category of firms (e.g. industrial sector) these arise.

But this is not all that is needed. The challenges of inclusive globalisation require that the view of people, (in other words, workers), are also captured in the system. This requires information on skills, occupations, and compensation paid to these categories of workers in different sectors. But again much of this information is collected in different domains, with different surveys, and so, again, there is a risk that the stove-pipe approach may not be consistent across all domains. For example labour force survey data on jobs within a sector rarely equal the equivalent measures of jobs in the same sector collected via business surveys or other administrative sources.

The development of TiVA type statistics is certainly a step-forward in this area but these too suffer from the stove-pipe approach used in statistical data collection. TiVA estimates, derived through the construction of a global input-output table, implicitly assume that all firms within a given sector have the same production function (input-output technical coefficients), import intensity and export intensity. This of course has never been true. We know for example that larger firms will typically have different production functions to smaller firms, because of economies of scale, and also higher labour productivity. And these firms will also typically be more export and, indeed, import orientated than their smaller counterparts (reflecting in part the disproportionate costs of trade faced by smaller firms compared to larger firms). The same generalisations hold true for foreign owned enterprises, or enterprises with affiliates abroad, compared to purely domestic firms. But TiVA estimates, relying as they do on national Supply-Use and Input-Output tables, cannot reflect these heterogeneities; meaning that key measures, such as the import content of exports are downward biased.

[3] Even if only implicitly through sampling and grossing techniques.

Moreover, the very process of globalisation has increased the scale of these heterogeneities, driving coach and horses through the assumption of homogeneity within sectors. As firms within sectors increasingly specialise in specific tasks in the production process, they also suck in greater imports from the upstream part of the value chain and have greater export orientation. In addition globalisation has itself led to an increased prevalence of (once rare) categories of firms such as *Factoryless Producers* and *Processers*, where recent changes in the accounting system further weaken the case for assumptions of homogeneity in technical coefficients. For example, all other things being equal, a processing firm in one sector will have significantly less (recorded) imports than a non-processing firm producing the same final product. Similarly, a Factoryless Producer will be allocated to the distribution sector (with limited intermediate consumption of goods) but the same firm that chooses to buy the material goods used by the processing firms will be allocated to the manufacturing sector (with significant intermediate consumption of goods).

The ability of national (and international) Supply-Use and Input-Output tables, based on industrial groupings alone, to describe how demand and supply relationships are related has therefore become more difficult. Typically, in confronting the problem of heterogeneity, the conventional approach has been to provide more detail by aggregating firms at lower levels of the industrial classification system, for example 3 or 4 digit groupings as opposed to two digit groupings; subject to confidentiality restrictions being preserved. But this approach may not be optimal, neither in terms of reducing heterogeneity within aggregations (and in a way that best responds to the policy drivers) nor necessarily optimal in terms of processing burdens.

That is not to say that industrial classification systems are completely obsolete. It would serve little purpose for example to devise an optimal system that did not retain some means of classifying firms on the basis of their activity, (e.g. manufacturing versus services) if only because these remain the key prisms that users look through when analysing production. But it does serve to highlight that other approaches to tackling heterogeneity can, and should, be considered.

The tool advocated in the SNA for ensuring coherence across various data sources to assure alignment of GDP estimates created by the income, expenditure and production approach is supply-use tables; the same underlying core statistical input required for TiVA estimates. As shown in this paper, through (in principle) simple extensions to conventional supply-use tables, *Extended Supply Use* tables provide the ideal basis for bringing together these various domains into a single integrated economic accounting framework that puts the measurement of the 'global' at the heart of the 'national'.

2. Extended Supply-Use Tables

2.1'Extended' SUTs in the 2008 SNA

Before beginning, it is perhaps instructive to note that the concept that will be developed here is not radically new. Many satellite accounts for example work around similar principals to those advocated below. Indeed Chapter 14 of the 2008 SNA provides a presentation of Supply-Use tables that differentiate production on the basis of market output, non-market output and production for own-final use. Such an approach capitalises on the readily available nature of data in most countries that can support such a breakdown. Obviously such a breakdown is superior to conventional tables without a breakdown as they provide additional information that can support more granular policies, for example with respect to subsistence farming, but they also provide a means for more coherent accounts, for example, imputations of output for own use and corresponding consumption estimates can be more readily aligned.

A few additional 'extensions' worth noting in the 2008 SNA presentation (and which provide entry points to analyse impacts on people, whilst also significantly improving productivity measures) are additional rows showing labour inputs (as hours worked), GFCF, and closing stocks of fixed assets.

That all being said, very few countries currently provide all of this additional information specified above, despite their importance.

Very simple elaborations, building on the existing presentation could be developed, for example, by differentiating activities on the basis of whether the observed units are in the formal sector (however that may be defined), where information is typically drawn from administrative sources and surveys or the informal sector (which typically involves some form of imputation).

A few important and instructive points are worth fleshing out here.

The first concerns the *rectangular* [4]presentation embodied in the 2008 SNA. In other words, splits of activities into different categories of firms are not replicated as additional splits of corresponding products by source category of producer: even though a breakdown of activities only into market/non-market/production for own-use, would not involve onerous assumptions to trace consumption to the same categories of specific producers – for example own-account production could easily be traced, by definition, to the consumer.

The second concerns the degree with which activities are split. Not all activities are necessarily split. For example for the category of production for own final use, the 2008 SNA presentation only specifies breakdowns for the agriculture, construction, real estate and private household services sectors , but in theory many other activities (at least in goods) could also be produced. The reason they are not, of course, reflects their generally low economic significance.

The third, and perhaps most important take-away from the SNA presentation concerns the underlying, albeit implicit, principle to pursue granularity in a manner that is instructive, cost-effective and feasible. As noted above for example, the breakdown advocated in the SNA does not, at least in theory, require additional surveys beyond those already collected in developing the accounts.

2.2. Extended SUTS for globalisation

This section builds on the underlying principle described above, recognising of course, as always, the limitations imposed by confidentiality restrictions, which are an underpinning principle in statistical dissemination.

The section runs through four distinct types of extensions:

- The first category looks at very simple extensions to the core accounts that require no additional breakdown of activities into categories or grouping of more homogeneous (or rather less heterogeneous) firms.

- The second looks at extensions that split activities into more homogeneous groupings of firms.

- The third looks at extensions that provide links between the core production accounts and the distribution of income account, and also to other important macro-economic variables (such as employment).

- The final extension, perhaps the most difficult to do since it may not always be possible to create such breakdowns with existing information, without assumptions, is the breakdown of products by distinct category of producer.

[4] That is a different number of rows (products) and columns (industry, or activity groupings) in the SUT.

2.2.1 Simple Extensions

There are a number of relatively simple extensions that can be added to conventional supply-use tables in a way that can greatly improve our ability to analyse and understand globalisation.

Perhaps the simplest of these extension is to separately show estimates of goods for processing transactions (manufacturing services on physical inputs owned by others) and re-exports (if import flow tables are not also provided). Such extensions are important for TiVA calculations as re-exports typically have only negligible (often zero) domestic content, while information on goods for processing transactions significantly improve the ability to create coherent global supply-use tables.

Such information is even further enhanced if breakdowns of activities also separately differentiate between processing and non-processing production (discussed later). Ideally, for goods for processing transactions, it is also helpful to show the value of those goods that have been imported (but whose ownership has not changed) and the full customs value of goods subsequently exported. Similarly, especially because the process of production is significantly different, it is also useful to show separately the value of merchanting with gross values of exports of goods.

A second set of simple extensions, albeit slightly more complicated, as such information is not always available or collected at the detailed product level available in supply-use tables, concerns the estimates of residents' expenditure aboard and non-residents' expenditure. In many countries these are only shown within conventional supply-use tables as additional separate items added to total imports and total exports respectively (with corresponding adjustments made to household final consumption). Again, for the calculation of global supply-use tables, it's important to have these items broken down by product. Tourism satellite accounts often provide a good basis for creating such breakdowns.

In many countries these items are added as additional rows in national supply-use tables and so it is not necessarily meaningful to describe additional columns broken down by products as 'of-which' items and so instead the recommendation made here is that they are added as complementary columns. It's important to note that separate breakdowns have a variety of applications, first and foremost for a better understanding of the tourism industry but they also matter greatly for TiVA and trade policy making, as the goods transactions do not (generally) involve tariffs, unlike conventional merchandise trade. This matters because analyses that use TiVA for example to assess the multiplicative impact of cascading tariffs along a GVC are likely to overestimate these costs if tourism trade in goods (where tariffs do not typically apply) are not separated[5].

A third set of extensions concerns the valuation of imports. Typically, goods transactions are recorded at CIF prices. But global supply-use tables require a common valuation of imports and exports, meaning that import values are also needed at FOB prices. As such a split of imports of goods into a FOB component and a 'CIF' component is also highly desirable. In addition, in order to analyse the impact of tariffs on global value chains, and indeed to help construct import-flow matrices (particularly those derived using the classic proportionality assumption) complementary information on tariffs/duties paid by product is also highly desirable.

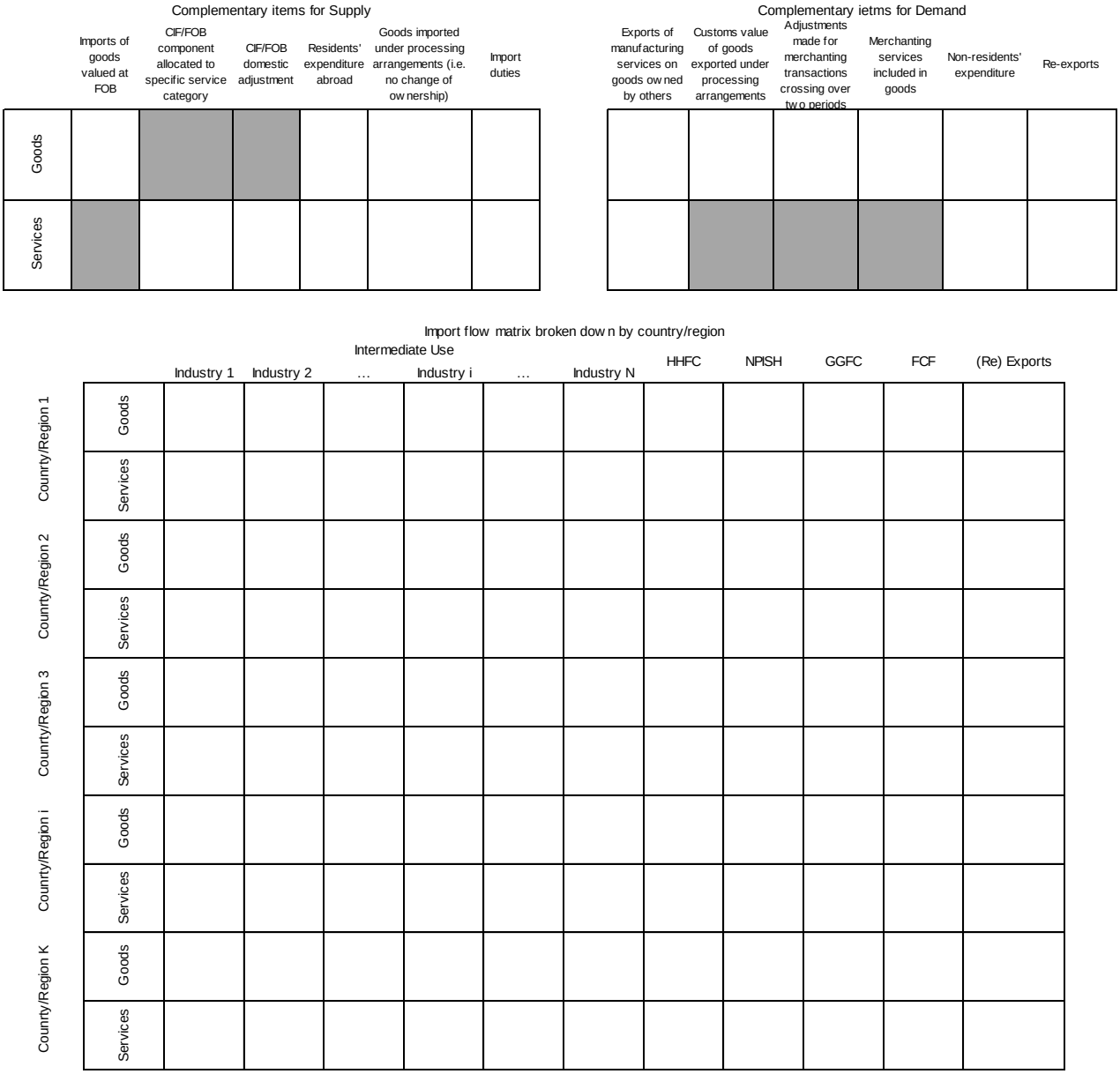
[5] Note that this is not unique to tourism expenditures. *De minimis* cross-border trade (below customs thresholds) are also, typically, tariff-free, and so, some consideration could also be given to exploring whether these too should be shown separately in SUTs. In theory this should be realisable, as in practice, in most countries *de minimis* trade is estimated using broader (often macro) approaches. However, and also in practice, these are not typically also estimated with a breakdown by product. For now these are thought to be small scale transactions and so the working assumption is that they care captured in the balancing process to create the SUT but digitalisation and intermediation platforms (such as Amazon, E-Bay etc.) have democratised access by households to producers abroad, and so the scale of *de minimis* transactions may be increasing.

A fourth set of extensions concerns the geographical breakdown of the import flow matrix within the supply-use framework (an essential step needed on the way to producing global input-output tables, but also, even if not widely used, very useful in constructing national supply-use and input-output tables). Countries use a variety of methods to derive their import flow matrices. In some, estimates are based on survey estimates or administrative sources but in many they are based on the assumption of proportionality[6] (ideally calculated at the most detailed product level possible, even if this level is more disaggregated than that used in dissemination, and taking into account end-use – BEC – type classifications). Ideally these tables could also be broken down by partner (or at least major partners or regional groupings). In the simplest case this could be done by also applying a proportionality assumption but more refined estimates could be derived through linking exercises; in particular through the linking of trade (customs) and statistical business registers at the firm level.

Figure 1 below describes all of the above extensions in a simple schematic flow diagram. For convenience, and also because national practices in the construction and presentation of supply-use tables differ, all items are described as complementary items.

[6] See UN Handbook on Supply, Use and Input-Output Tables with Extensions and Applications (forthcoming)

Figure 1: Simple Extensions (complements) to SUTS



Note in the above that the reference to 'CIF/FOB domestic adjustment' refers explicitly to the adjustment made in conventional supply use tables to adjust for the transportation and insurance services provided by resident producers. These expenditures should in theory be removed from the total value of imports to ensure that total imports are valued at FOB prices. Typically this adjustment is included as a separate row in most countries national supply-use tables (with a corresponding adjustment made to exports). The column referred to as 'CIF/FOB domestic adjustment' therefore reflects only the allocation of this component to specific service categories. Note that this is also described in the 2008 SNA but very few countries provide this information by product.

2.2.2 Extensions within Activities

As noted above, the concept of breaking down activities into more homogenous or policy relevant groupings is not new. The 2008 SNA for example describes breakdowns between market and non-market activities and many satellite accounting systems also embody this principle. The approach advocated in this paper is to develop aggregations of firms (and splits of activities) into those that best respond to the growing demands presented by globalisation.

It's important in this respect to note that the approach is deliberately not prescriptive. How countries develop Extended SUTs that meet the statistical challenges presented by globalisation necessarily depends on national circumstances. These are in the main driven by statistical capacity but they should also reflect national policy demands.

The OECD Expert Group on Extended Supply-Use tables[7], created in 2014, focused on three broad approaches that could, in theory, be developed by all countries (with varying degrees of complexity). These three approaches were:

- Breakdowns by size-class of firm (statistical unit)
- Breakdowns by trading status (exporter, two-way trader, importer, non-trader)
- Breakdowns by ownership status (foreign owned affiliates, Domestic multinational with affiliates abroad, domestic firm with no foreign affiliates).

Participating countries were also asked to consider variants, including combinations, of the above three breakdowns, for example breakdowns by trading status and size class, and also to consider alternative approaches that better reflected national circumstances. For example Chinese tables were broken down into three categories of firms – exporters operating within the Customs Processing regime, other exporters, and non-exporters; Mexican tables were developed by grouping firms on the basis of whether they were a global manufacturer or non-global manufacturer; and Costa Rican tables have been broken down into three categories of firms: firms operating within Free Trade Zones, Other Exporters and all other firms (and work is on-going to extend these breakdowns to include an ownership dimension).

Conceptually the breakdown of activities into more distinct (heterogeneous and/or policy relevant groupings) of firms, is relatively trivial to illustrate (Figure 2); it merely involves breaking down existing activities into new disaggregations; where such disaggregations are meaningful.

For example it would not be particularly useful, at least with respect to improving homogeneity, to disaggregate a particular activity if the overwhelming majority of output and exports within that activity were conducted by one category of firm. Indeed, in some cases it would not be possible to have disaggregations if the corresponding breakdown resulted in breaches of confidentiality (i.e. statistical disclosure of individual firms). This is another reason why it is preferable not to be prescriptive about the format of Extended SUTs.

However, challenges presented by confidentiality do provide an opportunity to consider whether current dissemination strategies are necessarily optimal, from a policy perspective at least. For example it may be preferable to reduce the degree of industrial activity breakdown presented if this provides scope to provide additional breakdowns by other categorisations of firm.

[7] https://www.oecd.org/sti/ind/tiva/eSUTs_TOR.pdf

Figure 2 below provides a simple illustration of such an Extended Supply-Use table with two categories of firm. Note the inclusion of additional breakdowns of Fixed Capital Investment, Exports and Imports by the relevant categories of firms and the additional row under output, showing the value of output that is exported. Note also, for ease of exposition, that the additional extensions described in Section 2.1 above are not illustrated below, however it follows that it would be preferable to include these extensions with additional breakdowns by category of firm where relevant. This includes, in particular, breakdowns of*: Imports of goods under processing arrangements*; *Exports of manufacturing services on goods owned by others*; *Customs value of goods exported under processing arrangements; and Adjustments made for merchanting transactions crossing over two periods*.

Figure 2: Extended Supply-Use Tables (Activity breakdown).

Supply

	Industry 1		Industry 2		Industry …		Industry k		Industry …		Industry N		Total Output	Imports		Margins	Taxes and Subsidies	Total Supply
	Category 1	Category 2	Category 1	Category 2	Category 1	Category 2	Category 1	Category 2	Category 1	Category 2	Category 1	Category 2		Category 1	Category 2			
Product 1																		
Product 2																		
Product …																		
Product I																		
Product ….																		
Product M																		
Total Output																		

Use

	Industry 1		Industry …		Industry k		Industry …		Industry N		HHFC + NPISH	GGFC	FCF		Exports		Total Demand
	Category 1	Category 2	Category 1	Category 2	Category 1	Category 2	Category 1	Category 2	Category 1	Category 2			Category 1	Category 2	Category 1	Category 2	
Product 1																	
Product 2																	
Product …																	
Product I																	
Product ….																	
Product M																	
Total IC																	
Value Added																	
Output																	
Of which: exports																	

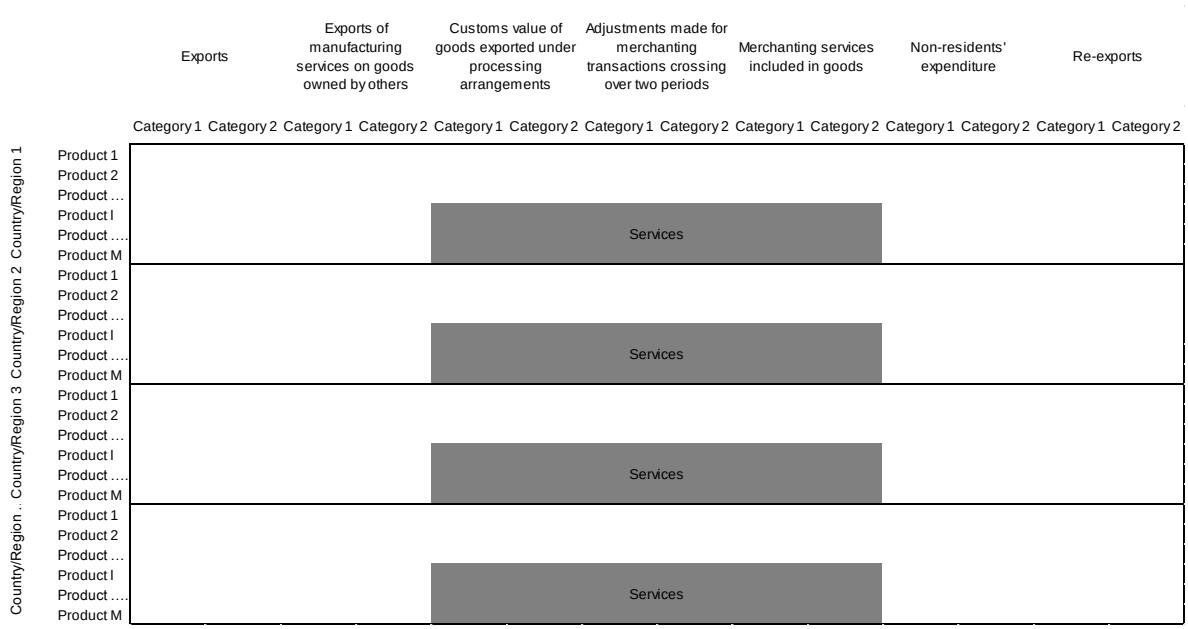
Import Flow

	Industry 1		Industry …		Industry k		Industry …		Industry N		HHFC + NPISH	GGFC	FCF		(Re)Exports		Total Imports
	Category 1	Category 2	Category 1	Category 2	Category 1	Category 2	Category 1	Category 2	Category 1	Category 2			Category 1	Category 2	Category 1	Category 2	
Product 1																	
Product 2																	
Product …																	
Product I																	
Product ….																	
Product M																	

One additional extension that would be very useful in this context concerns the geographical breakdown of exports. Standard indicators on GVCs, such as those derived via TiVA, are not able to track the true underlying granularity implicit in the value chain. For example, foreign owned affiliates seem more likely to have stronger trade relationships with their parent's resident country than independent firms, both with regards to imports and exports, especially when considering the whole of the value-chain. This can make a significant difference to trade relationships derived from TiVA measures where the 'averaging' effect tends to weaken the strength of those ties. For example, US firms exporting parts for assembly in Mexico often do so with a view to US markets in mind, but current TiVA estimates are not fully able to capture the granularity of these relationships: a breakdown of the origin of imports by category of firm and, correspondingly, the destination of exports by the same categories of firms would greatly improve the quality of TiVA based estimates, such as the US content of Mexico's exports to the

US. Figure 3 below provides a schematic of the type of information that it would be useful to provide in Extended SUTs.

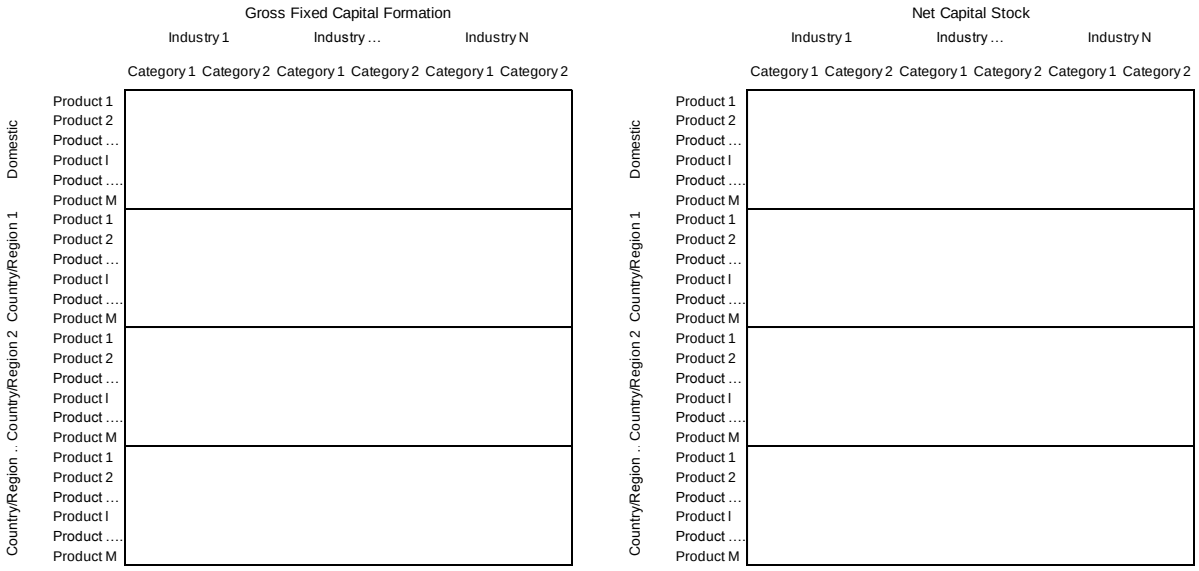
Figure 3: Extended Supply-Use Tables (Activity breakdown) for Exports.



One final complementary extension that would be of considerable use relates to capital flow matrices (Figure 4). Although many countries are able to produce estimates of gross fixed capital formation by activity, these are typically only available at a relatively aggregated product level, such as 'plant and machinery', 'intellectual property' etc., and rarely at the level of product detail provided in conventional supply-use tables. This is a significant statistical lacuna. It necessarily hinders the development of high-quality KLEMS type statistics as, by definition, it requires relatively aggregated measures of capital stock (derived typically via the Perpetual Inventory Method) but it also limits extensions in the domain of TiVA type statistics.

For example, and to illustrate, if Germany only exported capital machinery to China, there would be no German value-added embodied in China's exports and so Germany's dependencies with consumption in the Rest of the World on this basis could appear to be misleadingly limited. However a time series of capital flow matrices could be used to construct corresponding measures of capital services such that an extended TiVA system could be developed that recorded Germany's exports of capital investment goods as a flow of a series of capital services payments (akin to treating the purchase by China as if it was an up-front payment operating lease arrangement rather than an acquisition).

Figure 4: Extended Supply-Use Tables (Activity breakdown) for Investment and Capital Stock.



It's important to stress that in the same way that all activities do not need to be broken down, neither is it necessary for all of the additional extensions to be provided. For example, breakdowns by category of exports of manufacturing services on goods owned by others can, alone, significantly improve the quality of TiVA indicators. Moreover, and again to labour an important point, how countries define the categories of firms necessarily depends on the quality and availability of complementary information.

2.2.2.1 Capitalising on Customs Registers

One source of information, available in theory in all countries, that provides a rich source are registers of exporting firms used for Customs purposes. Typically, but not exclusively, these record imports and exports by exporting *Enterprises*, and in many countries (for example China and Costa Rica), complementary information is available on the export regime that the Enterprises operate within. For example, in China, as is the case in many countries with large processing based exports, processing firms are able to import parts duty-free (as long as the final good is subsequently exported). A similar situation exists for firms operating from Free Trade Zones (FTZ); which forms the basis of firm categorisation in Costa Rica's Extended SUTs.

But even without this additional granularity available in countries with, for example, large scale processing sectors and FTZs, customs registers are able to provide an excellent source for Extended SUTs because it is, in theory, possible to link the statistical units recorded in Customs Registers to the corresponding statistical unit recorded in the core statistical business register. Indeed it this linking that provides the basis of the Trade by Enterprise Characteristics datasets[8] that have been developed in recent years across many countries. Typically the following data are available by size class and industry through a simple matching exercise: Number of Exporting and of Importing Firms, Export values of Exporting firms, Direct Imports by product, Direct Imports by Exporting Firms. More recently, a number of countries have also begun to collect information breaking flows down by ownership (foreign/domestic) too.

[8] OECD Handbook on Linking Trade and Business Statistics (forthcoming)

Such a linking exercise can provide the building blocks for creating new aggregations of firms within supply-use tables broken down into:

- Firms that have no direct imports and no direct exports,
- Firms that have no direct imports but have direct exports,
- Firms that have direct imports and exports,
- Firms that have direct imports but no direct exports.

Regarding heterogeneity of production functions, with respect to measuring facets of globalisation, it is clear that such groupings could significantly improve the quality of estimates as they broadly define firm aggregations on the basis of one of the key target indicators of globalisation: *import content of a firm's exports*.

In constructing conventional supply-use tables national compilers currently produce aggregations based on activity information alone. By using the above additional disaggregations it is, at least in theory, a trivial exercise to produce extended supply-use tables (broken down by trading status).

There are however a few complicating features that should be borne in mind. The first relates to the statistical unit, which is not always the same in the statistical business register and the customs register, nor indeed necessarily the same as the unit used in constructing conventional national supply-use tables. Customs Registers for example often, but not exclusively, capture units in line with (or close to) the enterprise concept but the statistical unit used in statistical business registers is often a legal unit, whilst in many countries the unit used for conventional SUTs is the establishment. As such it is important to ensure that a common unit is used, or that appropriate links and apportionment methods are made to link across the various datasets. That being said, in many countries this is a relatively trivial exercise as the unit used is the same across all domains. Where the units are not the same, and where the challenges of reliable apportionment are onerous it seems preferable to select the highest common denominator as the basis for the unit across all three domains, for example the Enterprise[9].

An additional complication with respect to the use of customs registers in compiling Extended SUTs relates to the notion of exporting and importing firms. In most countries for example a significant share (around half in many countries) of total imports and exports are made by distribution firms (wholesale and retailers). But in constructing supply-use tables these firms are only shown as facilitators of imports and exports, in other words the conventional SUTs show the consumption of these imports by other consumers (e.g. firms, government, households, NPISH) and not the distribution firms themselves, and they also (implicitly) show the exports as having originated in the actual producing sectors, with the contribution of the distribution sector only added as a distribution margin.

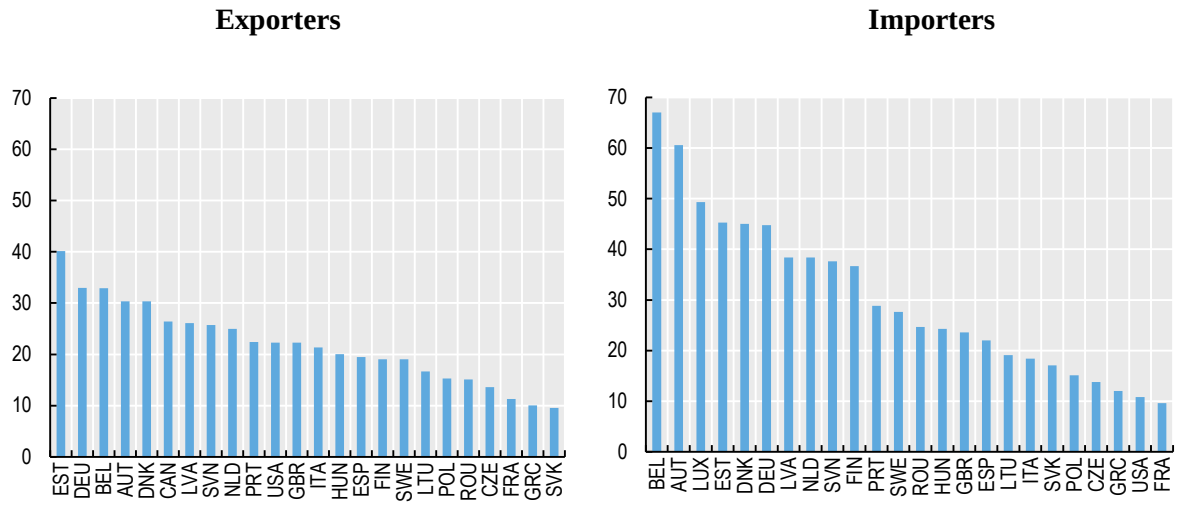
If it can be established that the distribution firm is affiliated to an upstream producer, the import and export of the affiliated distribution firm should be allocated to its affiliated consuming or producing partner. If however, these links cannot be made, and the size of overall exports of a particular product by distributors make up a significant share of overall exports of that particular product then considerable care is needed in interpretation or at least in terms of terminology. For example, countries should avoid, in these

[9] By way of a small but relevant digression, it's important to note that, partly because of the challenges presented by globalisation, and notably those challenges related to intellectual property, the 2008 SNA Research Agenda includes an item to investigate whether the establishment should remain the preferred unit for the construction of conventional supply-use tables.

circumstances, referring to firms as being exporters and non-exporters and instead refer to firms as ‘direct exporters’ or ‘highly export orientated’ and ‘other’. The same principals should necessarily be applied for imports, especially because many firms ‘indirectly’ import via distributors.

An additional reason for advocating such precise terminology concerns scale. The shares of firms not engaged in trade are rarely insignificant (Figure 5), and moreover a significant share of these firms export either very little or indeed only a small percentage of their output.

Figure 5: Share of all firms (Industry, 2014) that are



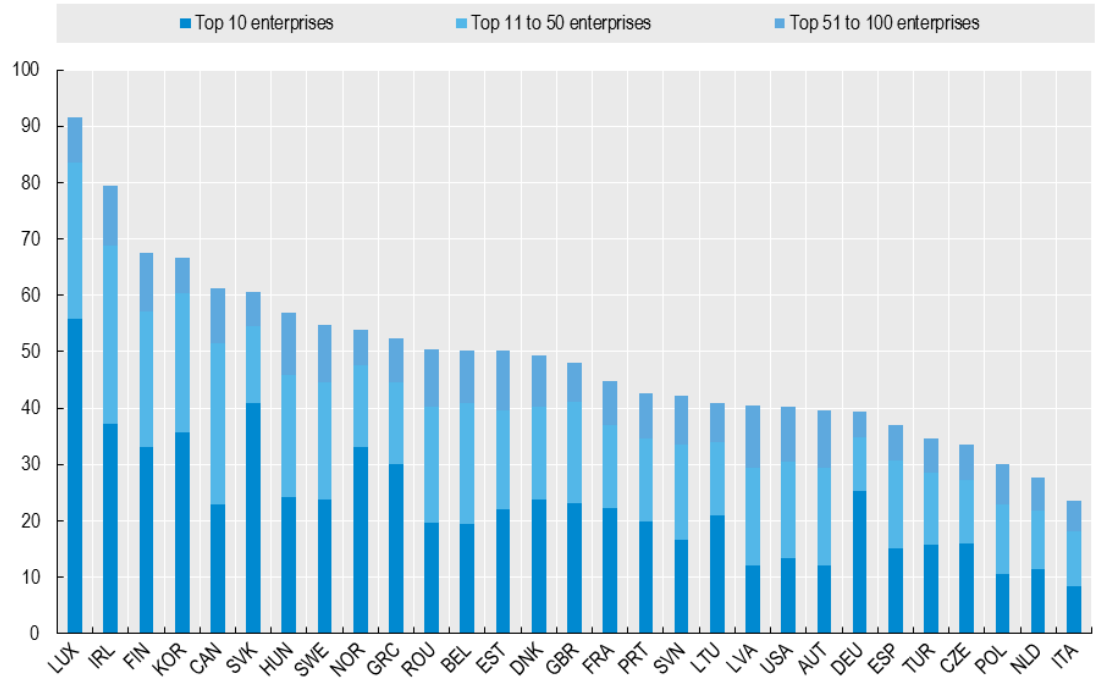
Source: OECD Trade by Enterprise Characteristics

As such there is a risk that an aggregation of firms purely around the concept of whether they export or import may be too crude an approach to deliver a significant improvement in homogeneity or indeed to deliver meaningful improvements to policy relevant indicators, such as the import content of exports.

A practical approach in this respect is to introduce a size threshold that further differentiates on the basis of the size of the firm or the share of output that is actually exported (for example differentiating between firms that directly export 20% of output and less than 20% of output or by only creating aggregations of significant large exporters in the country). One strength of this approach is that it can significantly reduce compilation burdens that may arise when full linking and full disaggregation of activities is undertaken. For example in most countries the top 100 exporting enterprises are responsible for around half of all exports (Figure 6). Clearly some care will necessarily be needed in adopting this approach as confidentiality issues quickly emerge the higher the threshold for inclusion but the point is to illustrate that it is able to introduce significant improvements in homogeneity through looking at only a smaller grouping of firms, and indeed targeted activities. This is perhaps of important note for developing economies where compilation burdens may rapidly become onerous if meaningful thresholds are not introduced. Indeed, such an approach is likely to work particularly effectively in some developing economies where exports are oriented around only a handful of core activities and by a handful of key firms.

Figure 6: Concentration of exports by exporting enterprises, total economy

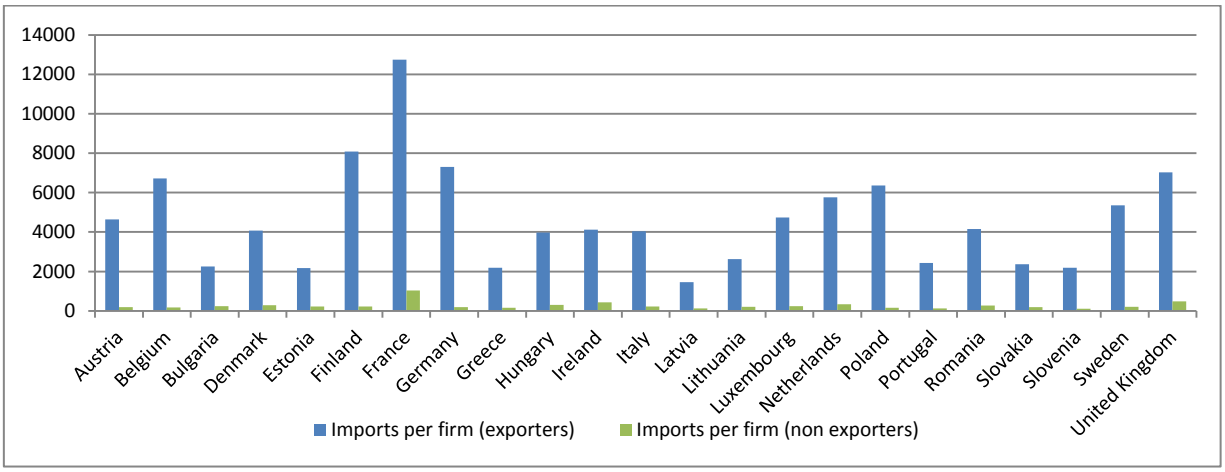
Percentage of total value of exports, 2015, or latest available year



Source: OECD Trade by Enterprise Characteristics

Another reason such an approach is worth exploring is the high correlation between direct imports and direct exports (Figure 7), which is perhaps not surprising given that this is one of the key defining features of GVCs and international fragmentation of production more generally. This means that a simpler approach that focuses on a core set of large exporters and activities is also likely to capture the desired homogeneity that would be obtained through additional aggregations of importers (moreover in most countries most exporters import, Figure 8).

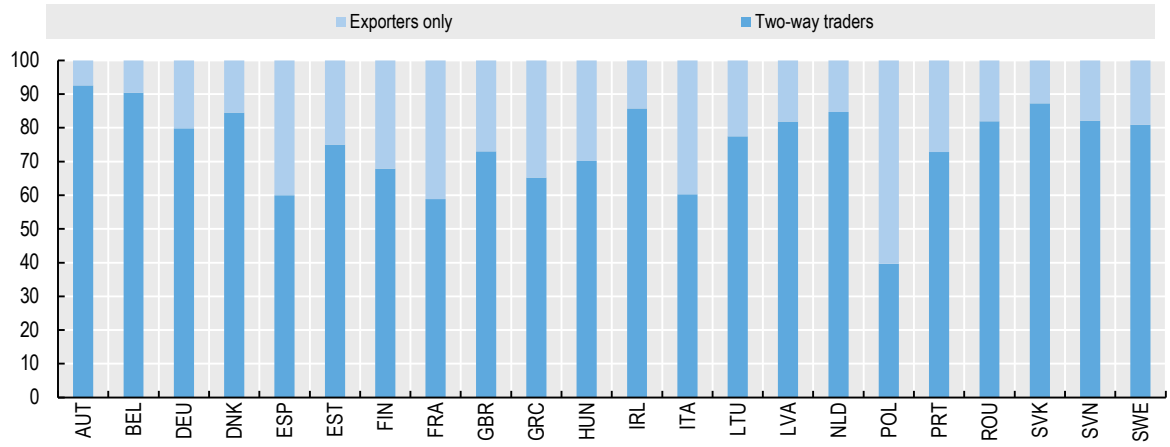
Figure 7: Imports per firm, USD 2011



Source: OECD Trade by Enterprise Characteristics

Figure 8: Incidence of two-way traders, industry

Share of two-way traders among trading enterprises, percentage, 2015 or latest available year



Source: OECD Trade by Enterprise Characteristics

The approaches used by China and Costa Rica are both examples of this modified 'threshold' approach. In the case of China, the approach identifies categories of exporters that differentiate between firms that export under the processing regime, those that export but under the normal regime (both using administrative Customs data that identify these firms) and other non-exporting firms. Once identified, the firms are grouped within activities and their respective columns within SUTs can be compiled, using the same data (based on business surveys and other administrative sources) that are used to construct the estimates in conventional SUTs. Costa Rica's approach is similar, except in this case the split is based on those firms operating (exporting from) FTZs.

In both cases the approach ticks two important boxes.

The first reflects improved homogeneity. It is clear, for example, that processing firms and firms operating from FTZs have very different degrees of global integration than other firms in the same activity. Almost by definition they have higher import content, reflecting in large part their duty-free nature. But they also differ in many other respects too. Processing firms for example are often bywords for assemblers, and even if they are classified to the same activity as firms engaged in producing a good from start to finish, it's also clear that the production function (and so input-output relationships) will differ significantly. The same holds true for firms in FTZs, reflecting a number of factors, including processing, size, degrees of foreign ownership (and, so, access to higher technology, including intellectual property). But this also reflects costs. For example, all other things being equal, the cost structure of a firm in an FTZ, at least with respect to the cost of imports, will by definition be lower than for firms outside of FTZs. Section 3, presents the results of these exercises and well illustrates the important difference they make to TiVA estimates.

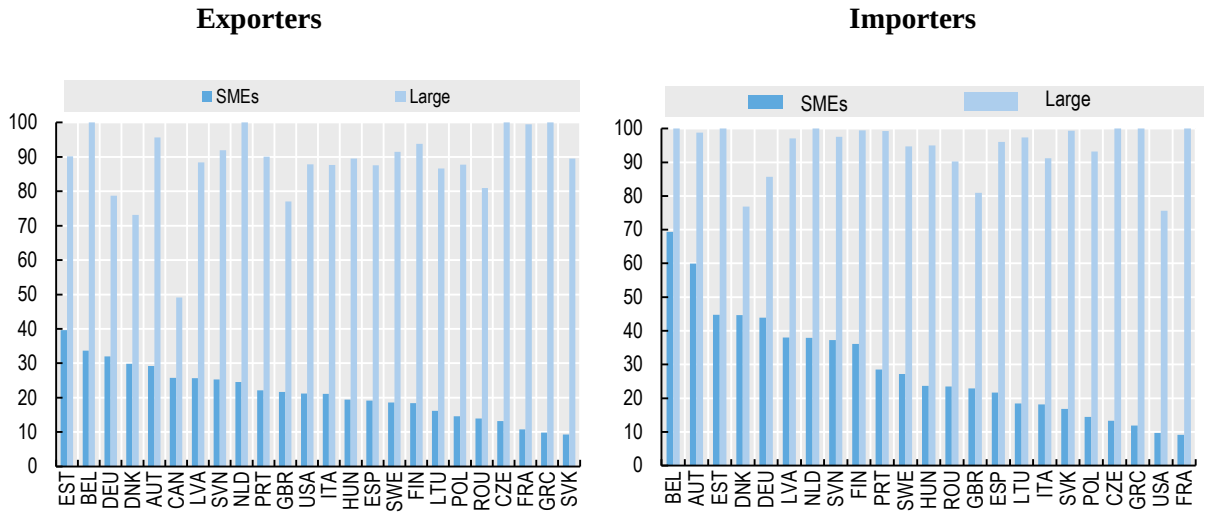
The second reflects policy. It is clear for example that there is particular policy and analytical interest in the role of processing firms in China. They have been important drivers of China's integration into GVCs but their role has been evolving in the last 10-15 years and policy makers are especially interested in motivating their graduation up the value-chain to higher skilled activities. The same is true for firms operating from FTZs. Understanding, for example, their integration into GVCs is of particular interest (including in due course how value-added generated by foreign owned affiliates is repatriated to parents overseas) but so too is better understanding how they integrate, and therefore how they create upstream spillovers in the domestic economy, not least to assess to what extent FTZs may hinder this (reflecting in

part the competitive disadvantages faced by potential domestic upstream providers who have to pay duties on any upstream imports they may require).

2.2.2.2 Capitalising on Structural Business Statistics for a size class dimension

Another area of significant policy interest, but also a long standing source of heterogeneity, relates to the size of firms. It is a well-known fact that larger firms are typically more capital intensive than smaller firms and also that they are able to capitalise on economies of scale. But it is also true that these economies of scale also manifest themselves in a trade context. Larger firms for example are more readily able to accommodate any fixed costs (e.g. dealing with regulatory and administrative barriers) involved in international trade, and it is perhaps of no coincidence that in most countries a significantly smaller share of smaller firms are engaged in international trade than larger firms, certainly with respect to exports (Figure 9).

Figure 9: Share of all firms (Industry, 2014) that are



Source: OECD Trade by Enterprise Characteristics

In practice it is a relatively trivial exercise to create breakdowns of activities into size class dimensions. Statistical business registers nearly always include these dimensions and together with the activity code, they form one of the most important pillars (stratification variable) of survey sample design. However of considerable interest in respect of globalisation concerns the degree of integration of the various categories of firms within GVCs. For those countries where survey or administrative sources reveal the share of output that can be exported, one relatively simple innovation is to include this information as an additional row in SUT.

However, more can be done.

One area that could be explored by countries concerns links at the detailed industry activity level with detailed merchandise trade customs data. Such a matching exercise could for example reveal that exports of particular detailed 6 or 8 digit HS (Harmonised System) products are only produced by certain categories of firms that can be described as large, medium, or small. Where more than one category of firm size is responsible for production, proportionality assumptions could be used – although not perfect for a number of reasons, not least because there is perhaps a higher probability that larger firms will account for a disproportionate share - when conducted at a relatively detailed product and industry level

the impact of the assumption is likely be lessened. This approach provides an ability to split the conventional export column in SUTs into categories of exporters (broken down by size class). It also provides an ability to create a further extension, as shown above, to include a breakdown by destination. This is of particular relevance as the evidence points clearly to smaller firms exporting disproportionately within neighbouring countries (and with countries where trade agreements exist) compared to larger firms.

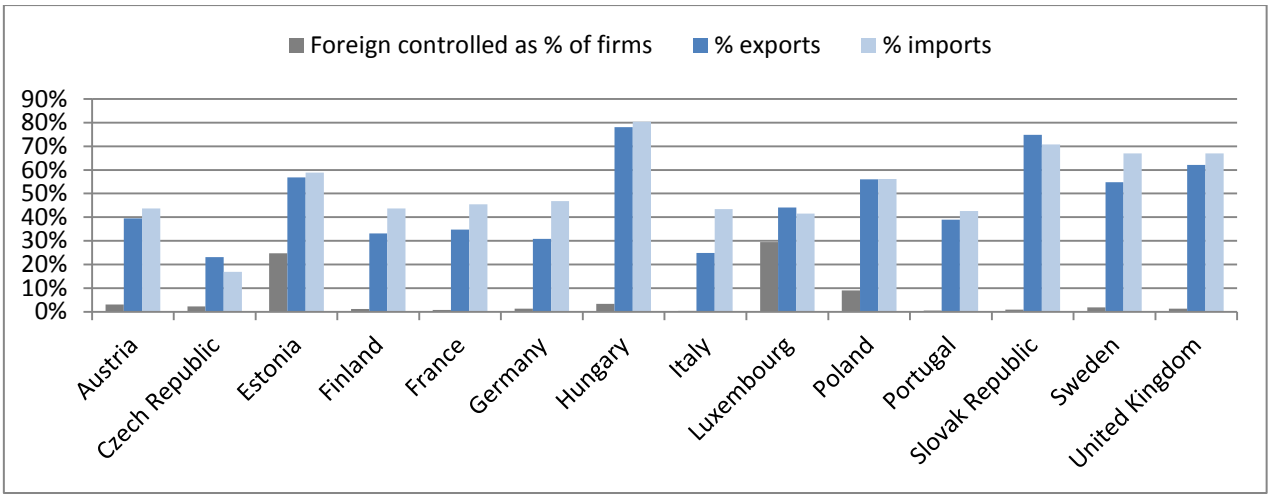
One avenue that could greatly improve the quality of information on imports and exports broken down by size class is to link SBS data to customs registers, by adopting the same linking methods outlined above in Section 2.2.1.1. Again however, some care will be needed in compilation as exports and imports included in customs registers are often recorded as being conducted by distributors but by combining detailed HS data, SBS, data and TEC-type statistics, the quality of this exercise could be greatly enhanced (including through the development of breakdowns that show the origin country of imports and the destination country of exports).

2.2.3.2 Capitalising on FDI and FATs data, for an ownership dimension

Arguably one of the most useful dimensions for constructing Extended SUTs concerns breakdowns by ownership structures – e.g. Foreign Owned Affiliates (FA), Domestic MNEs (DM) with affiliates abroad, and Domestic Firms (DF) with no foreign affiliates.

It is clear that foreign owned firms and multinationals, in general, shape GVCs. It is also clear that foreign owned affiliates are responsible for considerable shares of overall activity and in particular trade, despite their relatively limited number (Figure 10), with a much higher orientation towards international than their purely domestic counterparts. A focus on this small number of firms could therefore prove to be a very effective channel for developing Extended Supply-Use tables.

Figure 10: Foreign owned firms across economies (2011)

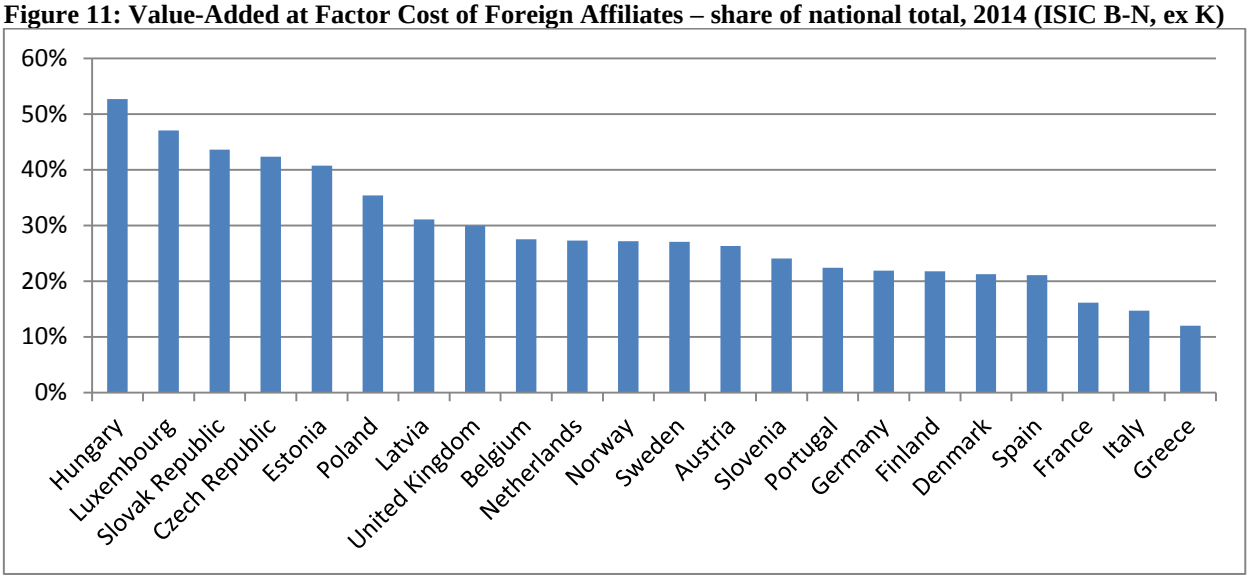


Source: OECD Trade by Enterprise Characteristics
Note: Foreign Owned firms are defined according to FATS/AMNE 50% thresholds

But a focus on ownership dimensions is also crucial for policy reasons. Thus far the TiVA database has been able to provide insights into GVC policy making by creating a narrative around trade. However to fully understand the nature of GVCs and indeed their drivers, it is important to create a trade-investment story. Multinationals (MNEs) have been important drivers of the growth in GVCs with estimates pointing

to around three quarters of total international trade being driven by the top 500 MNEs[10]. Moreover, the share of value-added generated by foreign affiliates approaches around half of all business sector value-added in some countries (Figure 11).

Figure 11: Value-Added at Factor Cost of Foreign Affiliates – share of national total, 2014 (ISIC B-N, ex K)



Source: OECD AMNE database

Value-added essentially reflects two main components[11] - (i) operating surplus (including mixed income), or compensation for capital, and (ii) compensation for employment. While the latter component largely reflects the direct benefits that accrue and 'stick' within the economy through production[12] the case is not so clear for the former, where foreign affiliates are concerned.

In perfect markets the operating surplus generated by foreign affiliates is equivalent to the return on produced 'tangible' and 'intangible' capital and also non-produced assets used in production[13]. While the National Accounts of countries attribute the ownership of this capital to the affiliated enterprise the ultimate beneficiary of the operating surplus is not necessarily the affiliate but its parent. This has raised questions – often in emerging economies but also in developed economies- about the actual benefits of foreign MNEs to the host economy. Indeed, more recently it has begun to raise questions about the meaningfulness of GDP itself as a tool for macro-ecomomic policy making.

Particularly important in this regard are transactions in intangible assets: those recognised as produced in the System of National Accounts (such as research and development, software, etc.) non-produced (such as brands) and also other knowledge-based capital (such as organisational capital, e.g. management competencies). Often, in international trade in services statistics, payments for the use of these produced and non-produced assets are recorded as purchases (intermediate consumption) by one affiliated enterprise from another. But often they are not, and instead they are implicitly recorded under primary income payments (such as investment income, or reinvested earnings in the Balance of Payments). In the former case, the value-added of the affiliate using the assets is lower, as the value-added generated through ownership of the asset appears on the accounts of the affiliate that owns it. In the latter case, however, the

[10] Source: Corpwatch.org

[11] It also includes taxes and subsidies on production.

[12] Not all labour compensation will necessarily stick in the economy, for example for cross-border workers.

[13] Such as land and other intangible assets not recognised as Intellectual Property Products in the SNA.

value-added of the affiliate using the asset is higher (as there is no intermediate consumption) with the 'ultimate' beneficiary (the owning affiliate) recording no value-added but instead recieving primary income from the using affiliate. In both cases, however, the ultimate 'income' generated by the asset ends up on the books of the owner (at least in theory, as even the very notion of the ultimate onwer is a complex issue).

Furthermore, the distinction between the two scenarios above is often clouded by (a) the ability of the statistical information system to record the flows and (b) transfer pricing and tax incentives of MNEs. So, while TiVA estimates consistently reflect the way these flows are recorded in a country's national accounts and, so, accurately reflect the share of a country's recorded overall value-added that is generated by its exports, they do not necessarily entirely reflect how countries truly benefit from GVCs, since part of the value-added that is generated does not remain in the economy but is repatriated to parent enterprises. Indeed, in some countries where foreign affiliates generate significant value-added and repatriate significant profits back to parent companies the policy focus has switched from GDP to GNI, and indeed in some countries, such as Ireland, to new accounting concepts[14].

This is not however an issue singularly related to knowledge-based assets. Transfer pricing is also prevalent in transactions related to goods. Moreoever, notwithstanding these issues, significant income flows generated by an affiliate can be repatratied to parents via other means, for example as interest payments.

Measuring these flows can provide an important narrative on the links between GVCs and foreign direct investment (as well as providing for estimates that overcome differences in statistical practices for recording trade related to knowledge-based assets). This requires more detailed data beyond the current purely industry-level information in the TiVA database. What is required are additional breakdowns of firms classified on the basis of their ownership.

Statistical tools to create these breakdowns do currently exist in many countries, in particular those with good quality FDI data and also those producing FATS data. Definitional issues are of course of relevance here. FDI data for example captures associate firms (where foreign parents hold between 10-50% of the company's capital) and subsidiaries (50% and over), whilst FATS data typically only capture subsidiaries. But, as before, the intention is not to be prescriptive and countries are encouraged to develop breakdowns in line with national circumstances and data availability. Ideally however the breakdowns would follow either FDI or FATS definitions as this would provide the basis for more coherent and integrated accounting frameworks. In addition, as shown in the section that follows, a breakdown by ownership structures would also provide an ideal basis for integrated and detailed balance of payments and national accounts.

The United States (Bureau of Economic Analysis) has already begun to develop Extended SUTs on the basis of FATS, with a three way breakdown between: FA, DM and DF [15] and Mexico (INEGI) have produced a hybrid variant that incorporates the concept of Global Manufacturers[16] that: a) import the majority of their purchases (imports account for at least 2/3 of their export value); b) produce only for exports; and c) are controlled by a foreign owner. These global firms were responsible for 55% of total imported intermediate consumption and for 71% of gross exports of the Mexican manufacturing sector in 2008. Details from the results of these initiatives are presented in Section 3. Costa Rica is also beginning to explore this extension[17]

[14] http://www.cso.ie/en/csolatestnews/pressreleases/2017pressreleases/pressstatementmacroeconomicreleasesyear2016andquarter12017/

[15] http://scholar.harvard.edu/files/jorgenson/files/4a.1_paper.pdf

[16] http://www3.inegi.org.mx/sistemas/tabuladosbasicos/LeerArchivo.aspx?ct=44462&c=33654&s=est&f=4

[17] *Integrating foreign direct investment data and extended supply and use tables into national accounts*, Gabriela Saborío and Rigoberto Torres, forthcoming.

2.2.3 Extending the core production accounts to the distribution of income account and other macro-economic variables.

One of the fundamental drivers behind the development of Extended Supply-Use tables is to provide the accounting framework for coherent and integrated international accounts. Currently, within the SNA and BPM6 there is no requirement to provide an activity breakdown of core economic variables, such as primary income flows. Typically these transactions, and in particular those relating to the distribution of income, are only compiled on the basis of SNA institutional sectors. This, to a large extent, reflects a current statistical reality concerning the way such data are compiled and, so, in some respects, the recommendations and discussion presented below are more about looking to the future than what can be done in the present. But through an articulation of a potential framework here it is hoped that countries will be motivated to begin to explore these extensions.

One important reflection in this respect concerns the nature of the statistical unit. Although not impossible (through for example assumptions and estimations), it is clear it is likely to be more complicated to produce such extensions when the statistical unit used in constructing SUTs is the establishment as compared to the enterprise, as many of the transactions required for the distribution of income account are less readily available on an establishment basis.

The extensions also include other macro-economic variables less affected by the choice of statistical unit however, and where the feasibility to develop more coherent accounts is higher; chiefly relating to a suite of employment variables. These extensions relate to conventional measures of employment headcounts, such as persons engaged, employees, and hours worked but they also include additional information on occupations. Occupational data is a key tool to understanding globalisation, providing, as it does, an easily interpretable link to skills, and, so, provides perhaps one of the most important data mechanisms to analyse heterogeneity across firms and the manner of their integration into GVCs. International fragmentation of production has significantly hampered the ability of conventional activity based data to provide this view as firms grouped within certain activities may find themselves engaged in significantly different tasks in the value chain, even if they are allocated to the same sector. Fabless firms for example that purchase material inputs for production by contractors will have a very different set of employees to those firms actually engaged in material production but such heterogeneity is masked when looking at activity data alone. Occupational data can at least provide some scope to better understand these differences and their implication for growth and employment more generally.

The potential to go further in this regard is significant. It is for example possible to consider additional extensions that partition workers on the basis of wage and salary cohorts, productivity cohorts, or indeed skills; which are also key to understanding the distributional impacts of globalisation. However, it is also possible to develop these additional insights in an ad-hoc manner.

The OECD's ANSKILL database for example provides information on employment and skill composition at the industry level. The database matches industry data at the two-digit level (currently classified according to ISIC Rev. 3) to occupations at the two-digit level (classified according to International Standard Classification of Occupations [ISCO]-88). It also includes an additional proxy for skills, in the form of data on the educational attainment of employees (classified on the basis of International Standard Classification of Education [ISCED]-97).

For ANSKILL, the ISCO-88 occupation classification corresponds to high, medium, and low-skilled 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.

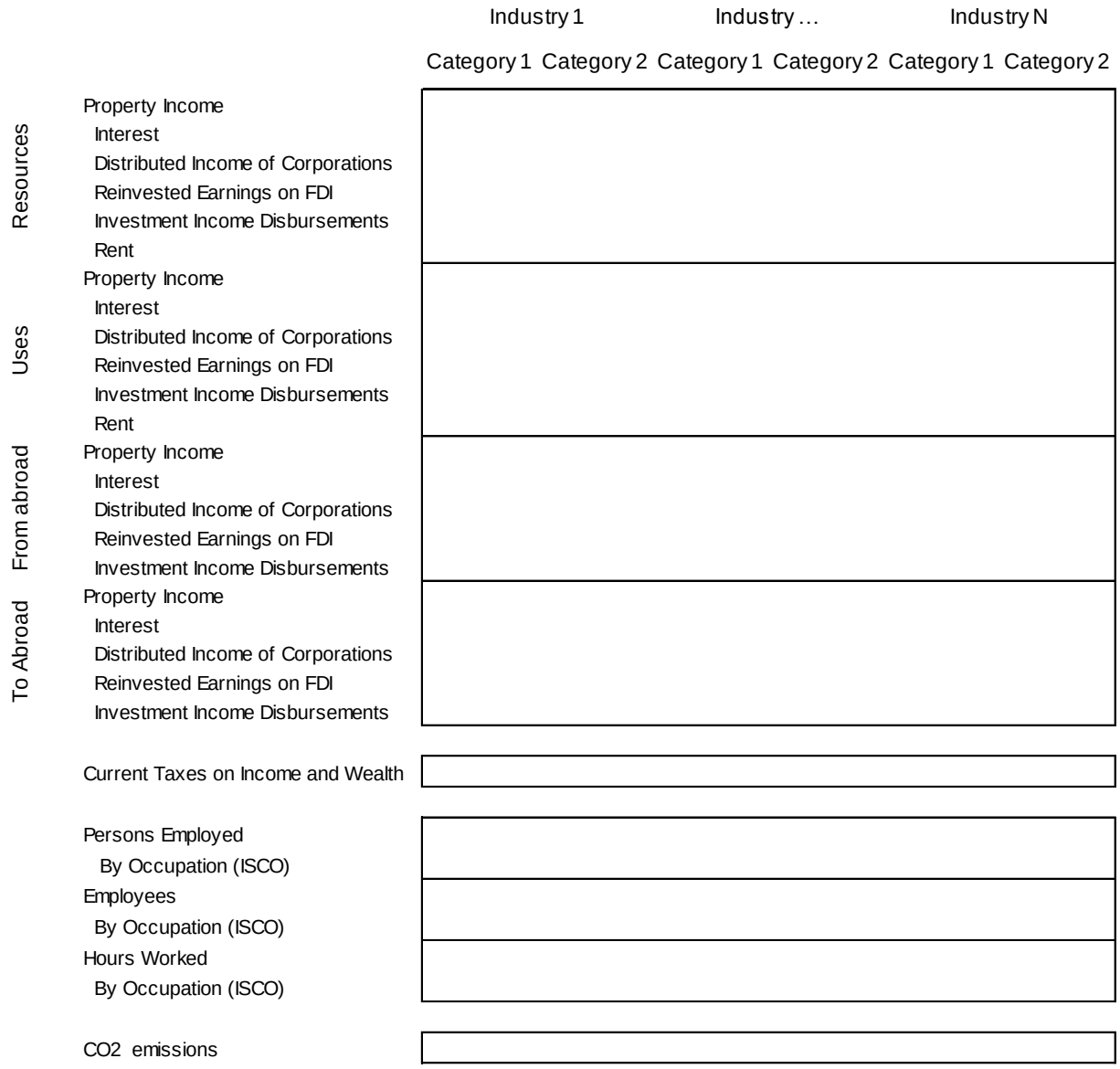
The ISCED-97 educational classification maps to high, medium, and low skill levels in ANSKILL as follows:

- 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.

Figure 11 below presents an overview of the extensions envisaged. As before, it is important to note that not all items are necessarily needed: extensions, in this respect, should not be seen as an 'all or nothing' choice. For example in the top half of Figure 11 below, the intention is to develop a set of seamless accounts that take users from the production account through to the distribution of income accounts. Doing this at the level of the total economy is needless to say non-trivial but, somewhat fortunately, as this is a key focus, it may be easier to do this for cross-border flows, especially with respect to reinvested earnings and perhaps debt interest.

Of additional note in the set of extensions below are the items on 'current taxes on income and wealth' and CO2 emissions, which are both of significant policy interest. The former, in particular when the breakdown of activities is on the basis of ownership, as there is a long-standing and growing interest in understanding whether multinationals are able to generate significant advantages through fiscal optimisation and where there are currently considerable information gaps.

Figure 11: Property income and other macro-economic extensions



2.2.4 Breaking down SUT rows by category of producer.

Perhaps the most complicated feature of full-blown Extended Supply-Use tables is breakdowns of rows (products) by origin producer. It is of course relatively trivial to provide such a breakdown on the Supply side but doing so by category of consumer is significantly more complex, and the complexity necessarily differs depending on the nature of the breakdown used for activities.

For example breakdowns by size class require that consumers are aware if they purchased their goods and or services from a small, medium or large enterprise, and this information is rarely collected. In some countries some scope to do this is available from VAT data but this requires a level of access to firm-level data that is not always forthcoming and entails a not insignificant compilation burden.

For other breakdowns the scope is to some extent less (albeit still) complicated. For example for the Extended Supply-Use tables produced by Mexico and China, Global Manufacturers (for Mexico) and Processors (for China) produce no output for the domestic market and so the breakdowns by rows are relatively trivial, as the only items where output of these categories of firms is consumed concerns exports (and marginally changes in inventories). This, but to a lesser extent, is partially true for any breakdowns that focus on the exporting status of firms. Certainly the higher the threshold used to determine 'exporting firms' the easier the task. For example if the thresholds used to determine an 'exporter' were 90% of total output then, by design, very little of the output would necessarily have to be allocated to other domestic consumers.

More generally, irrespective of the type of breakdown used, the higher the export intensity of a category of firms the lower the impact of assumptions to allocate the residual (non-exported) output to domestic consumers.

Regarding the allocation of residuals (output minus exports) to remaining categories of users, how this is done will necessitate the use of some stylised assumption, not dissimilar to the classic proportionality assumption used in constructing import flow tables. Some refinements are of course possible but these may create circularities that it will be important to keep in mind when presenting results. For example, with regards to breakdowns by size class one could assume that small firms in manufacturing predominantly sell goods and services to larger manufacturers, whilst their counterparts in certain service activities, such as accounting and legal sectors predominantly sell to households. But these could ostensibly create self-selecting facts that point to better integration of manufacturing SMEs in domestic value chains than service SMEs; hence the care needed when presenting results to users.

The OECD has used a variety of such approaches in its work to develop information on the scale of integration of SMEs within GVCs[18], and also regarding the scale of integration of non-trading firms and purely domestic firms[19]. Similar approaches were also used in developing the OECD's Trade and Investment Country Note series, which provides highlights on GVCs using the ownership dimension[20].

For the US Extended Supply-Use tables, based on ownership breakdowns, the derivation of Use relationships were derived using the quadratic programming constrained optimisation model adopted in Ma, Wang, and Zhu (2015)[21].

Although relatively easy to conceptualise without a diagram, Figure 12 below presents, for exhaustiveness, a full Extended SUT with the requisite product breakdown (again with the two category example used above). Note that no further breakdowns of import flow tables are required; in addition to those shown in Figure 2.

[18] https://www.oecd.org/trade/OECD-WBG-g20-gvc-report-2015.pdf

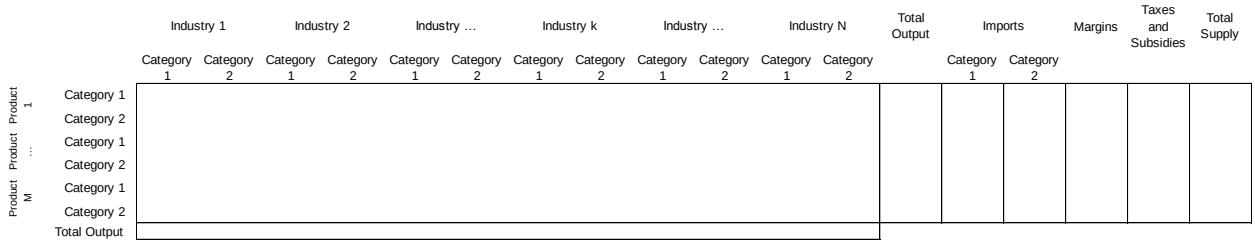
[19] http://www.oecd.org/std/its/enterprises-in-global-value-chains.htm

[20] http://www.oecd.org/investment/trade-investment-gvc.htm

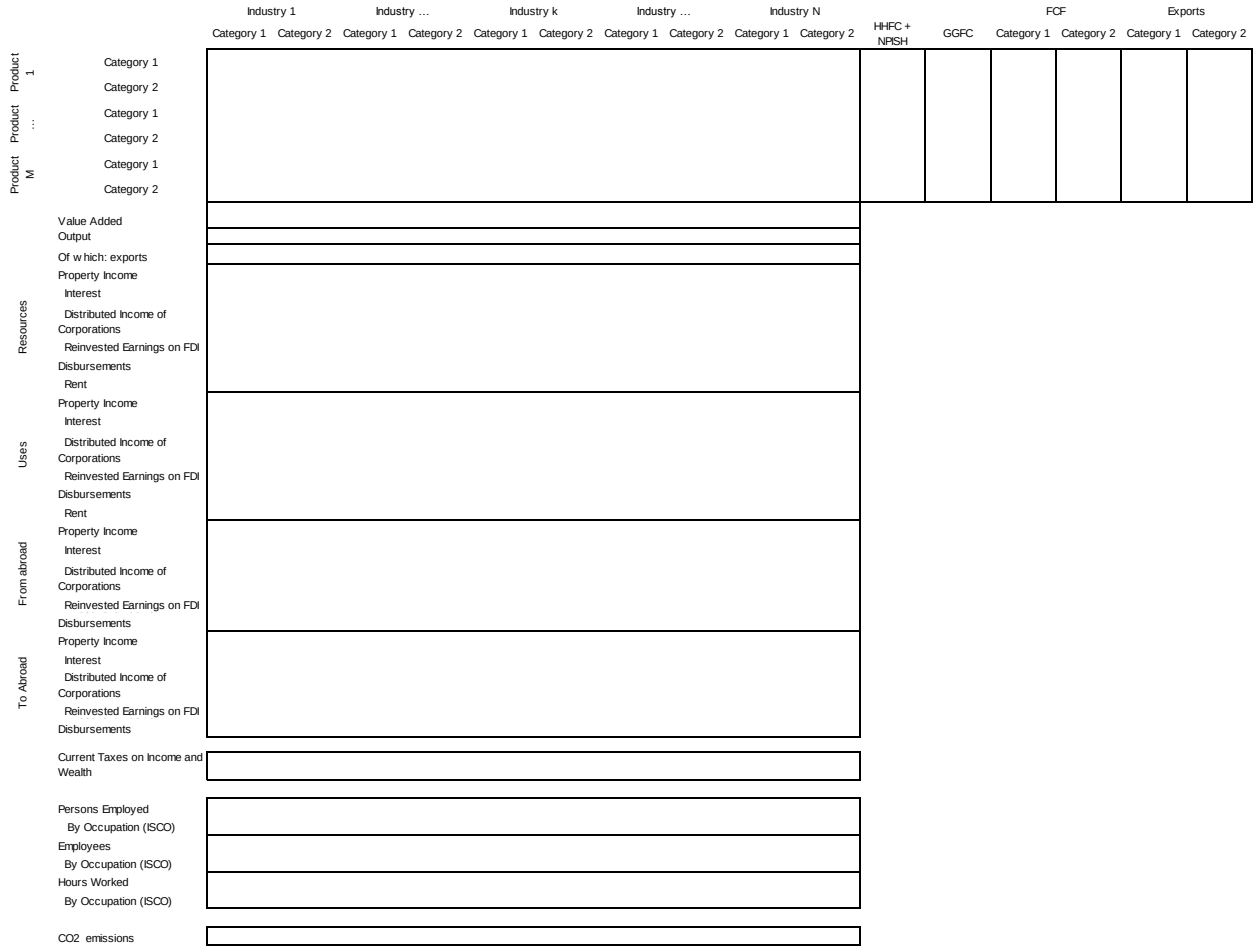
[21] Ma, H., Wang, Z., & Zhu, K. (2015). Domestic content in China's exports and its distribution by firm ownership. Journal of Comparative Economics, 43(1), 3-18.

Figure 12: Full Extended Supply-Use table

Supply



Use



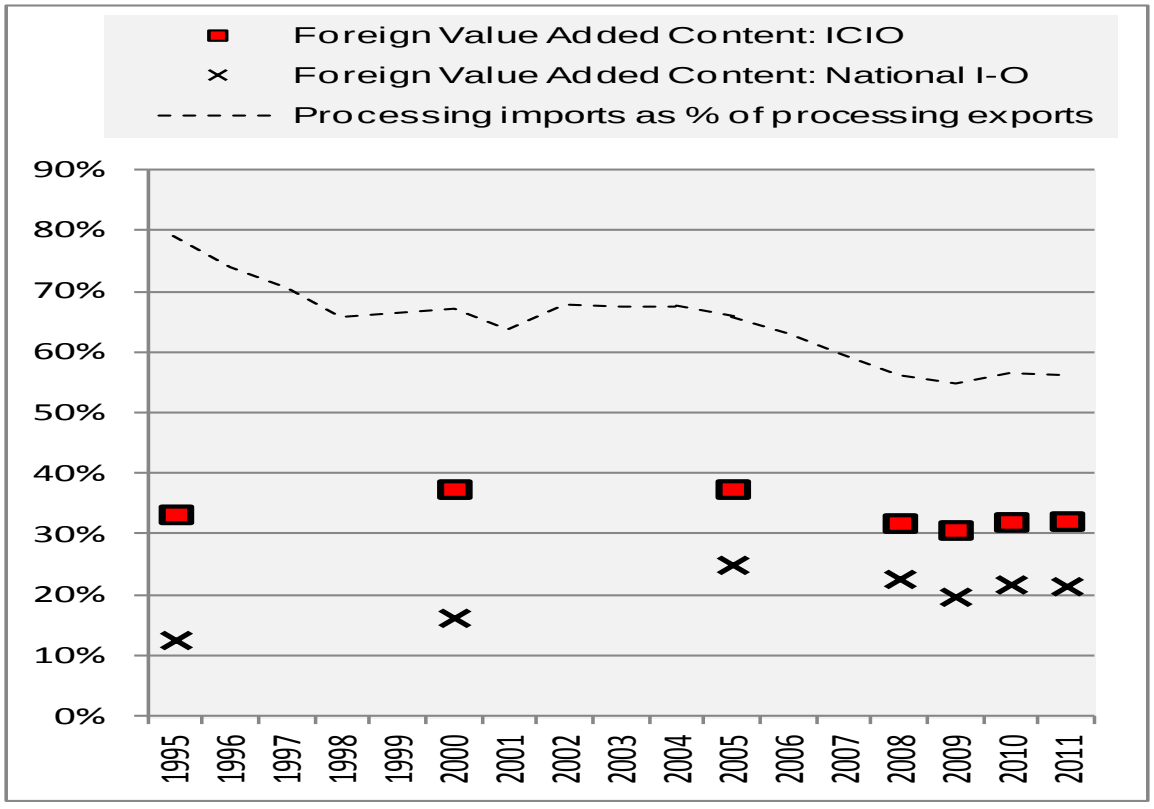
3. Results from using Extended Supply-Use tables

As described above a number of countries have already begun to develop Extended SUTs using a variety of approaches. This section provides a summary of the results of those initiatives and their impact, in particular on Trade in Value-Added estimates,

3.1 Results for China

The impact of incorporating an Extended Supply-Use table has a significant impact on the quality of TiVA results for China. Figure 13 below for example reveals significantly different movements in the trend of the foreign content of China's exports over the last two decades when comparing estimates based on extended SUTs (referred to as ICIO) and pure national tables without a breakdown (referred to as national)

Figure 13: Trade in Value-Added estimates for China, with (ICIO) and without (national) a breakdown for heterogeneity

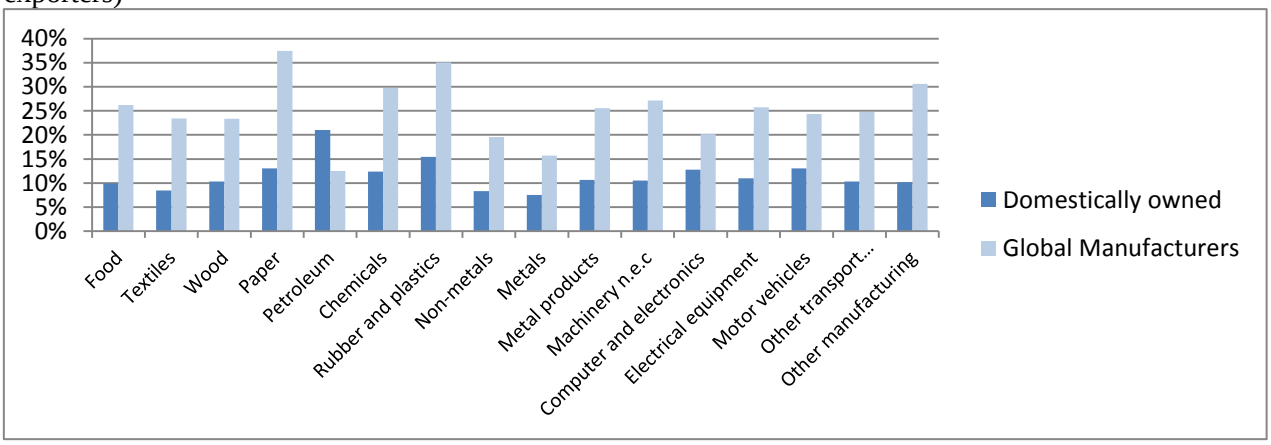


Source: OECD ICIO and Balance of payments database

3.1 Results for Mexico

Almost by definition the import content of Mexico's Global Manufacturing firms is significantly higher than comparable firms in the same sector. This can have a significant difference on highly policy relevant indicators, for example, on measures of the US content of Mexico's exports (Figure 14), where one-quarter of the exports by GM firms in the motor vehicle sector reflect upstream US contributions, compared to around half that amount for non GM firms; a relationship seen across most activities.

Figure 14: US VA content of Mexico's exports %, 2011, (By industry and 'ownership' of Mexican exporters)

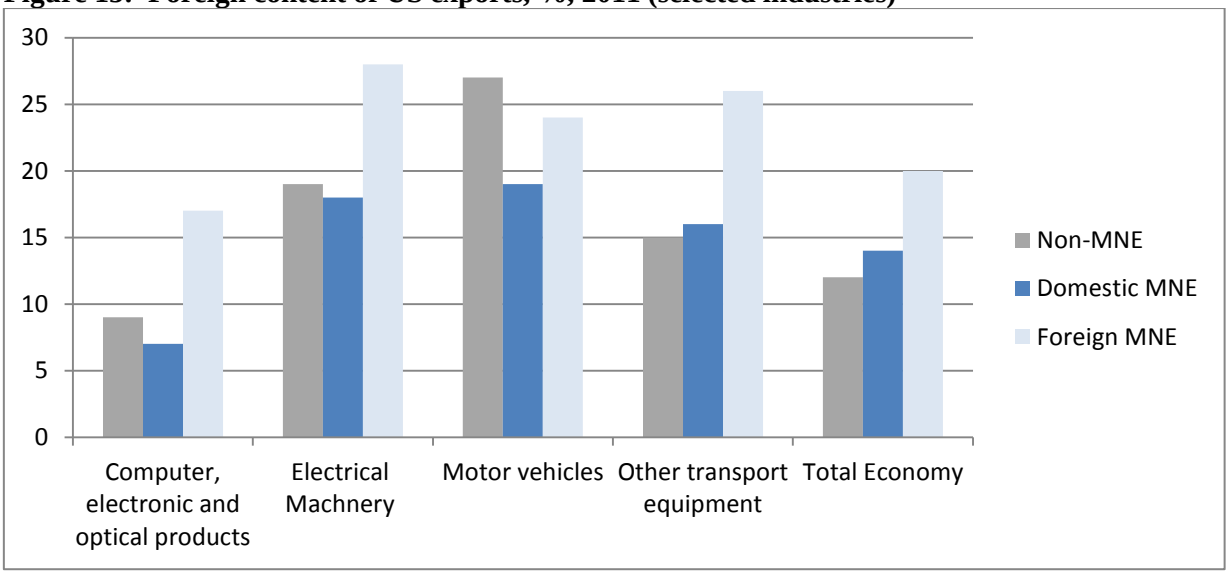


Source: Based on Mexico's Extended SUT

3.3 Results for the United States

Results for the United States also reveal significant differences between the foreign content of exports across categories of firms defined by ownership structure. At the whole economy level the foreign content of US exports by foreign owned firms is almost twice that of domestically owned non-MNEs. This partly reflects compositional effects but the foreign content is higher across nearly all activities (Figure 15)

Figure 15: Foreign content of US exports, %, 2011 (selected industries)

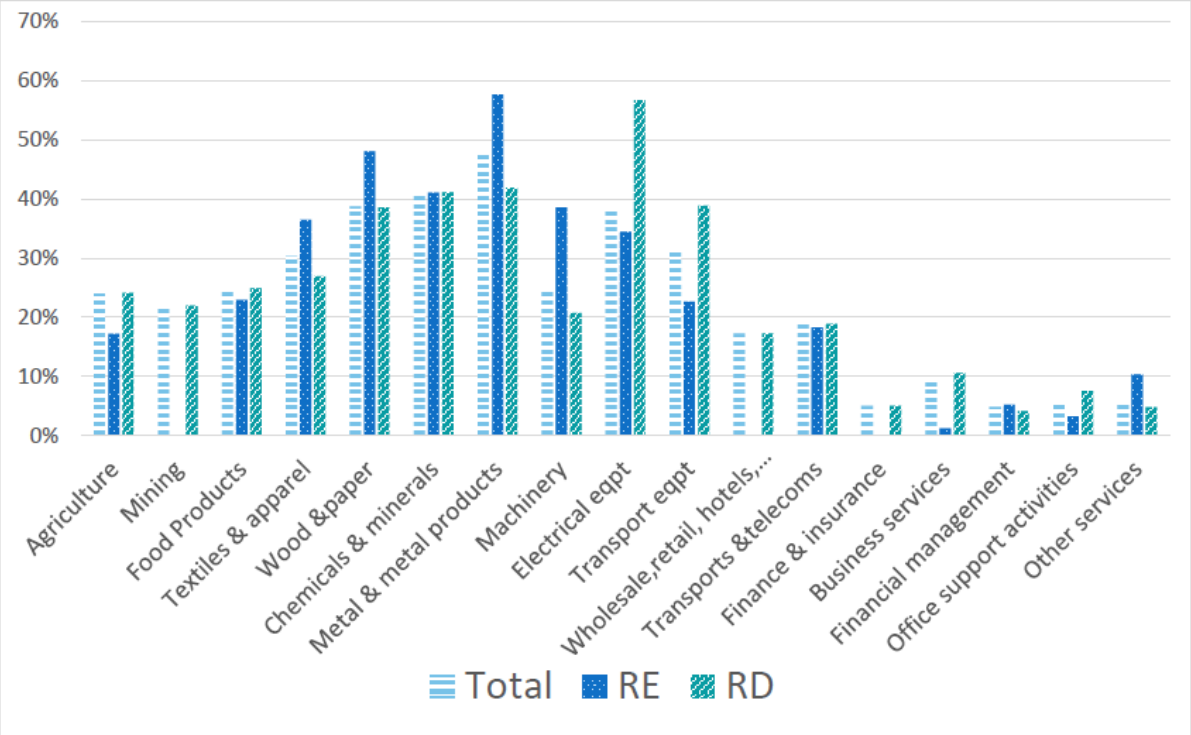


Source: Based on the US Extended SUT

3.4 Results for Costa Rica

A similar picture of strong heterogeneity emerges for Costa Rica, with firms operating from Free Trade Zones (referred to as RE in Figure 16 below) displaying a higher import content of exports than firms operating outside of FTZs (referred to as RD) across a range of important export activities.

Figure 16: Foreign content of Costa Rica's exports, %, 2012

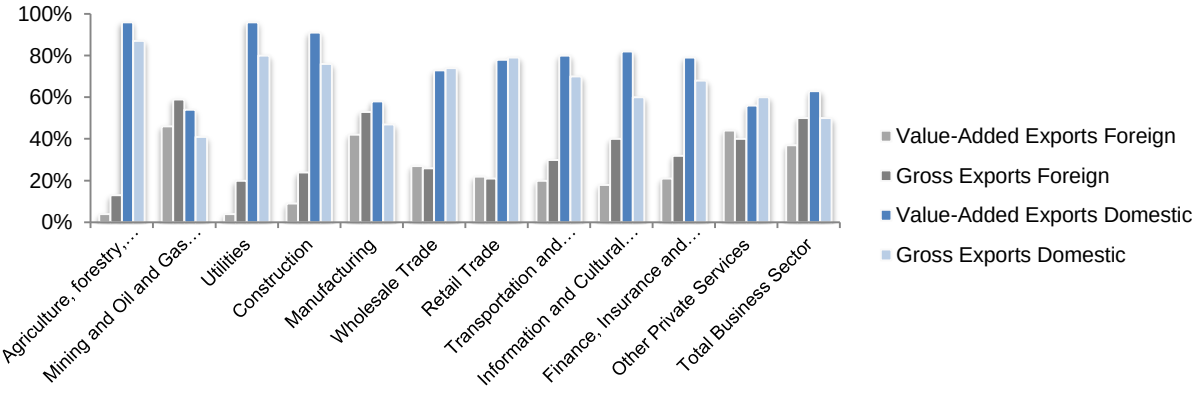


Source: Prepared with data from the Banco Central de Costa Rica.

3.5 Results for Canada

Results from a recent collaboration between the OECD and Statistics Canada revealed that the impact of compiling ESUT estimates for the business sector, accounting for either ownership or trading status, was an increase in the overall foreign value added content of Canada's exports of 4 percentage points. Figure 17, which shows that foreign owned firms are responsible for a lower share of exports in value-added terms than in gross terms, highlights this higher propensity to import by foreign owned firms; and, of course, the importance of capturing improved firm heterogeneity in national SUTs.

Figure 17: Share of gross and value-added exports by ownership status, %, 2010 (industries within business sector)



3.6 Results for Nordic countries

In a recent collaboration between 5 Nordic Countries (Denmark, Finland, Iceland, Norway and Sweden) and the OECD, the OECD developed extended SUTs with three variants of firm breakdown:

- By size class: Micro, Small, Medium and Large, further broken down by whether the micro, small and medium firms were independent or part of a larger enterprise group.
- By trading status: Non-traders, Two-way traders, importers and exporters
- By ownership status: Non-MNEs, Domestic MNEs and Foreign MNEs

Highlights from this collaboration are presented below as Figures 18-20. Figure 18 reveals the significant upstream integration of non-MNEs across all countries, compared to integration seen looking purely at gross trade relationships. Of particular note is the fact that in all countries bar Sweden this integration is primarily channelled via domestic MNEs but in Sweden the main link is through foreign owned MNEs, in large part reflecting scale. Figure 19 presents a similar picture showing the higher integration of smaller firms in GVCs when seen in value-added terms, through their upstream integration as suppliers to larger exporting firms. Figure 20 presents information on jobs sustained through integration in GVCs. A significant insight from this presentation is the fact that even within firms that have no direct exports, around one in six of all jobs in these firms are dependent on foreign markets.

It's important to note in this collaborative exercise that the results are unlikely to replicate those that are likely to materialise from national exercises that mainstream the development of Extended SUTs in the national statistical information system. The figures produced below, for example, necessarily re-aggregate national data in line with the 34 industry classification used in OECD-WTO TiVA but national compilers will be able to develop tables with greater granularity.

Figure 17: Shares of firms in exports in gross and value-added terms, %, 2013, by ownership structure

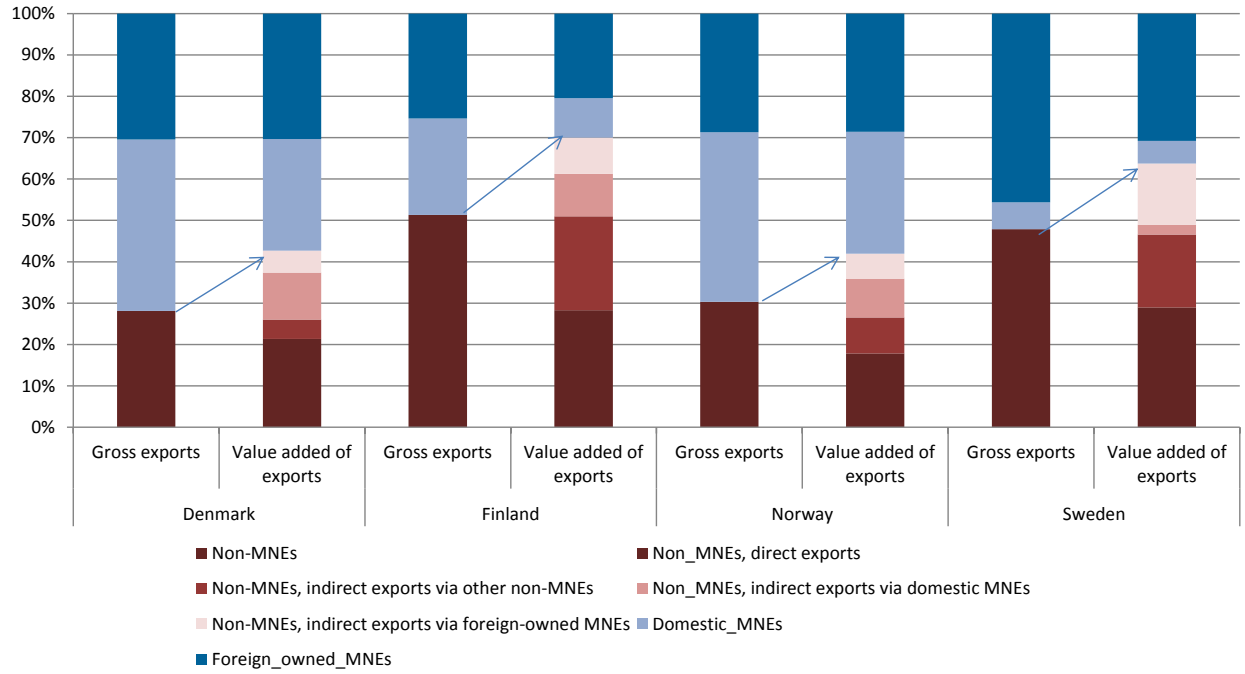


Figure 18: Shares of firms in exports in gross and value-added terms, %, 2013, by size class

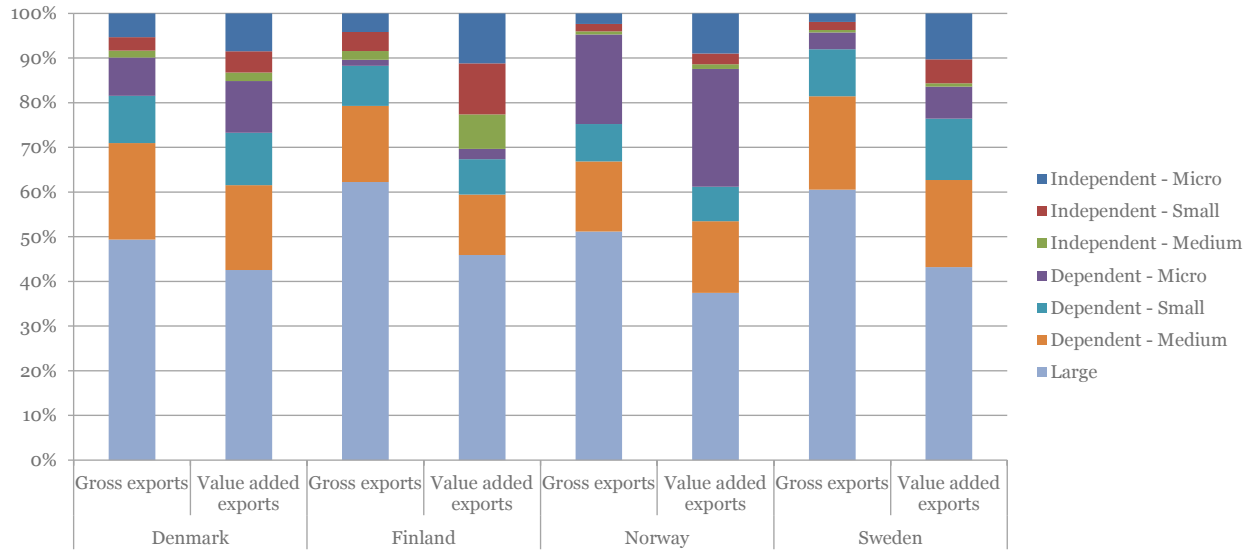
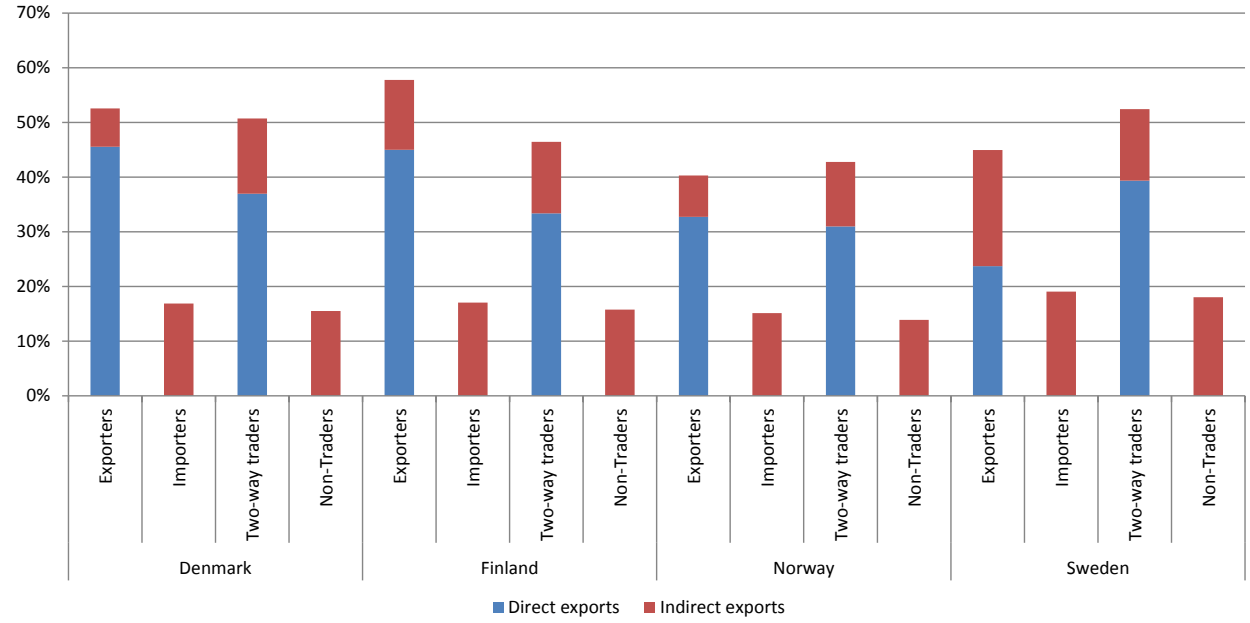


Figure 19: Jobs embodied in exports, % of total, 2013, by trading status



4. Concluding comments

The statistical challenges of globalisation are profound and it has become increasingly clear in recent years 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 focusing on competitiveness it is necessary to see the whole. National statistics build pictures based on interrelationships 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 organizations 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.

Although TiVA estimates have been able to shed important light on our understanding of international trade and its relation to activity and competitiveness, in particular the importance of recognising the importance of imports to exports, and, so, the hitherto hidden costs of protectionism as well as the benefits of trade liberalisation, particularly in services, they do not reveal the full picture. With significant shares of exports being driven by foreign affiliates, TiVA estimates have also revealed the importance of going beyond just value-added towards income, in order to capture flows outside of conventional international trade statistics, such as the repatriation of profits related to the use of non-produced knowledge based assets (e.g. brands) and, indeed, the repatriation of profits related to the use of produced knowledge based assets (e.g. software) that are (often incorrectly) not recorded as receipts from exports of services

The emergence of global value chains therefore also raises, arguably profound, questions about the way national statistics are currently compiled. In the same way that international organisations increasingly need to think ‘national’ in the way they present and compile their statistics, where ‘national’ reflects the single economic territory comprising the 'world' or large parts of it, national statistics institutions need to think global.

In other words, in the construction of national statistics greater emphasis is needed on the role of the Rest of the World, both as a source of demand and supplier of demand but also with regards to the role of

multinationals. This requires a rethink of the way that firms are currently aggregated within statistical information systems to move beyond the classic aggregation based almost exclusively on industrial classification systems towards more meaningful aggregations that better reflect today's 'global factory'.

Such considerations are also essential not only to better understand the way that global production is today organised but also to better understand how investment drives global value chains, and in particular how that very same investment can lead to difficulties in interpreting trade flows as well as GDP.

Extended Supply-Use tables provide an effective tool to respond to these developments and growing needs. Increasing globalisation of production raises challenging questions for national statistics. And fundamental and long-standing axioms regarding the nature of production and the way that statistics are necessarily compiled warrant a rethink. Certainly the evidence suggests that long-standing assumptions concerning homogeneity of firms within industry classifications should be reviewed. The evidence also suggests, particularly for those countries with FATS and TEC data, that an optimal level of aggregation may be achievable without any significant increase in compilation of reporting burden. But, of course, such reconsiderations need also take into account constraints such as burdens and confidentiality.

Supply-Use tables have become the conventional route with which coherent estimates of the national accounts, trade and production are now systematically compiled in many countries and lend themselves as being the ideal way in which to resolve these issues. Extended Supply-Use tables can play a similar role in responding to questions on globalisation.

Three final comments, providing a broader perspective, are worth making in this respect. The first concerns the quality of national supply-use tables. In many (most) countries, such tables are derived using a series of assumptions at least in some years, reflecting in part the often different periodic nature of the large number of datasets needed to construct SUTs. Many of these assumptions are based on some underling view of stability and homogeneity in production functions. As shown, globalisation is increasingly undermining the strength of these assumptions. Looking again at the how homogeneity is likely to manifest itself across firms and creating SUTs based around these categorisations of firms can greatly help to mitigate these effects and strengthen these assumptions, which will remain necessary, perhaps indefinitely, across most countries. As such, one important benefit of Extended SUTs that should not be overlooked is their ability to improve the quality of the core accounts, and indeed GDP. In the same way they are also ideally placed to be able to significantly improve the interpretability of the accounts, in particular, when the accounts are affected by phenomena related to globalisation, such as relocations.

The second comment concerns the potential momentum Extended SUTs could provide to the development and improvement of statistical business surveys. The evidence shows that significant heterogeneity exists across all categories of firms, and that the conventional stratification variables used in survey sampling (typically activity and size) may be sub-optimal. It may for example be necessary to include additional, but readily available, stratification variables, pertaining for example to ownership (e.g. part of a foreign MNE, domestic MNE, an Enterprise Group, Exporter, non-Exporter) in designing tomorrow's surveys.

The third comes back to the issue of the statistical unit. The current 2008 SNA preference for the establishment should not be a barrier to developing Extended SUTs, if for example these can only be developed using a different statistical unit, then counties are strongly encouraged to consider doing so. There is an increasing recognition that the arguments for the current SNA preference for the establishment have been weakened because of the changing nature of production and indeed because of the changes made in the SNA itself regarding economic ownership. This is further recognised in the 2008 SNA Research Agenda, where explicit references are made for the need to reconsider the establishment preference, taking into account the 'basic source information' and changes in the underlying accounting principles of 'Input-Output' tables, whose emphasis has moved from a *physical* perspective to an *economic* perspective.