Statistics Netherlands

Report

Using enterprise data to improve trade in value added estimates

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Remarks	The views expressed in this paper are those of the author and do not necessarily reflect the policies of Statistics Netherlands

Abstract[1] When making multi-regional input-outputtables, it is customary to remove the re-export flows. For countries with little re-exports the accuracy of singling out these flows does not need to be large, but for countries with large re-exports (such as the Netherlands, Singapore and Belgium) errors can have large effects. Allocating Dutch imports for re-exports to the wrong countries will underestimate the Dutch imports for Dutch consumption, because total imports remain fixed. And then the role of those countries for Dutch domestic production processes is underestimated. Similarly, allocating Dutch re-exports to the wrong countries will underestimate the Dutch exports of “made in Holland” to those countries bceause total exports remain fixed. So the role of those countries for the Dutch economy is underestimated as well. We discuss two approaches to allocate Dutch re-export flows to countries: one using commonly available aggregated data, one using micro data. The latter approach uses enterprise data to make a new data set about re-exports. This new data set is then used to adapt an existing Multi Region Input Output (MRIO) table. The two approaches yield very different results, for imports, exports, trade in value added and CO_2 emissions.

Keywords: *multi-regional input-output analysis, MRIO, trade in value added, TiVA, heterogeneity, re-exports, official statistics, WIOD*

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1. Introduction

Many studies (e.g. Hummels et al. (2001), OECD (2013a), UN (2013)) show that the strong growth of international trade is mainly driven by a growing share of intermediate goods and services. Complete production chains are split up over countries. Countries used to produce their own exports in full, but now these are only partially produced in their own country. The value added of exports for the local economy is therefore not equal to total exports.

This fragmentation of the production process created global value chains (GVCs) that link firms, workers and consumers around the world. The value chain describes the full range of activities that firms and workers perform to bring a product from its conception to end use. This includes activities such as design, production, marketing, distribution and support to the final consumer. Sturgeon (2013) gives a good overview of ideas and literature.

Until recently there were no statistics available to reflect this and researchers and policy makers had to rely on gross export statistics. But because of re-exports and the inflation of gross statistics due to the trade in intermediates, this leads to overestimation of the importance of trade. Recent work of OECD-WTO, the WIOD consortium and others led to the construction of new data sets such as MRIO tables and new indicators such as Trade in Value Added (TiVA). Together these filled the gap.

The new statistics about trade in value give many insights. They show on which countries one is really dependent, for imports, for exports, for welfare and for jobs. They show that some apparent macro-economic imbalances are not real. Dedrick et al. (2010) give the example of an iPod, assembled in China and exported to the United States. The surplus of China with respect to the United States is much smaller in terms of value added than in gross exports. Insights for policymakers are that they should pay more attention to obtaining and maintaining a good position in a production or value chain, to its high value activities, such as design and R&D. So, policies arise to integrate in value chains, to use them to be more competitive thanks to specialisation and get spill overs for the local economy through transfer of technology and knowledge (OECD (2013b)).

It is difficult to map global value chains. Still, this project had a good start and the preliminary estimates of trade in value added give good impressions of the order of magnitude of some phenomena. In this first major step – of course - a general approach was used and fine tuning is necessary to reduce the margin of errors. One of the roads to further refinements is taking heterogeneity into account. That can be heterogeneity between countries, because each country has specific issues that cannot be taken into account in a first general step. It can also be heterogeneity in industries of a country. This problem can be tackled using more detailed data, such as on the level of the enterprise. Such an approach to tackle aggregation bias in IO-tables is not new. It was already used by Bullard et al. (1976) to estimate the energy cost of a power plant. And a very recent example is Ahmad et al. (2013). They showed that the share of foreign content in Turkey's exports in 2005 was about 6 percentage points higher when using micro data compared to the estimates from a standard IO table. They distinguished firms that sell primarily to the domestic market and those that sell primarily to the world market.

This paper gives an example where the "one size fits all" approach was not yet sufficient, and shows how to use micro data to further improve the estimates about trade in value added. In particular, it shows that using more aggregated data only, the role of nearby economies for the Netherlands was overestimated, and that the role of economies further away was underestimated. For example, Dutch value added due to final demand in China was 50 percent higher using estimates using micro data compared to estimates that use more aggregated data.

A general approach does not work for the Netherlands, because it has high re-exports compared to most other countries. They form about one half of Dutch exports of commodities, and that is excluding transit trade (which are not part of the national accounting definition). This high share can be explained by several factors, such as a favourable position as the port to Europe, good infrastructure and skills in complex logistics (Kuypers et al. 2013). The value added of re-exports is very different from that of exports from domestic production. Therefore, to accurately allocate the value added due to trade, it is necessary to split the imports for consumption from the imports for re-exports. To integrate this into an MRIO table the bilateral trade data is needed for each commodity, for each type of import. The following example, with the aggregated data usually available to researchers, shows why.

Figure 1. Imports and exports, on country level

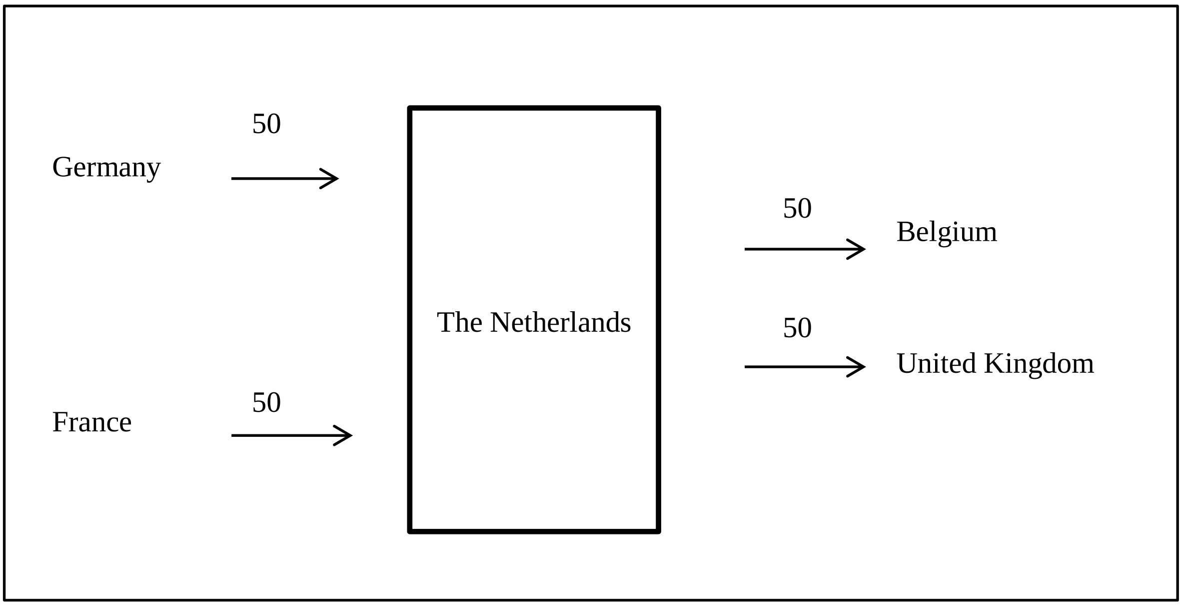
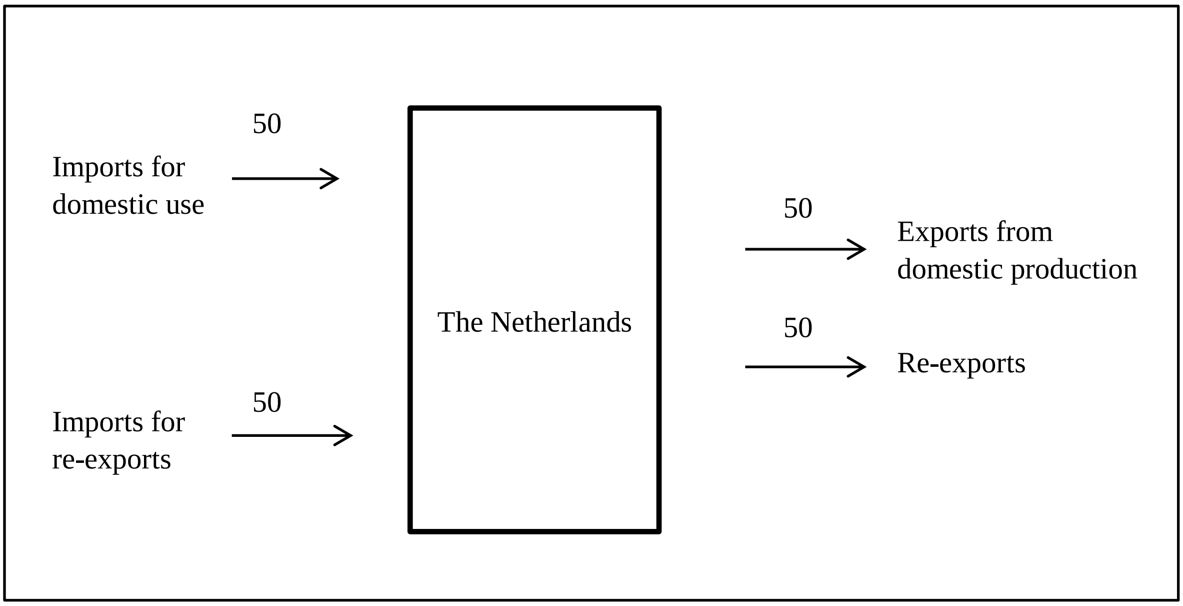


Figure 2. Imports and exports, domestic use/production or re-exports



How to estimate the imports from Germany and France that are destined for Dutch domestic use, Belgium and the United Kingdom, respectively? From this automatically follows the distribution of exports from Dutch domestic production to Belgium and the United Kingdom. Because total exports to Belgium (that are given) are the sum of re-exports to Belgium and Dutch exports of domestic production to Belgium.

If the size of imports from Germany for re-exports is overestimated, this has the following consequences:

- Imports from Germany for Dutch domestic use are underestimated, and so is the importance of Germany as source for the Dutch economy.
- Belgian and British imports from Germany (via the Netherlands) for domestic use are overestimated, and so is the importance of Germany as source for the Belgian and British economies.
- Because total imports for re-exports have to be the same, imports from France for re-exports are underestimated. Then imports from France for Dutch domestic use are overestimated, and so is the importance of France as source for the Dutch economy.
- Belgian and British imports from France (via the Netherlands) for domestic use are underestimated, and so is the importance of France as source for the Belgian and British economies

Similar consequences arise when the size of re-exports to Belgium is overestimated. Thus, it is very important to have good estimates about the re-export flows by country.

The structure of this paper is as follows. First, we explain the methods and data. Then we present the results. The paper ends with conclusions and suggestions for further research.

2. Data and methods

2.1 The newly constructed database about re-exports

In this paragraph we explain how the new database about Dutch re-exports was constructed. It contains for every eight digit commodity code in the Combined Nomenclature (Eurostat)

- Country of import
- Country of re-export
- Value of re-exports

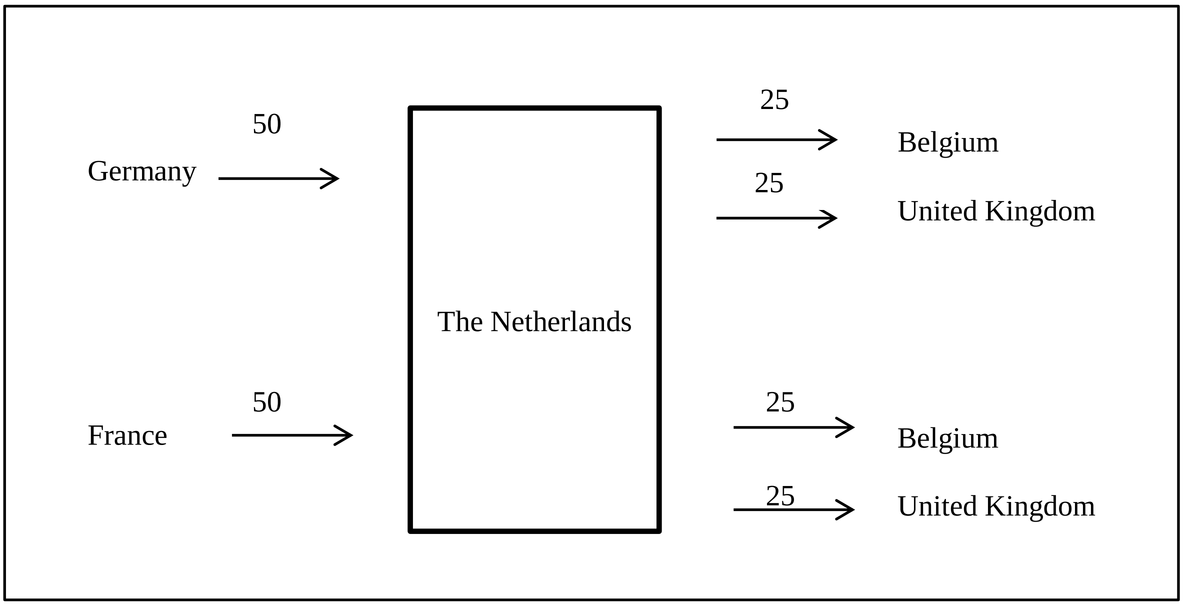
Matching this new information to the standard statistics about imports and exports, this yields for every eight digit commodity code

- For every country of import, the value of imports for Dutch domestic use
- For every country of export, the value of exports produced in the Netherlands

We now return to the situation described in Figure 1. To keep the example as simple as possible, we assume that all imports are destined for re-exports and that all exports are re-exports. First we illustrate the problems and possibilities with figures; subsequently we explain our method in detail.

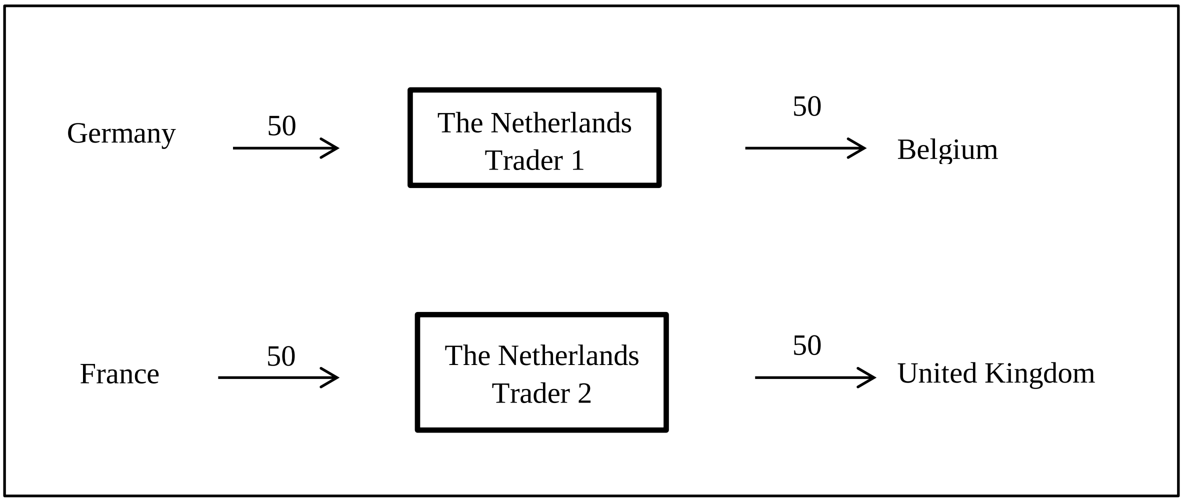
With no other information than the aggregated information available, the most reasonable approach is a proportional distribution. Half of all exports go to Belgium, so half of all imports from Germany destined for re-exports are assumed to go to Belgium as well. This is illustrated in Figure 3.

Figure 3. Proportional distribution, using only aggregated data



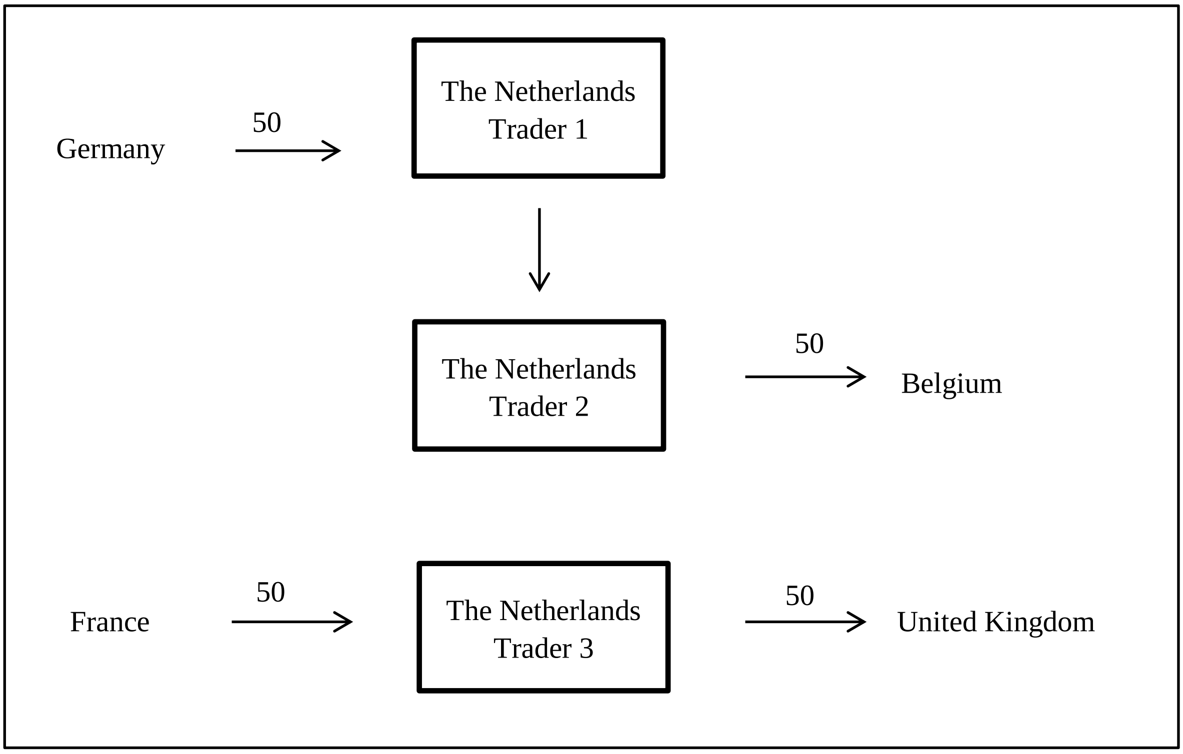
However, a closer look at the data on the level of the trader might show that there are only two traders involved. One trader imports everything from Germany and re-exports everything to Belgium. The other trader imports everything from France and re-exports everything to the United Kingdom. This is illustrated in Figure 4.

Figure 4. Using micro data on the level of the trader



It sometimes happens that one trader is importing the goods, sells them to another trader who subsequently re-exports the merchandise. Then the approach in Figure 4 does not work because the imports and exports flow are not connected at trader level anymore. So, one would have to fall back to the more generic approach of Figure 3 and apply a proportional distribution. However, for larger traders it is often known how they are connected. This is illustrated in Figure 5: it is known that Trader 1 imports everything from Germany, sells it to Trader 2 who re-exports everything to Belgium.

Figure 5. Using micro data on the level of the trader and extra information



After having illustrated the problems and possibilities, we now explain our method in detail.

First, we explain how we derived re-exports and the country they were exported to. For every trader (identified by his VAT-number), his exports are known by country of export and the eight digit commodity code. The percentage of re-exports is derived using the following guidelines:

- The trader can indicate in the trade survey which commodities are re-exports
- Statistics Netherlands profiles the larger traders, using information from visits and telephone calls
- Some commodities are not produced in the Netherlands (for example bananas), hence they must be re-exports.
- If, on the six digit level[2] of the Combined Nomenclature, exports are less than twice the imports, these exports are considered to be re-exports. Results are robust to changes of the (arbitrary) factor 2.

If no extra information is available, re-exports are proportionally distributed among the countries of exports. So, if a trader exports 50% of a given commodity to Germany, we assume that 50% of his re-exports of this commodity are exported to Germany as well.

Now we explain how to derive the country of import. It is easy when one and the same trader imports and re-exports. But problems arise because it is not uncommon that one trader imports the commodities, and another one re-exports them. For example, the mother enterprise imports from Asia, and the Dutch daughter distributes the commodities over Europe. To address such cases, we considered the traders with re-exports that (on six digit level) were at least 100 million euros higher than the imports of these commodities. Using the information from the contacts and matching to firms in the same enterprise group, we clustered traders to match the re-exports to the corresponding imports. In this way, we found imports that corresponded to re-exports for about 200 large traders that previously had insufficient imports. Then we matched re-exports to imports in several steps:

1. First match on the eight digit commodity level at the trader; if re-exports remain then
2. Match the remaining part on the six digit commodity level at the trader; if re-exports remain then
3. Match the remaining part on the six digit commodity level at national level; if re-exports remain then
4. Match the remaining part (always negligible) on two digit commodity level at national level

If no extra information is available, imports for re-exports are proportionally distributed among the countries of imports. So, if a trader has re-exports of a given commodity, and imports 25% of this commodity from Germany, we assume that 25% of his imports for re-exports of this commodity are imported from Germany as well.

[2] Re-exports are defined as "Goods transported via the Netherlands, which are temporarily owned by a resident of the Netherlands, without any significant industrial processing.". Statistics Netherlands implemented this "without any significant industrial processing" as "possible changes in the seventh and eighth digit level, but no changes at the six digit level". There are only a few exceptions.

2.2 Improving an existing MRIO table

Now the data from the previous paragraph is used to adjust an existing MRIO table. The method comprises several steps that are discussed in detail elsewhere by Hoekstra et al. (2013). It is based on the WIOD methodology. The World Input Output Database (WIOD), developed by a consortium of several research institutions, is publicly available and its methods have been documented very clearly. See Timmer et al. (2012) for more details. Our method intervenes in the WIOD methodology at the stage of the "International Supply Use Tables" (IntSUT). In this stage, there is still an industry by commodity structure to the database which also means that the commodities can be linked to trade data. For forty countries and regions the IntSUT data are used; however for the Netherlands data from Statistics Netherlands are used (SUT, trade data and environmental accounts).

A WIOD balancing procedure is then followed to construct the WIOT from the IntSUT tables, with one important difference: the data for the Netherlands are kept unaltered at every stage of the calculations. The end result is therefore an adjusted WIOD database that is entirely consistent to Dutch official national accounts statistics. We will call it the Single-country National Accounts Consistent WIOD (SNAC WIOD) in the rest of the paper.

3. Results

This section is a mix of results showing the differences between numbers derived using aggregated data and micro data.

Table 1 shows the share of domestic produced goods[3] in total exports of goods to the twelve[4] major export destinations of the Netherlands. One estimate uses micro information, for every pair of eight digit commodity code and country the value of Dutch products and re-exports are known. The other estimate uses more aggregated information. Namely, for every destination the value of exports for every eight digit commodity code and for every chapter of the Combined Nomenclature (not on country level) the percentage of domestically produced goods. This generic percentage is then used to estimate the value of exports of domestically produced goods to that country.

[3] Defined as the value of total exports minus the value of re-exports. Thus, domestically produced goods might still contain foreign inputs.
[4] To include nrs 11 and 12, China and the Russian Federation respectively.

Table 1. Share of Dutch domestically produced goods in total Dutch exports of goods, 2009

	Value exports	Share domestically produced according to		Difference
		micro data	aggregated data	
	bln euros	%		% point
Germany	75.2	51.4	55.9	-4.5
Belgium	34.6	59.0	60.4	-1.4
France	27.5	52.7	55.2	-2.5
United Kingdom	25.9	52.4	55.0	-2.6
Italy	16.0	51.2	54.8	-3.6
United States	13.9	61.1	50.7	10.4
Spain	10.5	43.2	49.9	-6.7
Poland	5.9	44.5	50.2	-5.7
Sweden	5.2	48.9	52.1	-3.2
Switzerland	4.8	55.5	52.7	2.8
China	4.6	68.2	52.9	15.3
Russian Federation	4.4	55.7	48.6	7.1

Thus, using the micro information we calculated that 51.4 percent of total exports to Germany consisted of domestically produced goods. But this was 55.9 percent when using only the more aggregated information. For European countries nearby, the estimate using micro information is lower than the estimate using aggregated information. But for the United States, China and the Russian Federation it is higher. The difference between the two estimates is even 15 percent points for China. This was to be expected; functioning as the "gate to Europe" the Netherlands will re-export more to European countries. But countries farther away will get those goods from countries that are more nearby.

Because domestically produced goods have a far higher value added per euro of exports than re-exports, this also has consequences for the value added of trade. Table 2 shows the results of estimating this value added of Dutch exports of goods to its twelve major exports partners. This is done using a general estimate for value added of re-exports and exports of Dutch products, respectively 9 and 58 cent for every euro (Kuypers et al., 2013). Because the share of domestically produced goods to European countries is overestimated using aggregated data, it will also overestimate the value added of exports to these countries. But on the other hand, it underestimates the value added of exports to China by almost a fifth.

Table 2. Value added of Dutch exports of goods, using micro data and aggregated data, 2009

	Value exports	Value added according to		Difference	
		micro data	aggregated data	absolute	relative
	bln euros			% point	%
Germany	75.2	25.7	27.4	-1.7	-7
Belgium	34.6	13.1	13.4	-0.2	-2
France	27.5	9.6	9.9	-0.3	-4
United Kingdom	25.9	9.0	9.3	-0.3	-4
Italy	16.0	5.5	5.7	-0.3	-5
United States	13.9	5.4	4.7	0.7	13
Spain	10.5	3.2	3.5	-0.3	-11
Poland	5.9	1.8	2.0	-0.2	-9
Sweden	5.2	1.7	1.8	-0.1	-5
Switzerland	4.8	1.7	1.7	0.1	4
China	4.6	1.9	1.6	0.3	18
Russian Federation	4.4	1.6	1.4	0.2	10

Table 3 shows more refined estimates of the value added of trade, using the input-output framework. It shows the Dutch domestic value added embodied in foreign final demand as a percentage of Dutch GDP (FDDVA_GDP in the TiVA database). This for the ten most important export destinations (in value added) of the Netherlands and three different MRIO-tables.

Table 3. Comparison of three methods to estimate trade in value added, 2009

	Share of Dutch GDP due to foreign final demand according to		
	WIOD SNAC	WIOD	OECD-WTO
	%		
Germany	4.3	5.4	4.1
United Kingdom	3.1	3.4	2.7
United States	2.7	2.8	2.5
France	2.2	2.4	2.0
Italy	1.4	2.1	2.0
Belgium	1.4	2.3	1.8
China	1.1	2.1	0.7
Spain	0.9	1.4	1.2
Ireland	0.6	0.3	0.6
Russian Federation	0.6	0.5	0.6

The differences between WIOD SNAC and WIOD can be large; for Germany the difference is even more than one percentage point. A first analysis by Edens et al. (2013) shows that WIOD estimates exports of Dutch domestically produced goods far higher than the official IO-tables of Statistics Netherlands. This explains why the value added of trade using WIOD is higher in general than the corresponding value of WIOD SNAC. The differences between WIOD SNAC and OECD-WTO are much smaller than those between WIOD SNAC and WIOD. China again is a special case; WIOD SNAC estimates it to be 50 percent higher than OECD-WTO.

Table 4 is similar to table 1. It shows the percentage of goods for Dutch domestic use[5] in imports of goods from the ten major import destinations of the Netherlands. One estimate uses more detailed information, for every pair of eight digit commodity code and country the values of imports for Dutch domestic use and for re-exports are known. The other estimate uses more aggregated information. Namely, for every source country the value of imports for every eight digit commodity code and for every chapter of the Combined Nomenclature (not on country level) the percentage in imports of goods for domestic use. This generic percentage is then used to estimate the value of imports for domestic use from that country.

Table 4. Percentage of goods for Dutch domestic use in total imports of goods, 2009

	Value imports	Share for domestic use according to		Difference
		micro data	aggregated data	
	bln euros	%		% point
Germany	53.0	60.6	55.1	5.6
Belgium	27.7	69.7	62.9	6.8
United States	23.5	36.6	42.9	-6.3
China	23.0	34.4	40.9	-6.5
United Kingdom	17.0	52.6	58.5	-5.9
France	13.8	58.4	56.7	1.7
Russian Federation	9.6	83.7	79.0	4.8
Japan	7.6	24.4	39.7	-15.3
Norway	6.8	74.6	76.0	-1.4
Italy	6.4	58.7	51.6	7.1

Now the situation is reversed: for countries closer to the Netherlands the estimate based on micro data is usually higher that the estimate based on aggregated data. And for countries far away (China, United States, Japan) the estimate based on micro data is lower. For Japan this estimate is even 15 percent points lower. Again, this was to be expected: goods from far away are more likely to be re-exported to European countries. And goods from other European countries will not be re-exported to other European countries through the Netherlands but will go directly.

[5] Defined as the value of total imports minus the value of imports for re-exports. These goods might be used as intermediate goods to produce exports.

This means that the importance of countries nearby for consumption in the Netherlands is underestimated, whereas that of countries far away is overestimated.

Table 5 shows foreign value added embodied in domestic final demand as a percentage of Dutch GDP (FDFVA_GDP in the TiVA database). This for the ten most important import destinations (for domestic final demand) of the Netherlands and three different MRIO-tables.

Table 5. Foreign value added embodied in domestic final demand as a percentage of Dutch GDP, 2009

	Share of Dutch final demand fulfilled by abroad according to		
	WIOD SNAC	WIOD	OECD-WTO
	%		
Germany	4.2	4.3	3.4
United States	2.4	3.1	2.8
United Kingdom	2.1	3.1	1.7
Belgium	1.6	1.9	1.2
China	1.6	3.1	1.6
France	1.3	1.3	1.2
Italy	0.8	0.8	0.7
Russian Federation	0.6	0.7	0.5
Japan	0.5	0.7	0.8
Spain	0.5	0.7	0.6

Just as in table 4, for countries closer to the Netherlands the estimate based on micro data is usually higher that the estimate based on aggregated data. And for countries far away (China, United States, Japan) the estimate based on micro data is lower.

The differences between WIOD SNAC and WIOD can be large; for China the difference is even one and a half percentage point. The aforementioned analysis by Edens et al. (2013) shows that WIOD also estimates imports for domestic use substantially higher than the official IO-tables of Statistics Netherlands. This explains why the value added of trade using WIOD is higher in general than the value of WIOD SNAC. The differences between WIOD SNAC and OECD-WTO are much smaller than those between WIOD SNAC and WIOD.

The adapted MRIO-table can be used to derive other indicators related to a global value chain as well. For example, the CO_2 emissions due to trade, see Hoekstra et al. (2013) and Edens and Hoekstra (2013). This indicator relates consumption to environmental pressures: final demand is related to all worldwide emissions needed to create the goods and services for this final demand. It is therefore often referred to as the “consumption perspective” or the “consumption-based approach”. This is usually set against the “production perspective” where the direct environmental pressures generated by economic activities are measured. Then only the emissions in the producing country are measured.

Table 6 shows a comparison of SNAC WIOD and WIOD with respect to CO_2 emissions due to final demand in the Netherlands.

Table 6. Country breakdown of CO2 footprint for the Netherlands using SNAC WIOD and WIOD, 2009

	CO_2 footprint according to		Share of total CO_2 footprint according to		Difference
	SNAC WIOD	WIOD	SNAC WIOD	WIOD	
	Kt CO_2		%		% point
Total	82158	100648	100	100	0
CHN	15787	21109	19.2	21.0	-1.8
DEU	7874	8987	9.6	8.9	0.7
RUS	6827	8220	8.3	8.2	0.1
USA	4974	6060	6.1	6.0	0.0
BEL	3160	4299	3.8	4.3	-0.4
GBR	3152	4278	3.8	4.3	-0.4
IND	2397	3541	2.9	3.5	-0.6
POL	1774	2423	2.2	2.4	-0.2
FRA	1488	2052	1.8	2.0	-0.2
JPN	1282	1775	1.6	1.8	-0.2

Source: Hoekstra et al. (2013)

Because SNAC WIOD estimates imports for Dutch domestic use substantially lower than WIOD, the corresponding emissions due to Dutch final demand are substantially lower as well. At table 4 and 5 it was already observed that imports from China for Dutch final demand are much smaller in the micro data than in the aggregated data. So it is not surprising that SNAC WIOD, that incorporated this micro data, not only has an absolute smaller value for China, but also a relative smaller value than WIOD.

4. Conclusions and suggestions for further research

Our results show that an approach using micro data (SNAC WIOD) may yield very different results than the approach that uses aggregated data (OECD-WTO) only. For example, the value added in the Netherlands due to final demand in China is 50 percent higher when using micro data. And in general the value added in the Netherlands due to countries far away is underestimated when using aggregated data, whereas that of countries nearby is overestimated. But consumption from nearby countries is underestimated and that from countries far away is overestimated. Therefore, to avoid ill-informed policy decisions, it is better to use the refined estimates.

There are other cases where heterogeneity plays a major role and more detailed data should be used to refine the rough estimates based on aggregated data alone. An example is employment due to trade. Using standard input-output techniques assigns the same amount of labour to every unit of production, whether it is for domestic use or for exports. But in many countries it was found that exporters are more productive than enterprises that only produce for the domestic market (e.g. the US (Bernard and Jensen, 1997), Germany (Wagner, 2005), and the Netherlands (Jaarsma and Lemmens-Dirix (2011)). So, if these estimates for employment due to trade are not refined, they will be too high.

Another example is trade in income. Duan et al. (2013) find that from 2002 to 2007, about 84% of total increment of China's value added in exports is ascribed to the increase of foreign investors' profits, while only 16% is due to the increase of China's national content in exports. They rightly remark that the global value chain (where income is produced and located) should be extended to a global income chain (showing which country owns the income).

Such questions about employment, income, but also related questions about productivity and competitiveness can only be answered by a combination of macro and micro statistics. The macro-statistics are necessary, because they give an integrated, consistent image of an economy. The OECD (2013a) pointed out that it is impossible to disentangle every single value chain by hand, and that such a case study approach would typically only show where the intermediate components were produced, but not where the intermediates parts for these components were produced and so on. This problem, albeit on a very aggregate scale, is solved if one starts from the framework of National Accounts. The micro-statistics are also necessary: they properly introduce the heterogeneity that is not visible in the National Accounts.

Bullard et al. (1976) suggested a cost effective approach of using micro data to improve macroeconomic estimates. They did so giving the example of determining the total "energy cost" of particular goods and services and describe a hybrid analysis. It starts from the IO-framework and then points out the parts where aggregation error is the largest. At those points, and those points alone, extra information is added about the particular value chain. It follows the chain of inputs back to the point where heterogeneity does not play a major part anymore.

This is much more efficient than addressing the problem of missing heterogeneity is splitting up MRIO-tables in more detail. That can be done for every single country and every single industry, but it might not be necessary. In the example about employment due to trade, it would not be necessary to split up an industry in exporters and non-exporters if the exports part of this industry was very small or very large. That approach would be inefficient.

Another approach that is not able to answer very broad questions, is to disentangle all steps in producing from a micro perspective and calculate the related indicators. This is feasible only when one is starting with a given value chain. Examples of mapping a global value chain are given in Gereffi et al. (2013), who describe the position of Costa Rica in global value chains of medical devices, electronics, aerospace and offshore services. A good review can be found in Sturgeon (2013). However, it takes many resources to answer more general cases with many value chains at the same time, such as total employment due to total trade.

Further research is necessary to show the consequences of global value chains. Policy makers want to know in which value chains their country is involved, which types of jobs, which kinds of skills are needed and involved, and how the value chains are distributed among the regions in their particular country. One approach to this question would be to use an MRIO table to map the global value chain for a given country, to use the national IO table to map the relevant value chains inside this country and then to use micro data to pinpoint the relevant skills and functions. A method to map value chains is described by Dietzenbacher et al. (2005). They illustrate it by identifying production chains in the Andalusian economy using only a simplified IO table. For example, the chain Trade and repairs -> Agriculture, hunting and forestry -> Food industry -> Hotel industry. The value chains resulting from their methods can be further refined using expert information. Then the industries involved can be mapped to enterprises, using the General Business Register, and then these enterprises can be connected to their employees. The last step of this approach has already be taken for several countries, e.g. Germany (Alda et al. 2005), Finland (Ilmakunnas et al. 2004), the US (Abowd and Kramarz 1999), the Netherlands (Fortanier et al. 2012) and Denmark (Munch and Skaksen 2008), to name but a few examples.

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