The role of small and medium enterprises in the Dutch economy: An analysis using an extended supply and use table[1]

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Abstract

The size of firms is becoming an increasingly relevant aspect of macro-economic policy. The overall importance of Small and Medium size Enterprises (SMEs) up to large multinationals is different in terms of their absolute level as well as their influence of economic growth, exports and innovation. In this paper we extend the traditional supply-use framework by taking firm size into account. We utilize firm-level data to construct a purpose-built supply-use table distinguishing between SMEs and large enterprises and derive an extended input-output table. An analysis using this table reveals the different roles of SMEs and large enterprises in the Dutch economy. SMEs serve an important role as suppliers, whereas large enterprises more frequently produce for final demand. Due to their function as suppliers, SMEs benefit more from Dutch exports to foreign markets, even those far away, than the traditional export figures show. SMEs are also less dependent on imports than large enterprises. This might be detrimental to the competitiveness of SMEs if they do not fully appreciate the benefits of sourcing internationally in terms of cheaper or higher quality inputs.

1. Introduction

The purpose of this paper is threefold: (1) to describe the construction of an extended supply and use table (SUT) and input-output table (IOT) for the Netherlands which distinguishes firm size, (2) to summarize its key properties and (3) to discuss some analytical findings resulting from our empirical analysis. We extend the traditional SUT framework by incorporating enterprise size and derive an extended input-output table. To the best of our knowledge, we are among the very first to do so.

A key assumption underlying input-output tables and the analyses derived from them is that of homogeneous industries (Miller and Blair, 2009). One of the consequences is that all enterprises operating within the same industry are assumed to use the same proportion of imported goods and services for their productive process.

However, enterprise homogeneity within industries does not hold in practice.[4] Several dimensions of enterprise heterogeneity have been investigated empirically and their correlation with enterprise performance measures such as innovation, profitability and productivity has been widely tested (see for instance Wagner (2007, 2012) and Bernard et al. (2007, 2012) for reviews of this literature). Neglecting heterogeneity in input-output analysis might introduce a bias in estimates of integration of a country in global value chains, since the enterprises that export are known to use relatively more imports (Piacentini and Fortanier, 2015). A split by size class does not resolve all heterogeneity problems in the input-output table, since additional differences between exporters and non-exporters, multinationals and non-multinationals and so on remain (Statistics Denmark and OECD, 2017). However, our more detailed breakdowns are expected to result in higher quality estimates (OECD, 2014).

In addition, from a policy perspective, adding a size dimension to the standard input-output tables (split by industry only) can lead to novel insights on the role of SMEs and large enterprises in the Dutch economy. This detail allows answering several policy questions. How do SMEs contribute to

[4] The level of heterogeneity is of course also dependent on the level of aggregation of industries in the input-output table. An input-output table with ten industries is of course far more heterogeneous than the US or Japanese tables which distinguish over 500 industries.

the economy, mainly as suppliers to final users or mainly by supplying to other industries? Are there important differences across industries? Are SMEs less dependent on international markets compared to large enterprises when the value chain is taken into account? To what extent do the input structures of SMEs and large enterprises differ?

In answering this type of questions we also present a methodological innovation related to the definition of SMEs. The traditional statistical delineation of SMEs entails nothing more than a division between enterprises with less than 250 employees and enterprises with 250 or more employees, irrespective of whether they are part of a large (multinational) enterprise or not. For this paper we have adopted a different definition which specifies that enterprises should jointly, at the highest national aggregate level (the enterprise group[5]), have less than 250 employees and should not be a subsidiary of a foreign multinational enterprise. For example, if a large multinational has an R&D division of 200 persons in the Netherlands, it is not considered an SME according to this definition. This definition is much closer to the EU definition of SMEs (European Commission), which is used to establish if an enterprise is eligible for SME support funds.

It is well known (Bernard et al. 2007, 2012) that SMEs are less connected to international markets compared to larger firms. This can lead to disadvantages for SMEs, since they might miss out on growth opportunities that foreign markets provide. Therefore, many countries have specific policy instruments in place to stimulate SMEs to overcome perceived barriers and internationalize their business activities through exporting or investing abroad.[6] However, in order to be able to develop effective policies it is crucial to gain a proper understanding of the position of SMEs in value chains, since SMEs might still profit from exports indirectly if they act as a supplier to these larger enterprises. More generally, what is the role of SMEs in Dutch value chains that lead to exports? This question is impossible to answer with the usual industry x industry input-output tables, but of great relevance to policymakers.

Section 2 provides a brief discussion of the relevant literature. Section 3 details the delineation of SMEs, the procedure of splitting the supply-use table, the procedure of constructing the input-output table and how this was implemented in practice. Our results are discussed in section 4, whereas section 5 concludes.

2. Literature

Abundant empirical studies have shown that international fragmentation of production has been rapidly increasing over the past decades. Hummels et al. (1998) and Hummels et al. (2001) coined the term vertical specialization in this respect, measured as the imported content of exports, and show that vertical specialization has increased by about 40 percent in the period 1970-1995. Developing a

[5] An enterprise group is an association of enterprises bound together by legal and/or financial links. A group of enterprises can have more than one decision-making centre, especially for policy on production, sales and profit. It may centralise certain aspects of financial management and taxation. It constitutes an economic entity which is empowered to make choices, particularly concerning the units which it comprises.

[6] Wymenga et al. (2013) investigated the number of support services in EU countries and 25 other countries for EU SMEs in international business and found 1542 different support services offered by 1197 organisations, varying from business associations, chambers of commerce, governmental institutions to trade and investment agencies.

longer time series, Johnson and Noguera (2012) corroborate this notion by showing that the ratio of value added to exports has been falling by 10 to 15 percentage points in the period 1970-2009, although considerable cross-country heterogeneity exists. This narrative is also confirmed by Timmer et al. (2014) and Baldwin (2016) in more recent contributions.

The rise of global value chains (GVCs) has caught the attention of policymakers, presumably because the effects of deep integration of firms in GVCs on the domestic economy are expected to be positive. There is some empirical evidence in this respect suggesting that an increasing degree of integration in GVCs at the industry level is associated with increased productivity and domestic value added (Kummritz, 2016). In addition, GVCs also provide a platform for the diffusion of innovation, technologies and ideas (Dietzenbacher and Los, 2002). Nonetheless, it is well known that SMEs employ a large part of the workforce, generate a large part of value added, but are less well-connected to international markets than larger enterprises (Gonzalez 2016, Statistics Denmark and OECD, 2017).[7] Van den Berg (2014) shows that the fraction of non-trading enterprises in the Netherlands decreases from 85 percent among the smallest enterprises to less than 30 percent among large enterprises. Piacentini and Fortanier (2015) find that this is the case for most OECD countries. However, non-trading firms can still be dependent on global value chains indirectly, by serving as a supplier to (large) domestic multinational enterprises (MNEs) that are well-integrated in GVCs.

Surprisingly little research is available about the extent that domestically oriented firms indirectly depend on GVCs. Beverelli et al. (2016) note that GVCs are generally set up by large MNEs. They show empirically that strong domestic links across industries (domestic fragmentation) explain subsequent deep integration in GVCs. This could imply that a considerable part of firms is indirectly dependent on developments on foreign markets while not being integrated in global value chains themselves. This notion is corroborated by findings of Bernard et al. (2015) derived from a sample of Japanese firms and their domestic production networks. They show that large firms have more suppliers than small firms and, more importantly, that the better connected the firm, the less well-connected its supplier and vice versa. Although their analysis only concerns domestic production networks it seems intuitive to extrapolate their findings to a model in which large numbers of smaller firms with small networks serve as a supplier to a relatively small number of larger MNEs well-integrated in GVCs.

Methods to split IO-tables were already developed in several papers. Pommée and Van Dalen (1997) use enterprise information to split the Dutch SUT of 1992 and subsequently they derive an extended IO-table where the industries are split into three size classes. USITC (2010) divided the IO-table of the USA for 2007 into SME- and large enterprise-specific accounts using an enterprise size-specific disaggregation of indicators such as exports in each industry. The estimates show that SMEs contribute to 41 percent of the total domestic value added that is embodied in exports of the USA, even though their share in direct exports is only 28 percent. Using a similar methodology, Piacentini

[7] Besides size, foreign ownership is positively correlated with trading activity as well. Illustrative in this respect is the descriptive finding of De Bontridder – De Steur et al. (2015) that foreign owned enterprises in the Netherlands make up just over 1 percent of the business population, but in the trade in goods statistics account for more than half of Dutch imports and over 40 percent of Dutch exports. This includes re-exports but excludes quasi transit trade. In the data and in the analysis we will treat foreign owned enterprises as large enterprises, since they can benefit from the advantages that the parent enterprise abroad provides, such as access to an international network or easier access to finance.

and Fortanier (2015) show that SMEs in European countries generally have a much larger share in the value added that is embodied in exports than in direct exports. Yang et al. (2015) found that splitting the Chinese input-output table into processing and non-processing industries lead to very different estimates of vertical specialisation. Tang et al. (2016) show that in China state-owned enterprises and SMEs have much higher value added embodied in exports to direct exports ratio's, compared to the rest of the economy. Cooperation between the statistical institution of the Nordic countries and the OECD (2017) showed amongst others that the differences between foreign and domestically owned enterprises also translate to their direct exports and value added embodied in exports. This study also found that on average foreign owned enterprises depend more on imports to produce. Hence, their exports contain less domestic value added.

The papers mentioned above each address heterogeneity in IO-tables by adding an extra split using enterprise characteristics different from the industry. Disaggregating IO-tables along the industry dimensions could also tackle the heterogeneity issue. However, it remains to be seen whether more granular IO-tables are the best way to tackle heterogeneity, or that more elaborate procedures such as the approach proposed in this paper yield better results. The OECD expert group on extended SUTs (OECD, 2014) anticipates that the optimal strategy varies even by country, since there is considerable country level heterogeneity. As a case in point, China and Mexico have relatively large processing industries, which is why the Multi Region Input Output table of the OECD splits many industries of these countries into processing and non-processing industries (OECD 2015).

Our paper derives an extended IO-table, but contrary to the examples described above it does this by creating an extended SUT first. This has additional advantages. Namely, balancing can take place on a far more detailed level than in an IO-table, namely on the level of product x industry. Furthermore, it avoids unlikely product x size class combinations (a small enterprise will not construct a road) and allows for a non-proportional distribution over the size classes of items that are difficult to capture with regular statistics such as fraud and moon-lighting.

3. Constructing the extended SUT and IO-table

3.1. General description of methodological process

First we constructed an extended Supply- and Use-Table from which subsequently an extended Input-Output Table was derived. This was done for the year 2012 and unless explicitly noted otherwise, all the data and information used also refer to the year 2012. The choice for 2012 was made because at the time of construction this was the year for which the most detail is incorporated in the Dutch national accounts. For more recent years there was not enough information available from the statistics that are the sources for the Dutch national accounts to make a good version of the SUT with this level of detail.

The methodology used to construct the extended SUT and IOT is similar to the procedure used to construct the regular SUT and IOT for the Dutch economy. See Eurostat (2008) for a description of the general methodology to derive SUT and IOT, Eurostat (2013) for a description of the methodology of national accounts itself and Statistics Netherlands (2017) for the details of the implementation in the Netherlands. Whereas a traditional SUT combines information from different sources to obtain data on production, value added, intermediate consumption and final consumption

at the industry level, our extended SUT adds the size dimension, resulting in disaggregation at the industry size class level. The process of constructing the extended SUT and IOT consists of the following steps.

1. Defining size classes and resulting industry size class clusters. In the construction of the extended SUT we will distinguish between five size classes. We combine these size classes with the industry classification that is used in the regular national accounts process, 128 industries based on ISIC Rev. 4, to obtain industry size class clusters. Overall, there are 640 potential industry size class combinations (128 industries times five size classes).
2. Assigning production, intermediate consumption and value added to each industry size class cluster. Central in the construction of the extended SUT is the availability of data on production, value added and intermediate and final consumption in each industry size class cluster. Depending on the data sources that are available for a cluster, different estimation procedures and assumptions are used to construct the corresponding parts of the extended SUT.
3. Populate the SUT-system with estimates produced in the first two steps and balance. The result is an extended SUT.
4. Split exports from domestic origin into industry size class clusters. Split intermediate use of imports into industry size class clusters as well. This step requires micro-level data on imports and exports of goods and services.
5. Use the extended SUT obtained in step 3 and the information from step 4 to derive the extended IOT. First, for each commodity an IOT is constructed from the extended SUT assuming a fixed sales structure. All commodity-specific IOTs are added together to derive the extended IOT.

We will discuss each of these steps in turn. In these steps we will use the following data for the year 2012:

- The existing SUT
- Microdata from the Structural Business Statistics survey
- Microdata about imports and exports of goods
- Microdata about imports and exports of services

3.2. Defining enterprises, size classes and industry size class clusters

An enterprise bundles a coherent set of business activities leading to the production of a set of goods and services and may consist of more than one legal entity[8]. A domestic enterprise group on the other hand may consist of one enterprise (the majority of cases) or it may group multiple enterprises producing different goods and services.

In order to assign enterprises to a particular industry and size class (in terms of labour), we rely on information available in the General Business Register (GBR). The GBR contains detailed information on all active enterprises in a particular year, including their main industry of activity and the number

[8] Consider a manufacturer of basic metals and the seller of these basic metals both owned by the same family but organized as two legal entities active in the Netherlands. Since both legal entities operate in the basic metals industry, they are considered one enterprise.

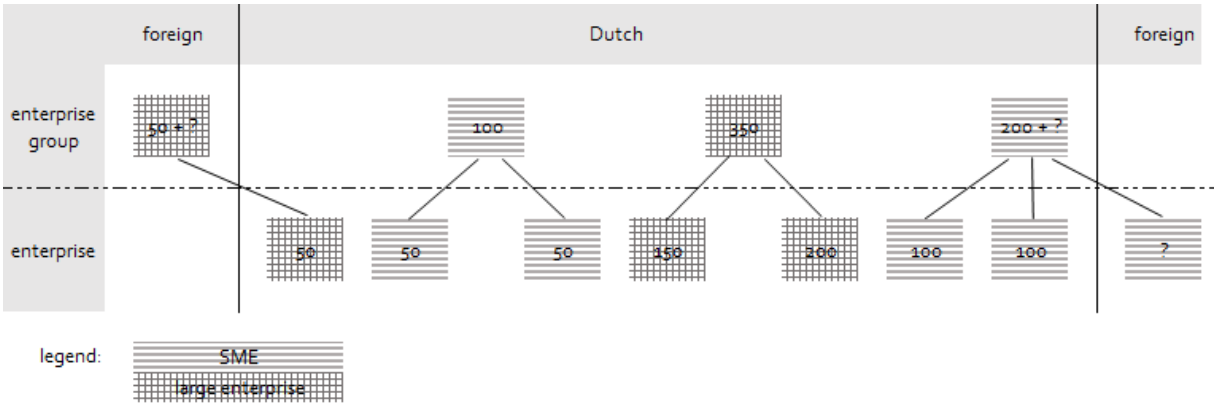
of persons employed by the enterprise and the enterprise group. The General Business Register is the backbone of all business statistics in the Netherlands. From the Foreign Affiliates Statistics it is known whether the enterprise is part of a domestic enterprise group or whether the enterprise is foreign-owned.

Statistics concerning turnover, value added, intermediate input use, etc. are generally constructed at the level of the enterprise. However, we will use the size and ownership information about the domestic enterprise group to define size classes.

The traditional delineation of SMEs is done at the level of the enterprise. Small enterprises employ less than 50 employees and medium-sized enterprises employ between 50 and 250 employees. However, this implies that under this definition small enterprises that are part of a larger (national or international) enterprise group are also considered SMEs. Consider a distribution centre of a large foreign car manufacturer employing 50 people locally, but employing thousands worldwide. From a policy perspective considering this enterprise as an SME is considered less desirable, since policies specifically targeting SMEs are generally not developed with this type of enterprise in mind. To mitigate this shortcoming, we rely on a modified version of the SME definition proposed by the EU (European Commission) in the context of SME policy design and evaluation.[9]

This modified definition delineates SMEs using two dimensions of the (domestic) enterprise group: size and nationality of ownership. Enterprises should jointly, at the highest national aggregate level (the enterprise group), have less than 250 employees to be considered an SME. In addition, enterprises of which the ultimate controlling institution is located outside the Netherlands are always considered to be part of a large multinational enterprise (MNE). In an empirical assessment of the various delineations of SMEs, Lemmers (2014) shows that in terms of trade the impact of applying the modified EU-definition of SMEs relative to the traditional definition of SMEs is large. For example, the value of imports and exports that is assigned to SMEs is more than halved when the stricter modified EU-definition is applied.

Figure 1. Demarcating SMEs



A few decisions we make in this process need clarification. First, enterprises under foreign control (multinational enterprises or MNEs) could jointly, at the international aggregate level of the parent

[9] In the operationalization of this definition the criterion concerning the combination of turnover and balance sheet total is excluded due to data limitations. Moreover, we rely on domestic enterprise group size as a proxy for global group size which we do not observe.

company, still have less than 250 employees and thus in a strictly technical sense be an SME. However, while we observe that the Dutch enterprise has a foreign parent, we have no data on global group size. We adopt a conservative approach for all foreign-owned enterprises: regardless of their global or domestic enterprise (group) size they will not be assigned the SME status. The idea behind this choice is that regardless of the global group size the MNE can rely on the global network of the foreign parent, with access to information, funds and more, and therefore the MNE will show more resemblance to a large enterprise than to an SME.

Second, domestically owned enterprise groups with less than 250 employees in the Netherlands could have subsidiary companies abroad rendering the international conglomerate too large to be considered an SME. Unfortunately, we do not know the full population of foreign subsidiaries nor do we have the exact information on global group size including these subsidiaries. However, it seems that this is a relatively small group. Using tax information and a model Lemmers (2014) estimates that the share of such Dutch SMEs in total exports of goods is only 0.2 percent. We assume that domestically owned enterprise groups with less than 250 employees in the Netherlands have less than 250 employees worldwide as well.

Based on the GBR data and following the delineation of an SME defined above, all 1.4 million enterprises in the GBR are assigned to a particular industry size class cluster. Namely, enterprises are assigned to a particular industry using the main industry of activity of the enterprise as listed in the GBR. At the most detailed level the extended SUT and IOT distinguish 128 industries. We distinguish five size classes:

1. Small enterprises employing at most 50 employees, not part of a large domestic enterprise group and not foreign-owned;
2. Medium-sized enterprises employing between 50 and 250 employees, not part of a large domestic enterprise group and not foreign-owned;
3. Small- or medium-sized enterprises that are linked to large domestic enterprise groups and/or are foreign-owned[10];
4. Large enterprises employing more than 250 employees;
5. Unassigned enterprises: enterprises active in financial services, government services, education or healthcare are not assigned to a particular size class.

Overall, there are 640 possible industry size class combinations (128 times 5) at the most detailed level. But since an industry is split into category 1-4 or not split at all (category 5), there are fewer industry size class combinations in practise.

3.3. Assigning production, intermediate consumption and value added to each industry size class cluster

The process of constructing the extended SUT is largely similar to the process of constructing the conventional (containing no enterprise characteristics except the industry) supply-use table (SUT). The biggest difference lies in the use of the industry size class clusters defined in the previous step. To construct the extended SUT we require information on production, intermediate consumption and value added at the industry size class cluster level. Depending on the data available, we adopt

[10] This allows constructing information employing the “traditional” definition of SMEs as well.

different methods to obtain information for each of the industry size class combinations that occur in practice. We will discuss the different methods in turn.

The primary data source used to obtain information on production, intermediate consumption and value added is the Structural Business Statistics survey (SBS). The SBS contains financial information for a selection of industries referred to as the "non-financial business economy".[11] The SBS survey is exhaustive for enterprises employing more than 50 employees, for smaller enterprises a combination of tax data and a survey based on random sampling is used to obtain data in each industry size class cluster.[12] The response in the SBS survey for turnover is about 80-90 percent (depending on the industry) of the total estimated turnover. We then take the following steps to calculate total value added by industry size class cluster:

1. Remove outliers and calculate mean value added per employee of the responding enterprises by industry size class cluster;
2. Assign in each industry size class cluster the mean value added per employee of the responding enterprises to non-responding enterprises and enterprises not in the survey;
3. Calculate total value added by industry size class cluster by multiplying value added per employee with the number of employees at the enterprise level;
4. Use in each industry size class cluster the ratio of total value added reported by responding enterprises to calculated value added of all enterprises after imputation to obtain weighting factors. These are used to estimate the other variables from the Structural Business Statistics;
5. Aggregate the industry size class clusters (with industry and size class from the SBS) to the industry size class clusters that are to be used for the extended SUT;
6. Reconcile the data by industry size class cluster in such a way that the aggregates on industry level are consistent with the values by industry that national accounts used in its production process.

Next we tackle industries that are not covered by the SBS. This concerns the industries agriculture, forestry and fishing, financial institutions, government, education, healthcare and culture, sports and recreation. Except for the financial institutions, these industries have limited exports. The information for these industries is estimated as follows:

- The industries *agriculture and fishing* are separated in size classes proportionally according to the number of employees in each industry size class cluster in the population registry. In doing so, we impose the same input-output structure on each size class within each industry.
- The industry *forestry* is separated in size classes by evaluating information from individual enterprises in this industry.

[11] Industries covered by the SBS are agricultural services, mining and quarrying, industry, electricity, gas and water supply, waste management, construction, wholesale and retail trade, transportation and storage, accommodation and food services, information and communication services, business services and personal services. In ISIC 4, this corresponds to B-N minus K.

[12] It should be noted that the industry size class clusters of the SBS do not always match perfectly with the industry size class clusters defined in section 3.2. In 77 out of 1068 size class-industry combinations (size class of the SBS) this discrepancy leads to missing data for a particular industry size class combination required for the extended SUT, since the population registry contains enterprises in a particular size class industry combination, but no response is recorded for the SBS. In these cases, the necessary information is imputed using data from adjacent size class industries.

- The industries containing *financial institutions, government, education* and *health care services* are not separated in size classes, since the available statistical information does not allow for a solid separation of industries into industry size class clusters.
- The industries *culture, sports and recreation* consist of a total of 20 underlying sub-industries. These sub-industries are separated in size classes proportionally according to the number of employees in each industry size class cluster in the population registry, again imposing the same input-output structure on each size class within each sub-industry. Note that some sub-industries consist of only large enterprises (e.g. lotteries and betting) and some consist only of small enterprises (e.g. arts). The information by size class of the 20 sub-industries is then aggregated to the level of industry size class clusters.

Finally, in order to construct a complete picture of the economy the economic value corresponding to some activities is being estimated and imputed as far as they are either incompletely observed or not observed at all. Note that several of these adjustments are not specific to the added size class dimension. Also, some adjustments have to be made because the SBS and national accounts use different concepts. All of the additions and adjustments are also part of the regular SUT procedure.

- Holding companies in smaller size classes are not covered by the SBS. The financial figures are being estimated and divided proportionally over the various size classes of the industry of the holding companies.
- An estimate is made of the economic size of individuals building their own houses, growing crops, etc. These activities are solely assigned to small enterprises. The same holds for illegal activities.
- Remuneration in kind is usually reported by enterprises in the SBS as a current cost. This is adjusted in the compilation of the national accounts, since there it should be recorded as part of value added. The adjusted values are assigned to size classes proportionally.
- Cost of fraud, which is reported in the national accounts mainly as consumption of households instead of current costs for enterprises as in the SBS, is assigned to small enterprises.
- Research & development is reported by enterprises in the SBS as a current cost while in the national accounts framework it is considered an investment. The adjustment is made according to reported costs of R&D in SBS. The same holds for investments in other intangible assets.
- Financial intermediation services indirectly measured (FISIM). Banks usually do not charge a direct fee from their customers for their intermediation with loans, deposits etc. Instead they charge an indirect fee because there is a margin between the interest rate that they pay (or receive) themselves and the interest rate that the customer pays (or receives). In national accounts this implicit fee is called FISIM. Following international agreed methodology (Eurostat 2013), FISIM is assigned to size classes proportionally to their production.

The resulting estimates per industry size class cluster are reconciled with published national accounts data for total output and total intermediate consumption. Subsequently product data are reconciled with the aforementioned totals.

In a final step, the supply-use table including size class dimension is balanced by applying the same algorithm as for constructing the regular supply-use table. In this process, the expert knowledge

plays a crucial role. The outcome of the balancing procedure is evaluated on its plausibility e.g. by investigating ratio's such as the production per worker and the likeliness that certain industry size class clusters perform certain activities (e.g. it is unlikely that small enterprises build complete ships). This process ultimately yields a supply-use table with a size class dimension that is fully consistent with the SUT reported in the National Accounts for 2012. However, supply and use are not yet divided in a domestic and foreign part. This takes place in the next step.

3.4. Accounting for differences in supply and demand structure between industry size class clusters using trade data

For the transformation of the SUT to an IO-framework exports of domestic origin have to be split by industry size class clusters and intermediate use from imports has to be split by industry size class clusters. To complete the SUT, it is necessary to split supply and use into domestic and foreign parts. This accounts for differences in the supply structure of different industry size class clusters. Specifically, we employ micro-level data on trade in goods and services to separate domestic demand from exports and domestic supply from imports in each industry size class cluster.

The international trade in goods (ITG) data contain detailed information on the enterprise importing or exporting and (with exception of the smaller traders)[13] the products traded. This is necessary to accommodate for an important methodological difference between ITG and national accounts: in ITG trade is assigned to the trading enterprise, whereas for national account purposes exports (imports) by intermediaries (wholesalers, transport companies) are re-assigned to the producing (consuming) industries by exploiting the product dimension of the trade data.

About 87 percent of the import value and 80 percent of the export value in the ITG statistics can be assigned to enterprises in the GBR, and therefore to an industry size class cluster. The remaining value cannot be matched to enterprises in the GBR. The main reason why ITG units do not match to the GBR is that several large multinationals register their trade for administrative reasons at the Dutch VAT number of a non-resident parent or subsidiary instead of the VAT-number of the resident enterprise. The non-resident enterprises are registered for VAT purposes in the Netherlands but they do not have a physical establishment in the Netherlands, therefore they do not appear in the GBR and a match between this ITG unit and the GBR is impossible. Since their trade is actually trade of a resident enterprise, it is included in ITG statistics. Note that this trade that is not assigned to an industry size class cluster in ITG has to be assigned to such a cluster in the SUT.

After assigning trade from the trade statistics (ITG) to an industry size class cluster based on the industry and size class of the trading enterprise, we adopt a stepwise approach, by product, to assign it to the proper industry size class cluster in the SUT. Below we explain how to do this for imports; the method for exports is similar. The method is illustrated in table 1.

[13] For extra-EU trade, data on the products traded and origin and destination are always available. For intra-EU trade, a reporting threshold of 900,000 euro applied in 2012. Enterprises that export (import) less than this cut off value do not have to report a breakdown of their exports (imports) at the product and destination level.

1. Comparison of imports (in ITG) and use (in SUT) in each industry size class cluster:
    a. If use exceeds imports, the assumption is that all imports by this industry size class cluster are being used by itself
    b. If imports exceed use, the assumption is that the industry size class clusters complete imports are being used by itself and the additional imports are used by other industry size class clusters. This yields a remainder of imports that needs to be redistributed over industry size class clusters where use exceeds imports.
2. Remaining use by industry size class cluster is calculated, i.e. the part of use that is not imported.
3. Remaining imports from step 2 and unassigned trade and trade below the threshold (that has no product detail) are proportionally redistributed over industry size class clusters with use exceeding imports based on their remaining use as calculated in step 2.
4. Total imports by industry size class cluster are calculated by adding imports from step 1 and 3.

Table 1. Example of the distribution of imports of a product by destination industry

	Imports in ITG	Use in SUT	Step 1	Step 2	Step 3	Step 4
Furniture industry	20	40	20	20	5	25
Wholesale	40	10	10	0	0	10
Household consumption	0	20	0	20	5	5
Subtotal (excl re-exports)	*60*			*40*		
Re-exports	0	20	20	0		20
Total	**60**	**90**	**50**	**40**	**0**	**60**
Redistributed	-	-	10	-	-	-

The compilation of data concerning trade in services by industry size class cluster is somewhat different. First, the trade in services data by industry size class cluster have been prepared for the year 2014, because several methodological improvements have been implemented in 2014 compared to earlier years. The trade values for 2014 have been extrapolated back to 2012 using commodity level value growth figures, assuming the same growth for each industry size class.

Second, trade in services by larger traders is registered at the enterprise group level rather than the enterprise level. Using additional tax information trade figures are assigned to enterprises. This improves the assignment to the correct industry size class cluster, since that of the enterprise is more specific than that of the enterprise group. Third, unlike trade in goods, which is observed for the population of enterprises, trade in services data are only collected for a sample of service traders. Moreover, the sampling strata used to sample traders are specific to the trade in services statistic and hence do not correspond to the industry size class clusters of the extended SUT. To accommodate for this, a two-step approach is taken. In a first step survey weights are used to redistribute services trade across industries and size classes. In a second step these weights are adjusted to assure that the distribution of services trade matches the distribution of service traders by size class from the GBR.

Finally, the treatment of travel differs between imports (Dutch residents travelling abroad) and exports (foreigners travelling to the Netherlands). Imports of travel services are assigned to industry size class clusters based on reported costs in the SBS. Exports of travel services are derived from the

Inbound Tourism Survey. Spending by visiting tourists is allocated to products and connected to the main producing industry of the products concerned. In a subsequent step expenses are distributed over size classes based on output.

3.5. Deriving the extended input-output table

Finally, the input-output table distinguishing between SMEs and large enterprises is derived from the SUT by adopting the same method that is used to derive the regular IOT. That means that a separate IOT is constructed for each commodity in the SUT. The row and column totals of this commodity-specific IOT are filled using the commodity-specific supply and use table. Domestic demand can then be calculated as the remainder of production minus exports and can be disaggregated into intermediate and final demand by assuming a fixed product sales structure (cf. method D in Eurostat 2008 to derive an IOT from an SUT) of size classes within industries. The final extended IOT is derived by adding all commodity-specific IOTs. The detail of the actual SUT and IOT and the published SUT and IOT is shown in table 2.

Table 2. Detail of SUT and IOT

	Published tables	Unpublished tables
Split industries	58	122
Unsplit industries	11	11
Products	78	650
Primary inputs	12	16
Categories of final demand	9	18

There are several reasons for publishing in less detail. Firstly, the stability of the results. Already in the regular published tables, without a split by size class, industries are aggregated because in some cases the industry data is based on too few observations. We follow this aggregation in order to publish at the same industry level as the regular tables. Secondly, we aggregate a little more because of confidentiality. In some cases the number of enterprises in an industry size class cluster was low and it would be possible to derive the results of a single enterprise. This is not allowed under Dutch statistical law. To preserve confidentiality, two methods were used. Either two industries would be aggregated to one (e.g. manufacture of tobacco was combined with manufacture of beverages) or the industry would not be split by size class (e.g. mining, postal and courier services).

3.6. Estimating the contribution of SMEs to value added

After deriving the extended IOT, it is possible to estimate the contribution of SMEs to value added in exports and in domestic final demand. Our empirical method to do this derives from a basic input-output model (Miller and Blair, 2009). For the purpose of the current extended IO-framework, it is useful to note that we have incorporated the industry and size class dimension in what would commonly be the industry dimension. As a consequence, the extended IO-table differs solely from its standard counterpart (industries only) in that it has more rows and columns. Hence we can rely on a

basic input-output model to illustrate our empirical method, which aims to calculate the contribution of SMEs and large enterprises to total value added. A similar analytical framework has been applied in many different empirical settings, for an application in the context of the estimation of CO_2 emissions embodied in exports, see for instance Su et al. (2010).

The basic input-output model (Miller and Blair, 2009) can be expressed in matrix form as:

$$x = Zi + f = Ax + f$$

Or, in words, each industry's total output (x) is equal to the summation of intermediate (Z) and final demand (f) for its product, with i being a column vector of 1's and A representing a matrix of direct production coefficients. Rewriting this equation gives us the basic formula for input-output analysis:

$$x = (I - A)^{-1} f = Lf$$

Where L is known as the Leontief inverse; a matrix element L_{ij} expresses the amount of output industry *i* needs to supply, both directly and indirectly, for 1 unit of production for final demand of industry *j.* Define vector *v* as a vector representing the value added generated per euro of output by industry (and $\hat{v}$ as the diagonal matrix of v), so that total value added by industry (V) can be expressed as follows:

$$V = \hat{v}x = \hat{v}(I - A)^{-1} f = \hat{v}L(f_d + f_e)$$

Where, following Su et al. (2010), f_d denotes the vector of domestic final demand and f_e the vector of foreign final demand (exports). Note that $\hat{v}L$ yields a square matrix M of which the element M_{ij} represents the amount of value added generated by industry *i* for 1 unit of production for final demand of industry *j.* Total value added embodied in exports by industry can then be easily expressed as:

$$V_e = \hat{v}L\hat{f}_e i$$

And analogously, total value added generated for domestic final demand can be expressed as:

$$V_d = \hat{v}L\hat{f}_d i$$

All necessary information for the input-out analysis is derived from the extended input-output table of 2012 separating between 128 industries and 5 size classes (small, medium-sized, small and medium-sized subsidiaries of large enterprises and/or foreign owned enterprises, large and undivided). Although all analyses are carried out at the lowest level of aggregation possible (128 industries x 5 size classes), we will not report results at this level for reasons of tractability and confidentiality.

4. Empirical results

This section illustrates the different roles of SMEs and large enterprises in the Dutch economy. First it shows the distribution of the value added generated by SMEs and large enterprises over industries. Then some results are presented using the newly developed extended IOT using basic input-output analyses. Besides estimating the imports embodied in exports, this table also allows to show the

roles of the two size classes as suppliers to intermediate and final demand, and their involvement in (the Dutch part of) global value chains. Although the extended IO-table contains 133 industries and 5 size-classes, we will present our results in this section in less detail. For example, we will only discern between SMEs, large enterprises and enterprises in industries that are not split by size class (but only in table 3). In this section an enterprise is to be considered an SME if and only if its enterprise group is under Dutch control and has less than 250 persons employed.

4.1. Contribution of SMEs to the Dutch economy: industry differences

Although the total value added by SMEs is comparable to the total value added by large enterprises, table 3 shows that there are large differences between the distributions of value added over industries. SMEs are relatively large in terms of value added in agriculture, construction, trade and services. Mining and manufacturing are dominated by large enterprises which therefore dominate the value added of these industries. This is an intuitively straightforward finding; a farmer or wholesaler can easily be operational with less than 250 employees, whereas the petrochemical industry, for example, is comprised almost exclusively of large enterprises.

Table 3. Distribution of value added over industries, by size class, 2012

	SME		Large enterprises		Not split	
	Value	Share in total	Value	Share in total	Value	Share in total
	mln euro	%	mln euro	%	mln euro	%
Agriculture, forestry and fishery	9729	4.5	496	0.3	0	0.0
Mining and quarrying, manufacturing and utilities	32188	14.9	69268	36.6	0	0.0
Construction	19703	9.1	8123	4.3	0	0.0
Trade, transport, accommodation and food services	65022	30.1	50119	26.5	0	0.0
Financial services	0	0	0	0	49908	28.0
Business services	43432	20.1	35276	18.6	0	0.0
Government, education and health care	0	0	0	0	128584	72.0
Other services	45925	21.3	26068	13.8	0	0.0
Total	215999	100	189350	100	178492	100.0

Obviously, the different distribution of SMEs and large enterprises among industries will influence indicators at the macro-economic level. As a consequence, we have to be extra careful when we observe a difference between SMEs and large enterprises. For example, when we observe that SMEs generally use less imports to produce their output. It is then important to check whether this is only because they are generally more active in industries that use less imports, or that this difference can be observed across the board.

4.2. Different composition of inputs for SMEs and large enterprises

Besides differences between SMEs and large enterprises in terms of the industries, there are also differences in input structure. Based on our calculations, Table 4 shows that SMEs are less dependent on imports in the production of goods and services for final demand than large enterprises. On average, SMEs need 19 cents of imports to produce 1 euro of final demand, whereas large enterprises need 41 cents. This lower import dependence can be observed in the majority of industries, as can be seen in the Appendix. A Wilcoxon signed-rank test for the difference in import dependence between SMEs and large enterprises in each industry showed that this difference was statistical significant difference.

As a consequence, the production for final demand by SMEs contains more Dutch value added per euro than that of large enterprises. Still, due to the scale of the large enterprises their total value added is of the same magnitude as that of SMEs (as could be seen in table 3). Table 4 also shows that of each euro of production by an SME for final demand, on average 41 cents of value added is generated by the producing SME. This is 32 cents for large enterprises. One might expect that SMEs rely less frequently on specialised suppliers of goods and services and that they carry out more of the necessary activities themselves before arriving at the final product. In other words, that there is less specialisation in tasks among SMEs. However, this is not confirmed by our results; figure A2 in the appendix shows that on industry level it is sometimes the SMEs, sometimes the large enterprises with the highest own value added embodied in final production. And a Wilcoxon signed-rank test between SMEs and large enterprises showed that the null hypothesis that these shares are equal cannot be rejected. This suggests that the findings on macro level are caused by the different distribution of SMEs and large enterprises over the industrial landscape.

Table 4. Composition of the input used in final production, by size class, 2012

	SMEs %	Large enterprises
Own (direct) VA	41	32
Indirect VA of large enterprises	11	10
Indirect VA of SMEs	16	13
Indirect VA of unsplit industries	11	2
Imports	19	41
Other primary inputs	2	1
Total	100	100

Other primary inputs are taxes less subsidies on imports, non-deductible VAT and other taxes less subsidies on products.

4.3. Roles of SMEs and large enterprises in the Dutch economy

There are notable differences between the roles of SMEs and large enterprises, as can be seen in table 5. This table shows the output structure of the two types of enterprises, divided in a direct (seller to final consumer) or an indirect role (as a supplier to others) and in a domestic and foreign (exports) part. SMEs are in general more often suppliers to other enterprises than suppliers to final

consumers; 58 percent of their value added is due to supplying to other enterprises. Large enterprises create half of their value added due to sales to final consumers and half due to supplying others.

Table 5. Output structure of SMEs and large enterprises, 2012

	SMEs	Large enterprises
	% of generated value added	
Direct	42	51
Domestic sales	26	22
Exports	16	29
Indirect, as a supplier	58	49
Domestic sales	40	32
Exports	18	17
Total	100	100

A Wilcoxon signed-rank test showed that SMEs have statistically significant more indirect value added, as a supplier, than large enterprises. This is illustrated by figure A3 and confirmed in other studies, e.g. the report of Statistics Denmark and OECD (2017) on the role of Nordic enterprises in global value chains.

4.4. Exports of SMEs and large enterprises

Another important conclusion that can be drawn from table 5 is that SMEs generate more value added serving as a supplier in the value chain of an exporter than they generate by exporting themselves. Of their value added, 16 percent is due to direct exports and 18 percent due to indirect exports. But for large enterprises the corresponding percentages are 29 and 17, respectively. In total, large enterprises derive more of their total value added from foreign markets, and that is due to their direct exports.

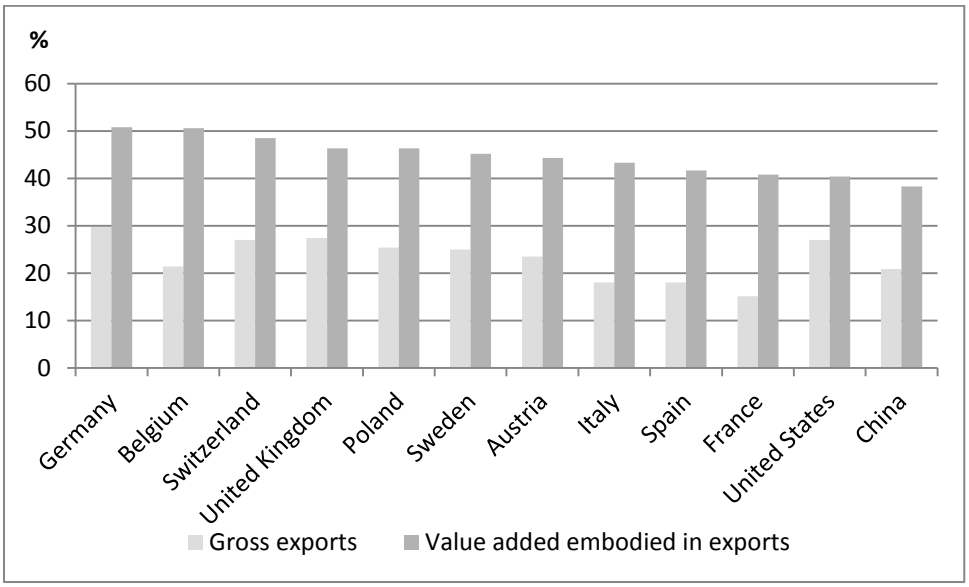
It is not surprising that we observe that SMEs are less prone to international trade than large enterprises. Barriers that are often mentioned in literature (e.g. Kneller and Pisu 2011, Smeets et al. 2010) by enterprises are obtaining information about foreign markets, finding business partners, dealing with cultural differences, complying with technical standards and regulations, and political and economic conditions of foreign markets. The larger an enterprise, the easier it is to bear the fixed costs associated with overcoming such barriers (USITC 2014).

Barriers that obstruct SMEs to trade will obstruct them to import, thus creating an extra barrier to export as well. It has already been shown for the Netherlands (Van den Berg & Van Marrewijk, 2017) that enterprises that import are more productive. In general, more productive enterprises enjoy larger export success (e.g. the surveys of Wagner (2007 & 2012)), the rationale being that the importing enables the enterprise to benefit from foreign input markets in terms of a larger variety of goods and services available at a lower price and/or with a higher quality. This enables the enterprise to be more efficient and productive than when they would have purchased similar inputs at the domestic market, which in turn makes enterprises more competitive on the international market.

With this theoretical foundation in mind, it should come as no surprise that SMEs are relatively more focussed on the domestic markets and relatively less on foreign markets. However, their customers on the domestic market have considerable exports. As a consequence, SMEs have considerable indirect exports, and although SMEs might have a relatively small share in gross exports, they have a larger share in Dutch value added exports.

Figure 2 shows that this holds for exports of domestically produced goods to each of the twelve most prominent trading partners of the Netherlands as well. Although SMEs are responsible for only 30 percent of the gross exports of goods to Germany, their share in the value added due to exports of goods to Germany is 50 percent. About one fifth of gross exports to China are carried out by SMEs, suggesting that they fall behind large enterprises in terms of not optimally taking opportunities that the high growth levels of the Chinese economy provide. Nonetheless, SMEs show to have a share of two fifth in value added due to exports of goods to China by serving as a supplier in the value chains of exporters, twice as much as their share in gross exports.

Figure 2. Share of independent SMEs in Dutch produced exports to important partners, 2012



These findings are very relevant to policymakers. There is concern (European Commission, 2013) that SMEs might not benefit from economic growth elsewhere because their share in exports is relatively low. But their share in value added due to exports is often much higher, when looking at individual trade partners sometimes more than twice as much, due to their contribution earlier in the value chain. The downside of this hidden internationalisation is that SMEs will be hit more by a significant drop in exports (such as in the 2008-2009 crisis), than is to be expected based on gross export figures.

5. Conclusions

This paper extends the traditional supply-use (SUT) framework (and by extension the input-output (IOT) framework), that have industry as the only enterprise characteristic, by incorporating firm size and foreign ownership. This enables us to account for, but not remove all, firm heterogeneity along

these dimensions in our empirical analysis. We describe the process of constructing the extended SUT, present some key features of the resulting SUT and derive analytical findings from basic IO-analysis of the extended IOT, focusing on the question to what extent SMEs contribute to exports both directly and indirectly.

The key feature of our approach is that we utilize firm-level data on e.g. size, industry, turnover, value added and international trade to construct a purpose-built SUT distinguishing between SMEs and large enterprises. In the process we also separate independent SMEs from small firms belonging to large (domestic or foreign) conglomerates. The resulting extended SUT is transformed into an input-output table by adopting the same strategy developed for the traditional IOT.

An analysis using the resulting extended IOT reveals that the role of SMEs in the Dutch economy is considerably different from that of large enterprises, even though the value added generated by the two subsets is comparable. This difference in roles is partially due to a composition effect in terms of industries. We observe that SMEs serve as suppliers to other enterprises more often than large enterprises who produce more for final demand (sell directly to consumers and/or export). SMEs are more focussed on domestic markets for both their demand and supply of goods and services and less focussed on direct sales to foreign markets compared to large enterprises. Due to all kinds of barriers to international trade, SMEs are less active on international markets than large enterprises both in terms of imports and exports.

Using traditional measures of foreign market involvement, SMEs seem to benefit relatively little from economic growth in foreign markets compared to large firms, because they are much less prone to export themselves: their share in gross exports of domestically produced goods and services is only 25 percent whereas it is 66 percent for large enterprises. The remaining exports are by the unsplit industries. However, taking the whole value chain into account, a different picture emerges: the share of SMEs in Dutch value added due to exports is 43 percent. SMEs serve an important role as suppliers to large exporting enterprises. By participating in such value chains, SMEs can benefit from the possibilities that emerging markets, even those far away, offer without having to put up the considerable investment associated with exploring new export markets. The results thus suggest that large enterprises serve as a gateway to foreign markets for SMEs. Conversely, SMEs are important suppliers for large enterprises and in doing so add to the competitiveness of large enterprises on foreign markets.

Of each euro of production for final demand a larger share remains with the producing SME in terms of value added. On average 41 cents remain with the SME compared to 32 cents at large enterprises. However, this seems due to a composition effect: SMEs are more often active in industries where the own value added in final production is higher. SMEs are less dependent on imports in the production of goods and services for final demand than large enterprises. This implies that SMEs might not benefit as much from importing less expensive and/or higher quality inputs as large enterprises, which might render them less competitive on international markets.

Concluding, our disaggregation of industries into SMEs and large enterprises and the subsequent analysis shows that there are significant differences between SMEs and large enterprises. It led to additional insights that are relevant to policy makers.

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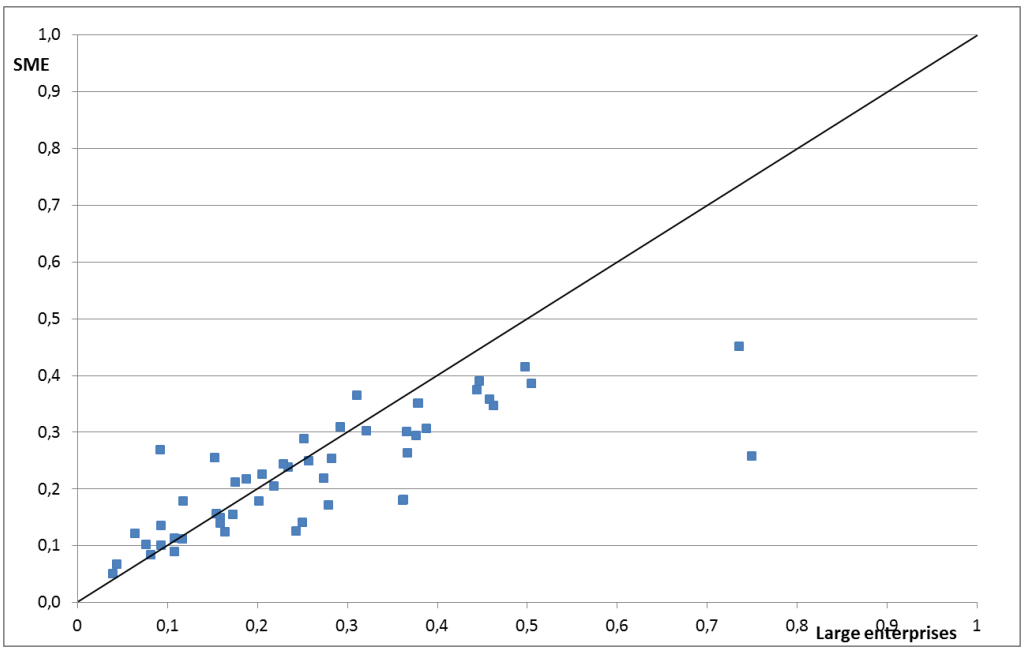
Appendix. Some results at the industry level.

Sometimes we observe a difference at the macro-level but it is important to be clear about the interpretation. For example, overall SMEs use less imports than large enterprises. However, it is not immediately obvious whether that is because SMEs might be relatively active in industries that use less imports, or that the difference can be observed across industries. Therefore this appendix presents three graphs about the differences between SMEs and large enterprises at the industry level and the corresponding statistical tests.

Due to confidentiality (see 3.6), the results are not reported on the highest aggregation level (128 industries) but on a more aggregated level (starting from 69 industries). Industries that are not split, such as the financial institutions, are not included in the graphs or statistical tests. Industries where we assumed (due to lack of information from the SBS, see 3.3) that the input-output structure is the same for each size class, such as culture, sports and recreation, are not included either.

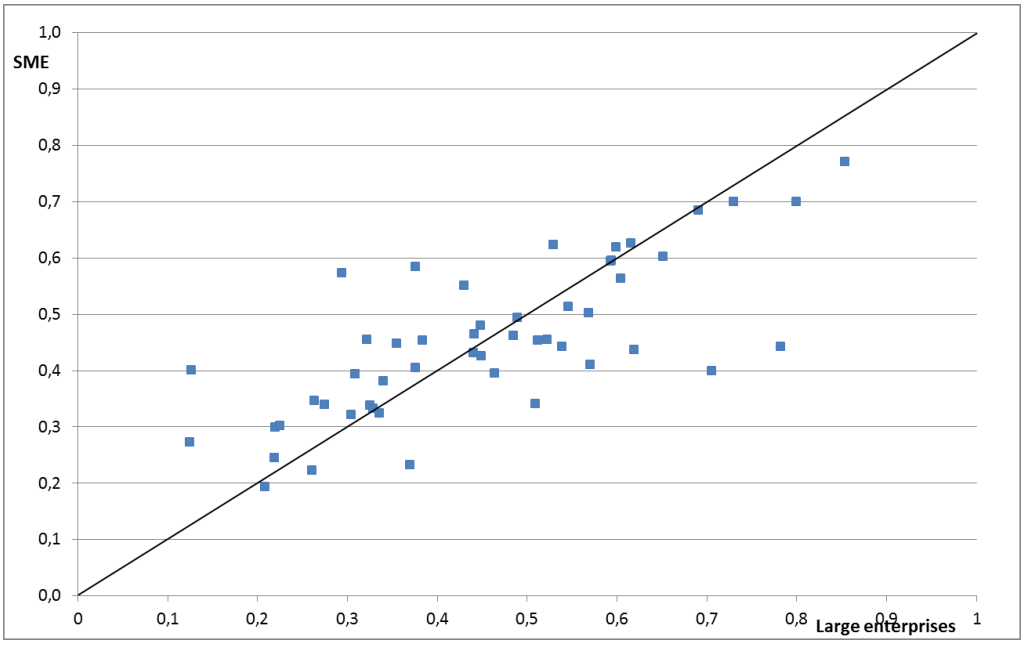
If the difference between SMEs and large enterprises is lower than 1 percentage point, we do not include the industry in the statistical test because the difference might be caused by rounding in the IO-table. We performed a Wilcoxon signed-rank test to compare the results for the two size classes. This non-parametric test is used when comparing two related samples.

Figure A1. Value of imports embodied in 1 euro of final production, by industry and size class, 2012



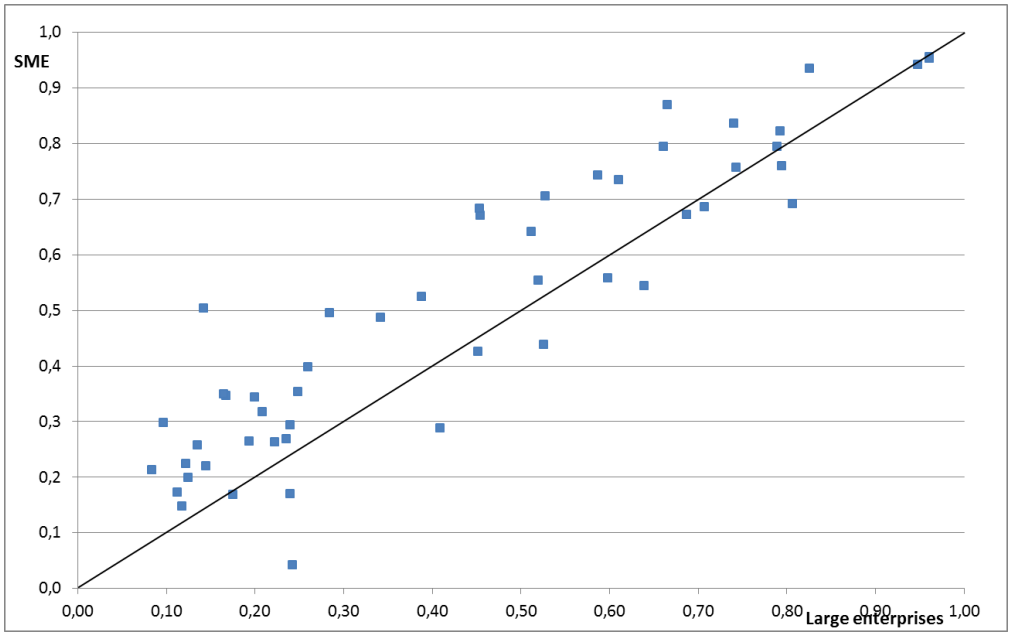
A Wilcoxon signed-rank test indicated that the imports embodied in 1 euro final production are statistically significantly lower for SMEs than for large enterprises, n = 44 , Z = -2.707, p <0.007.

Figure A2. Own value added embodied in 1 euro of final production, by industry and size class, 2012



A Wilcoxon signed-rank test did not reject the null hypothesis that the own value added embodied in 1 euro of final production was different for SMEs compared to large enterprises, n = 45, Z = -0.006, p <0.995.

Figure A3. Indirect value added as share of total value added, by industry and size class, 2012



A Wilcoxon signed-rank test indicated that the indirect value added as share of total value added was statistically significantly higher for SMEs than for large enterprises, n = 46, Z = -4.037, p <0.000.