Exporting services and exporting goods – What are the effects on aggregate productivity growth?

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Abstract:

We estimate the importance of exporting for productivity growth. We extend the approach in existing studies, such as Bernard and Jensen (2004) by distinguishing between the effects of exporting goods and exporting services. Further, we include service sector firms in a unified treatment of (nearly) the full population of private sector firms in Denmark, and we rely on a new decomposition technique developed by Melitz and Polanec (2012).

In the service sector, 24 percent of the increase in TFP is a result of exporting, while 46 percent of the increase in labor productivity is a result of exporting. In the manufacturing sector, the numbers are 5 and 6 percent, respectively. However, when distinguishing between the impact of exporting services and the impact of exporting goods, we find that, in the manufacturing sector, the export of services has actually given rise to a decrease in aggregate productivity, implying that it is only the exporting of goods which have contributed to a higher productivity. Similarly in the service sector, it is more than 75 percent of the impact of exporting, which is due to the exporting of goods, leaving only a very small impact of the exporting of services.

1. Introduction

The productivity of exporting firms has been a topical issue in the recent decade(s). The main focus has been on the extent to which exporting firms are more productive than non-exporting firms (see, *e.g.*, Bernard and Jensen, 1999), and whether any differences reflect a causal effect of exporting or self-selection (see, *e.g.*, Wagner, 2007 for a survey). Most studies support that the main explanation for the higher productivity of exporters is self-selection, but some studies also find a causal effect of exporting on productivity (see, *e.g.*, Girma *et. al.*, 2004, and De Loecker, 2007). However, an important insight from the recent literature is that, even if the higher productivity of exporting firms solely reflects self-selection, firms' entry at export markets may give rise to a higher aggregate productivity, because of the reallocation of resources from less productive, non-exporting firms to more productive, exporting firms (see, *e.g.*, Melitz, 2003). Calculation of the reallocation effect is data demanding as it requires firm-level data for entire sectors, but, *e.g.*, Bernard and Jensen (2004) find that the reallocation of resources towards more productive exporting firms may explain between 40 and 65 percent of the increase in productivity in the US manufacturing sector between 1983 and 1992.

Another distinguishing feature of the literature on exporting and productivity is its focus on the manufacturing sector and the export of goods. In most advanced countries, the manufacturing sector only accounts for a minor part of the activities in the private sector, dominated by the service sector. In addition, trade in services accounts for a large and growing part of world trade (see, *e.g.*, Francois and Hoekman, 2010). This focus on the manufacturing sector is to a great extent data driven as detailed data for trade in services are still rare.

In this paper, we estimate the importance of exporting for aggregate productivity growth. We extend the approach in existing studies, such as Bernard and Jensen (2004), in

two important dimensions. First, we include the export of services, and we explicitly distinguish between the productivity effects of exporting goods and exporting services. Second, we include service sector firms in a unified treatment of (nearly) the full population of private sector firms in Denmark. Furthermore, we provide separate estimates on the importance of exporting services and exporting goods for aggregate productivity growth. In doing this, we rely on a new decomposition technique developed by Melitz and Polanec (2012).

There is a lot of evidence supporting that manufacturing firms that export goods are more productive than other manufacturing firms. There is much less evidence on the productivity of firms (manufacturing or service) that export services and the productivity of service firms that export goods. One important exception is Breinlich and Criscuolo (2011) who make a “portrait” of firms importing and exporting services. They find that the relationship between productivity and services export is very similar to the relationship between productivity and goods export. However, it is still an open question how much trade in services contributes to aggregate productivity compared to trade in goods.

Another feature, which should be taken into account, is that there are firms exporting both manufactured goods and services. It is thus often the case that goods-exporting firms within the manufacturing sector also export services (see, *e.g.*, Hijzen *et al.*, 2011). One reason for this is that some capital goods are sold as part of a "package" which also includes installation and maintenance services. When analyzing the productivity advantage (or disadvantage) of service exporters, it is thus important to distinguish between firms whose main activity is to produce services and firms whose main activity is to produce manufactured goods but who also produce and export services. Hence, in the analysis we distinguish between firms in the manufacturing sector, which are mainly producing and exporting goods, and firms in the service sector, which are mainly producing and exporting

services – but we also distinguish between export of services and export of goods within both sectors.

We consider Danish firms in the period 2002 to 2008. During this period, the share of goods export in total sales has been constant at approximately 23 percent, while the share of service export in total sales has increased from 6 to 7 percent. As in Breinlich and Criscuolo (2011), we find that both exporters of services and exporters of goods are more productive than non-exporters. Furthermore, an increase in the export intensity of goods or services is also associated with a positive productivity effect. However, the productivity effects of exporting goods seem to be larger and more persistent than the productivity effects of exporting services.

When considering the impact of exporting services and exporting goods on aggregate productivity, we also find important differences. In the service sector, the growth rate in TFP would have been 3.7 percentage point lower, and the growth rate in the labor productivity 3.2 percentage points lower without the contribution of exporting. When relating these numbers to the actual increase in TFP in the service sector (15.5 percent), and the actual increase in labor productivity (7 percent), this implies that, in the service sector, exporting explains 24 percent of the increase in TFP and 46 percent of the increase in labor productivity. The actual increases in TFP and labor productivity in the manufacturing sector are much larger than in the service sector, but the contribution of exporting to productivity is smaller. Without the impact of exporting, the increase in TFP in the manufacturing sector would have been 1.6 percentage points lower, which amounts to 5 percent of the actual increase in TFP. With respect to labor productivity, the increase would have been 1.7 percent lower without the impact of exporting, which amounts to 6 percent of the actual increase in labor productivity. Hence, it is mainly the service sector, which has realized increasing productivity from exporting, but it is mainly the exporting of goods which has been

responsible for the higher productivity in both the service and the manufacturing sector. Actually, in the manufacturing sector, the exporting of services has been responsible for a decrease in both TFP and labor productivity.

Besides the paper by Breinlich and Criscuolo (2011), there are only a few papers considering whether exporters of services are more productive than non-exporters. Temouri *et al.* (2008) use enterprise data from UK, France and Germany, and they find that exporting firms in the service sector are more productive (measured as value added per employed person) and pay higher (average) wages than non-exporting service producing firms. They also consider profitability (gross value added minus wages relative to total sales), and find that in France, the profitability of exporters is higher than that of non-exporters in the service sector. In the UK there is no difference between exporters and non-exporters, and in Germany, the profitability of exporters is lower than that of non-exporters.

Jensen (2008) focuses on trade in high-tech services. An important part of his analysis is to consider the tradability of services using the concentration of production as a measure of tradability. However, he also considers how exporters of services differ from non-exporters. It is confirmed that for these high-tech services, the results are similar to the results found when using data for manufacturing firms – although it is less common for service producers to export and they typically export a smaller fraction of their sales than manufacturing firms. Exporters are larger than non-exporters, pay higher wages, and the labor productivity is higher.

The rest of the paper is structured as follows. In Section 2, we present the data, and in Section 3, we consider the effect of exporting on firm productivity, employment and value added at the firm level. In Section 4, we present our main results on the aggregate productivity effects of exporting goods and services. Finally, Section 5 concludes.

2. Data and Basic Facts

When comparing the performance of exporting and non-exporting service producers, a number of new issues arise relative to the case where only manufacturing firms are considered. One is that manufactured goods are tangible, visible and storable, while services are often intangible, invisible and perishable, requiring simultaneous production and consumption (see, *e.g.*, Copeland and Mattoo, 2008).[1] An implication of this is that it is more difficult to measure trade in services than trade in goods. This is also reflected in the framework of the General Agreement on Trade in Services (GATS), which distinguishes between four modes of international trade in services. Mode 1 constitutes services that are being shipped across borders (often electronically), such as, *e.g.*, computer software, call-centre services, *etc*. This is the type of service trade that resembles trade in goods most closely. Mode 2, on the other hand, constitutes services where the consumer has to move (temporarily) to the country of the supplier to enjoy the service, as in the case of, *e.g.*, tourism and education. Mode 3 covers trade in services through a commercial presence of the supplier in the country of the customer, *i.e.*, where the supplier sells its services through a local subsidiary of the company. Finally, mode 4 constitutes services, which require that residents of the exporting country move temporarily to the country of the consumer to deliver the service – either on behalf of their employers in the exporting country or on their own account. Many consultancy services are thus covered by this mode. In our analysis, we are going to restrict attention to mode 1, and that part of mode 4, which is on behalf of a firm in the exporting country, as these are the types of international trade in services which are recorded at the firm level.

[1] There are exceptions from this. As an example, the production of software is a service activity, despite the fact that software may be stored on, *e.g.*, harddisks and CD's.

We have access to a very rich matched worker-firm longitudinal data set covering the total Danish population of workers and firms for the years 1995-2008. Each individual and each firm is associated with a unique identifier, and all employed individuals are linked to a firm at the end of each year. These data contain detailed information on individual socio-economic characteristics and firm characteristics on an annual basis. On this data set, we merge information about firm-level exports of goods and services. Our firm-level measure of service exports is derived as the difference between the firm's total export (including both goods and services) and the firm's export of goods only. The total amount of exports is recorded at the firm-level for taxation purposes in the VAT register in Statistics Denmark, while the data for trade in goods are based on information from the Danish External Trade Statistics register at Statistics Denmark as well as the VAT register.

A couple of additional remarks about the construction of the service export measure are in order. The External Trade Statistics are compiled in two systems: Intrastat (trade with EU countries) and Extrastat (trade with non-EU countries). The level of detail in these registers is very high as trade flows are recorded by destination/origin country and eight-digit product code. Trade flows in Extrastat are recorded by customs authorities, and the coverage rate is therefore close to complete. In contrast, the coverage rate in Intrastat is lower (around 90%), because some, predominantly small firms, appear not to report data to the system. Also, data on intra-EU trade is censored in a way such that only firms exporting goods with a total annual value exceeding a certain threshold are recorded in the files. Fortunately, the VAT register also records the total goods export to EU countries and the total goods import from EU countries from 2002 and onwards, and the coverage rate here is higher. Hence, we are able to calculate goods trade and therefore service trade at the firm-level fairly accurately for the years 2002 through 2008. The numbers for service trade derived in this way will in

principle cover all mode-1 exports as well as the part of mode-4 exports that takes place via firms, *i.e.*, through services transactions.

It should also be emphasized that in contrast to the data on trade in goods, we only have data on the total export of services, and hence we are not able to distinguish between different types of services. This is a further argument for distinguishing between different industries. In the main part of our analyses, we choose to distinguish between 8 different manufacturing industries and 20 different service industries (see Appendix A for the list of industries). It should be noted that there are certain services which are exempted from VAT in Denmark. For the firms in these industries, it is not possible to identify the exports, and they have therefore been left out of the analysis.[2] Further, the construction sector has been left out, and there are two reasons for that. First, production in the construction sector is neither "pure" service nor "pure" manufacturing, and one of our purposes is to compare the effects of exporting services to the effects of exporting goods. Second, in the years 2002 to 2008, the development in the construction sector was heavily influenced by the business cycle with "overheating" in the middle part of the period, and a sharp decline at the end of the period.

In Figure 1, we show the development in the export of goods and services. We see that the share of goods which is exported has been basically constant, while there has been a weak tendency for the export of services to be increasing, reaching 7.4% of total sales in 2008.

[Figure 1 around here]

As productivity measures we use both total factor productivity (TFP) and real value added per worker. Below we are going to use a method to decompose aggregate productivity suggested by Melitz and Polanec (2012). Following Melitz and Polanec, we simply use the

[2] The most important of these industries are *financial intermediation* and *transportation of people*.

OLS estimates of firm-level TFP. It is well known that this estimate may be biased, and we could alternatively use, *e.g.*, the Levinsohn and Petrin (2003) routine to compute firm-level TFP. However, when using this routine, we get decreasing returns to scale of the estimated production function, which is not appropriate in a decomposition analysis. Further, as argued by Van Biesebroeck (2004), the differences in the estimated TFP when using different methods are unlikely to be of first order.

We distinguish between four different types of firms: non-exporters, exporters of services (only), exporters of goods (only) and exporters of both goods and services. Table 1 shows average characteristics of the four types of firms in 2002 and 2008.

[Table 1 around here]

The employment share of non-exporters was around 33 percent in both 2002 and 2008. Most of the export stems from goods exporters (25 percent of the employment share in 2008) and exporters of both goods and services (34 percent of employment share in 2008). The employment share of "pure" service exporters is much lower, but has been increasing from 7.1 percent in 2002 to 7.6 percent in 2008. The value added share and the sales share show pretty much the same picture as the employment share, but non-exporters contribute less to value added and sales than to employment reflecting that the labor productivity of non-exporters is lower than that of exporters.

The number of exporting firms has been decreasing, while the number of non-exporting firms has been increasing. This is partly counteracted by the mean size of the firms as the mean sizes of service exporters and exporters of both services and goods have been increasing, while the mean size of non-exporters has been decreasing. Service exporters are around twice as large as non-exporters, but goods exporters and exporters of both goods and services are close to three times as large as exporters of services.

A noteworthy difference between the different types of exporters is that firms exporting both goods and services export 40 percent of their output, while the firms exporting only goods export 36 percent and exporters of services export "only" around 20 percent of output.

Table 2 shows how the different types of exporters compare to non-exporting firms. It is, *e.g.*, seen that all types of exporters are more productive than non-exporters, no matter whether the measure of productivity used is value added per worker, TFP or the wage bill per worker. However, service exporters have a lower TFP, a lower value added per worker, and a lower wage bill per worker than the other types of exporters. It is interesting to note that when controlling for industry and size, the differences in productivity between exporters and non-exporters become smaller. This may indicate that the higher productivity of service exporters compared to non-exporters is partly a result of certain industries being more productive than other industries, and that the more productive industries export more than the less productive industries.

[Table 2 around here]

3. Exporting, productivity and growth

In this section, we analyze how the productivity of exporters of services compares to the productivity of non-exporters and exporters of goods. Furthermore, we compare the growth performance of exporters and non-exporters.

The results in Table 2 indicate that exporters of services as well as exporters of goods are more productive than non-exporters. However, these differences between different types of firms may be partly explained by other differences than export status such as industry, year, educational level of employees, size and capital per worker. Furthermore, they

may be a result of the most productive firms self-selecting into being exporters. To control for these other possibilities, we estimate the following equation:

$$\Delta \log(productivity_i) = \beta_0 + \beta_1 \Delta type_i + \beta_2 \Delta se_i + \beta_3 \Delta ge_i + \gamma \Delta Z_i + \varepsilon_i \qquad (1)$$

where $\Delta \log(productivity_i)$ is the log change in the productivity of firm *i* between 2002 and 2008, where productivity is measured be either TFP or labor productivity. $\Delta type_i$ is a vector of dummy variables capturing the different types of firms, *i.e.*, whether firms start or stop to export goods and/or services between 2002 and 2008, or whether firms export goods or services throughout. Δse_i and Δge_i are the changes in the export intensities (*i.e.*, exports relative to sales) of services and goods, respectively, between 2002 and 2008,. Z_i is a vector of other controls, including the educational level of the employees, the capital-worker ratio, the size (number of employees) and industry. The model is estimated in first differences to eliminate the effects of permanent unobserved firm differences on productivity, *i.e.*, we control for the effects of self selection of the most productive firms into exporting. Furthermore, we use long differences – i.e. the difference between 2008 and 2002 – to diminish any short-run stochastic impacts on the variables. However, it is important to emphasize that we do not control for the possibility of a firm-specific temporary shock, which simultaneously affects exporting behavior and productivity. For this reason, the estimated parameters do not necessarily reflect causal effects of exporting.

In Table 3, we report the outcome of the regressions. The results for the manufacturing sector are reported in panel A, and the results for the service sector in panel B.

[Table 3 around here]

First, we see that "starts exporting goods" is associated with an increase in the productivity of approximately 13 percent, both in the service sector and in the manufacturing sector, and both when we consider TFP and labor productivity. Second, regarding "starts exporting services", there is a smaller increase in the productivity of approximately 5 percent

in the service sector, and no significant change in the manufacturing sector. Third, "stops exporting services" tends to give rise to a decrease in the productivity of firms within the manufacturing sector, while there are no significant change in the service sector. Fourth, the most significant difference between the effects of exporting goods and exporting services relate to "exports goods throughout" and "exports services throughout". Firms in both the manufacturing sector and the service sector exporting goods throughout realize an increase in productivity of approximately 5 percent, while there are no significant effects of "exports services throughout" in the service sector, and in the manufacturing sector this is associated with a decrease in productivity of approximately 7 percent. Finally, a higher export intensity of both goods and services tend to increase the productivity. In conclusion, it seems to be the case that there are larger and more significant productivity effects associated with exporting goods than with exporting services.

To analyze the importance of exporting for the growth of the firm, we estimate the following equation:

$$\Delta \log(activity_i) = \beta_0 + \beta_1 \Delta type_i + \beta_2 \Delta se_i + \beta_3 \Delta ge_i + \gamma \Delta Z_i + \varepsilon_i \qquad (2)$$

where $activity_i$ is measured either by real value added or employment. The results of estimating (2) are reported in Table 4.

[Table 4 around here]

First, we see that both value added and employment tends to increase in firms which start exporting. However, the effects of "starts exporting goods" are larger than the effects of "starts exporting services", especially in the manufacturing sector. Second, employment and value added tend to decrease in firms which stop exporting – especially in firms which "stops exporting goods". Third "exports goods throughout" tends to increase value added in the service sector, while there are no significant effects in the manufacturing sector. With respect to "exports services throughout" this tends to decrease value added in the manufacturing

sector, but to increase employment in the service sector. Finally, an increase in the export intensity of goods tend to increase value added and employment in both sectors, while an increase in the export intensity of services tend to decrease employment in the manufacturing sector, but to increase value added in the service sector. In conclusion, the effects of exporting goods and exporting services have qualitatively similar effects on value added and employment, but the effects of exporting goods tend to be larger.

4. The contribution of exporting to productivity growth

The aggregate productivity development within a sector depends on the productivity development of individual firms as well as the reallocation of resources between firms with different productivities. Therefore, our next step is to decompose the development in the aggregate productivity over the period 2002 to 2008 for the service and the manufacturing sector, respectively, into contributions arising from the change in productivity within firms and contributions arising from the reallocation of resources. We are going to use a recent decomposition method suggested by Melitz and Polanec (2012), which is an extension of the method suggested by Olley and Pakes (1996).[3] The point of departure is productivity at the firm level, φ_{it}, which may be labor productivity (real value added per labor unit), or total factor productivity (TFP). The aggregate productivity at time t is calculated a weighted average of the firm level productivities, φ_{it}, of the n_t firms, where the weights, s_{it}, are the market shares:

$$\Phi_t = \sum_{i=1}^{n_t} s_{it}\varphi_{it} \tag{3}$$

When using TFP as the productivity measure, the measure of firm's market share used is the firm's share of total value added, and when using labor productivity, the market share used is

[3] The advantage of this method compared to other methods decomposing productivity growth is that it yields unbiased contributions of surviving, entering and exiting firms.

the firm's share of total employment. The decomposition method splits the aggregate productivity, Φ_t, into the following two components:

$$\Phi_t = \bar{\varphi}_t + \sum_{i=1}^{n_t}(s_{it} - \bar{s}_t)(\varphi_{it} - \bar{\varphi}_t) = \bar{\varphi}_t + cov(s_{it}, \varphi_{it}) \quad (4)$$

where $\bar{\varphi}_t = \frac{1}{n_t}\sum_{i=1}^{n_t}\varphi_{it}$ is the unweighted firm productivity mean, and $cov(s_{it}, \varphi_{it})$ is the covariance between market share and productivity. If bigger firms tend to be more productive, this covariance is positive. The change in the mean productivity between two periods is now given as:

$$\Delta\Phi = \Phi_2 - \Phi_1 = \Delta\bar{\varphi} + \Delta cov \quad (5)$$

The aggregate productivity thus increases between period 1 and period 2 if there is an increase in the unweighted productivity mean and/or if there has been a change in the covariance between market shares and productivities of firms.

The aggregate productivity in period *t*, Φ_t, can also be written as a weighted mean of aggregate productivities of different subgroups of firms. In particular, if we distinguish between surviving, entering and exiting firms, the average productivity in two subsequent periods can be written as:

$$\Phi_1 = s_{S1}\Phi_{S1} + s_{X1}\Phi_{X1} \quad (6)$$

$$\Phi_2 = s_{S2}\Phi_{S2} + s_{E2}\Phi_{E2} \quad (7)$$

where Φ_{St} and s_{St} are the aggregate productivity and aggregate market share, respectively, of surviving firms in period *t* (*t = 1,2*). Φ_{X1} and s_{X1} are the aggregate productivity and aggregate market share, respectively, of exiting firms in period 1, and Φ_{E2} and s_{E2} are the aggregate productivity and aggregate market share, respectively, of entering firms in period 2. Now, the change in aggregate productivity can be written as:

$$\Delta\Phi = \Delta\bar{\varphi}_S + \Delta cov_S + s_{E2}(\Phi_{E2} - \Phi_{S2}) + s_{X1}(\Phi_{S1} - \Phi_{X1}) \quad (8)$$

The first term reflects the average increase in productivity of surviving firms (*i.e.*, within firm productivity changes). The second term reflects productivity effects of

reallocations among surviving firms. If more productive firms get a bigger market share, or if the productivity increases more in firms with a higher market share, this term tends to be positive. The third term is the productivity effect of entering firms – if these firms have a higher productivity than surviving firms in period 2, this term becomes positive. Finally, the last term is the effect of exiting firms. If these firms are less productive than surviving firms in period 1, this term becomes positive.

The decomposition in (8) can be applied to the private sector as a whole or any subsector. If our point of departure is the private sector, the change in the aggregate productivity for the private sector as a whole can also be decomposed into contributions from the manufacturing sector and the service sector, respectively, as well as contributions from inter-sectoral reallocations (see Melitz and Polanec, 2012, for details). In the following we decompose the contributions in the manufacturing sector and the service sector separately using (8), while also computing these sectors contributions to the aggregate productivity development of the private sector.

The results of this exercise are provided in Table 5. The numbers in italics are weighted contributions of a certain category to the aggregate productivity development in the private sector (weights being the shares of firms in a certain category), and in a column they add up to the *Intra-sector effect*. We get the *Total effect* on the private sector by dding the *Inter-sector effect*.

[Table 5 around here]

We observe that the aggregate increase in private sector TFP has been 24 percent, and the increase in value added has been 13 percent. A very small part of the increase is due to reallocations between the service sector and the manufacturing sector. The increase in the productivity of the manufacturing sector has been much higher than the increase in the service sector. Aggregate TFP in the manufacturing sector has thus increased by 34 percent,

while it has increased by “only” 16 percent in the service sector. Similarly, value added per worker has increased by 28 percent in the manufacturing sector, while it has increased by only 7 percent in the service sector.

We also see that the relative importance of within firm productivity changes and reallocations differ between the two sectors. The main source of productivity increases in the manufacturing sector is within firm productivity changes, while the main source in the service sector is reallocations. Firms entering have a negative contribution to aggregate productivity both in the service sector and in the manufacturing sector, while exiting firms have a positive contribution. These results reflect that both new firms and exiting firms are less productive than surviving firms. Melitz and Polanec (2012) get similar results using a sample of Slovenian manufacturing firms.

The question we want to answer is how much of the productivity change in Table 5 that is a result of exporting? In order to do this, we use the estimated effects of exporting reported in Tables 3 and 4 to construct counterfactual values of TFP, labor productivity, employment and value added for each firm in our dataset. These counterfactual values are decomposed in the same way as the actual values reported in Table 5.

We report three sets of counterfactual calculations. First, we neutralize all effects of exporting, i.e. the effects of the export dummies: “starts exporting goods”, “starts exporting services”, “stops exporting goods”, “stops exporting services”, “exports goods throughout” and “exports services throughout”, and the effects of the change in exporting intensities. The results of these calculations are reported in panel A of Table 6. Second, we only neutralize the effects of exporting goods, and these results are reported in panel B of Table 6. Finally, we neutralize the effects of exporting services, and the results are reported in panel C of Table 6.

[Table 6 around here]

We see that the increase in both TFP and labor productivity would have been lower without the impact of the exporting of firms. In the manufacturing sector the increase in TFP would have been 1.6 percentage points lower, and since the actual increase in TFP is 34.2 percent, this implies that 5 percent of the increase in TFP in the manufacturing sector is due to the impact of exporting. If we instead consider labor productivity in the manufacturing sector, the increase would have been 1.7 percentage points lower, which is 6 percent of the actual increase in labor productivity in the manufacturing sector. In the service sector, the impact of exporting is much larger. Without the impact of exporting, the increase in TFP would have been 3.7 percentage points lower, which is equivalent to 24 percent of the actual TFP increase in the service sector. If we consider labor productivity, the numbers are even lager. Without the impact of exporting, the increase in labor productivity would have been 3.2 percentage points lower, but since the actual increase is only 7 percent, this amounts to 46 percent.

From panel B, we see that, in the manufacturing sector, the impact on productivity of the export of goods is even larger than the impact of goods and services (panel A). The mirror image of this result is given in panel C, where it is seen that exporting services have had a negative impact on the productivity in the manufacturing sector. For the service sector, there is a positive impact of both exporting goods and exporting services, but from panel C, it is seen that the impact of exporting services is very small, and the main contribution stems from the exporting of goods. Hence, in both the manufacturing sector and the service sector, it is mainly the exporting of goods which has a positive impact on productivity.

5. Conclusion

We have considered the impact of exporting on the productivity of firms and on the aggregate productivity. By using a very rich Danish dataset for the years 2002 to 2008, we explicitly distinguish between firms in the manufacturing sector and firms in the service sector, and between exporting goods and exporting services. This makes it possible to discover some important differences between the service sector and the manufacturing sector.

It turns out that firms that start to export become more productive than non-exporting firms, but it is especially the case for firms that start to export goods. Similarly, we find that firms that continuously export goods realize a higher increase in productivity than non-exporting firms, whereas this is not the case for firms exporting services. Similar differences are found when considering the growth in value added and employment. Firms that start exporting realize a higher growth in value added and employment than other firms, but the effects of exporting goods tend to be larger than the effects of exporting services.

These differences between the impact of exporting services and exporting goods are also seen at the aggregate level. The exporting of firms has contributed to increase the aggregate productivity. This is the case in the manufacturing sector, but it is especially the case in the service sector, where 24 percent of the increase in TFP is a result of exporting, while 46 percent of the increase in labor productivity is a result of exporting. In the manufacturing sector, the similar numbers are 5 and 6 percent. However, what is also very noteworthy is that, in the manufacturing sector, the export of services has actually given rise to a decrease in aggregate productivity, implying that it is only the exporting of goods which have contributed to increase productivity. Similarly in the service sector it is more than 75 percent of the impact of exporting which is due to the exporting of goods, leaving only a small impact of the exporting of services.

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Appendix A

We consider the following industries.

Manufacturing industries:	Two digit NACE codes
Food, beverages and tobacco	15 and 16
Textiles, apparel, leather and footwear	17, 18 and 19
Wood, paper, pulp and printing	20, 21 and 22
Chemicals, plastic and rubber	23, 24 and 25
Glass, ceramic and cement	26
Iron and metal	27 and 28
Machinery and electronics	29, 30, 31, 32, 33, 34 and 35
Furniture	36

Service industries:	Two-digit NACE codes
Sale, maintenance, repair of motor vehicles and retail sale of fuel	50
Wholesale trade except motor vehicles	51
Retail trade except motor vehicles	52
Hotels and restaurants	55
Land transport	60 (except 60.10, 60.21, 60.22, 60.23)
Water transport	61 (except 61.10, 61.20)
Air transport	62 (except 62.10, 62.20, 62.30)
Supporting and auxiliary transport activities	63 (except 63.11, 63.12, 63.21, 63.22, 63.23, 63.30)
Real estate activities	70 (except 70.20, 70.3210, 70.3220)

Renting of machinery and equipment	71
Computer and related activities	72
Research and development	73
Legal, accounting, book-keeping, management consultancy etc.	74.1 (except 74.15)
Architectural and engineering activities	74.2
Technical testing and analysis	74.3
Advertising	74.4
Labour recruitment and provision of personnel	74.5 (except 74.5010)
Investigation and security activities	74.6
Industrial cleaning	74.7
Miscellaneous business activities n.e.c	74.8

Table 1: Average Characteristics of Exporters vs. Non-Exporters, 2002 and 2008

	Non-exporters		Service exporters		Goods exporters		Service and goods exporters	
	2002	2008	2002	2008	2002	2008	2002	2008
Private sector employment share	0.328	0.334	0.071	0.076	0.264	0.249	0.338	0.342
Private sector output share	0.192	0.178	0.060	0.064	0.312	0.314	0.436	0.444
Private sector value added share	0.256	0.249	0.072	0.073	0.290	0.307	0.382	0.371
Total export/sales	0.000	0.000	0.201	0.235	0.359	0.359	0.393	0.407
Service export/sales	0.000	0.000	0.201	0.235	0.000	0.000	0.112	0.133
Goods export/sales	0.000	0.000	0.000	0.000	0.359	0.359	0.282	0.274
Number of employees	8.535	8.006	14.516	16.417	38.874	35.393	48.045	48.090
Number of firms	41,599	43,298	5,277	4,791	7,357	7,299	7,613	7,375

Note: The table displays aggregate numbers for the four firm types.

Table 2: Characteristics of Exporting Firms in 2008

	Service exporters	Goods exporters	Service and goods exporters	Service exporters	Goods exporters	Service and goods exporters
log employment	0.535	0.859	1.056			
log employment, high-skilled	0.416	0.505	0.712	0.091	0.062	0.167
log employment, medium-skilled	0.327	0.859	0.995	-0.145	0.123	0.119
log employment, low-skilled	0.415	0.515	0.607	0.030	-0.063	-0.092
log total sales	0.949	1.675	2.028	0.276	0.533	0.683
log value-added per worker	0.179	0.423	0.486	0.057	0.234	0.293
log capital per worker	-0.251	0.163	0.066	-0.069	0.206	0.205
log TFP	0.260	0.433	0.527	0.071	0.190	0.250
log wage bill per worker	0.223	0.271	0.317	0.073	0.062	0.083
Industry fixed effects	no	no	no	yes	yes	yes
log employment	no	no	no	yes	yes	yes

Note: All results are from regressions of the firm characteristics in the first column on three dummies indicating the type of exporting firm.

Table 3. Productivity Effects of Goods and Services Export

	Manufacturing sector				Service sector			
dependent variable:	Δlog(TFP)	Δlog(TFP)	Δlog(VA/L)	Δlog(VA/L)	Δlog(TFP)	Δlog(TFP)	Δlog(VA/L)	Δlog(VA/L)
Stops exporting services	-0.0587**	-0.0495*	-0.0565**	-0.0461	0.0138	0.0231	0.0187	0.0282
	[-2.13]	[-1.78]	[-2.03]	[-1.64]	[0.75]	[1.23]	[1.00]	[1.48]
Starts exporting services	-0.0079	-0.0202	-0.0105	-0.0238	0.0629***	0.0516***	0.0590***	0.0473**
	[-0.31]	[-0.79]	[-0.41]	[-0.92]	[3.39]	[2.71]	[3.13]	[2.45]
Exports services throughout	-0.0735***	-0.0735***	-0.0740***	-0.0739***	-0.0024	-0.0017	-0.0038	-0.0031
	[-3.11]	[-3.11]	[-3.09]	[-3.10]	[-0.17]	[-0.12]	[-0.27]	[-0.22]
Stops exporting goods	-0.0379	-0.0265	-0.0276	-0.0174	0.0230	0.0283	0.0345	0.0392*
	[-1.12]	[-0.78]	[-0.80]	[-0.50]	[1.04]	[1.26]	[1.53]	[1.72]
Starts exporting goods	0.1475***	0.1323***	0.1370***	0.1229***	0.1415***	0.1341***	0.1296***	0.1227***
	[4.94]	[4.38]	[4.54]	[4.03]	[6.51]	[6.09]	[5.87]	[5.49]
Exports goods throughout	0.0520***	0.0512***	0.0530***	0.0521***	0.0437***	0.0432***	0.0426***	0.0421***
	[2.83]	[2.79]	[2.85]	[2.81]	[2.92]	[2.88]	[2.80]	[2.77]
ΔServices export intensity		0.3113***		0.3250***		0.1365***		0.1381***
		[3.36]		[3.47]		[3.30]		[3.29]
ΔGoods export intensity		0.1494***		0.1359**		0.1145**		0.1081**
		[2.86]		[2.57]		[2.56]		[2.38]
ΔShare of employees with higher education	0.1777***	0.1746***	0.2119***	0.2079***	0.2456***	0.2448***	0.2627***	0.2619***
	[3.10]	[3.05]	[3.66]	[3.59]	[9.82]	[9.79]	[10.35]	[10.32]
ΔShare of employees with vocational education	0.2514***	0.2486***	0.2749***	0.2717***	0.2660***	0.2656***	0.2843***	0.2838***
	[6.75]	[6.67]	[7.30]	[7.22]	[16.12]	[16.10]	[16.97]	[16.95]
Δlog(capital per employee)	-0.0690***	-0.0692***	0.1464***	0.1462***	-0.0938***	-0.0939***	0.1217***	0.1215***
	[-11.22]	[-11.26]	[23.54]	[23.54]	[-34.28]	[-34.32]	[43.80]	[43.76]
Observations	6547	6547	6547	6547	24968	24968	24968	24968
R-squared	0.0508	0.0532	0.1098	0.1120	0.2393	0.2397	0.2484	0.2489

Note: All regressions include industry dummies. t-statistics in brackets.*** indicates significance at 1% level, ** indicates significance at 5% level, and * indicates significance at 10% level.

Table 4. Value Added and Employment Effects of Goods and Services Exporting

	Manufacturing sector				Service sector			
dependent variable:	Δlog(VA)	Δlog(VA)	Δlog(Empl)	Δlog(Empl)	Δlog(VA)	Δlog(VA)	Δlog(Empl)	Δlog(Empl)
Stops exporting services	-0.0986***	-0.1115***	-0.0421	-0.0654**	-0.0748***	-0.0700***	-0.0935***	-0.0982***
	[-2.85]	[-3.18]	[-1.51]	[-2.32]	[-3.37]	[-3.11]	[-4.91]	[-5.08]
Starts exporting services	0.0387	0.0444	0.0492*	0.0681***	0.1354***	0.1303***	0.0765***	0.0830***
	[1.22]	[1.38]	[1.93]	[2.64]	[6.07]	[5.70]	[4.00]	[4.23]
Exports services throughout	-0.0649**	-0.0667**	0.0091	0.0072	0.0235	0.0243	0.0273*	0.0274*
	[-2.18]	[-2.24]	[0.38]	[0.30]	[1.42]	[1.47]	[1.92]	[1.93]
Stops exporting goods	-0.2263***	-0.1933***	-0.1987***	-0.1759***	-0.1861***	-0.1716***	-0.2206***	-0.2108***
	[-5.29]	[-4.50]	[-5.78]	[-5.09]	[-6.98]	[-6.37]	[-9.65]	[-9.12]
Starts exporting goods	0.3382***	0.3034***	0.2012***	0.1805***	0.3590***	0.3417***	0.2294***	0.2190***
	[8.99]	[7.99]	[6.65]	[5.91]	[13.75]	[12.92]	[10.24]	[9.65]
Exports goods throughout	0.0354	0.0349	-0.0175	-0.0172	0.0647***	0.0630***	0.0221	0.0209
	[1.53]	[1.51]	[-0.94]	[-0.93]	[3.59]	[3.50]	[1.43]	[1.35]
ΔServices export intensity		0.0601		-0.2649***		0.1068**		-0.0313
		[0.52]		[-2.83]		[2.15]		[-0.74]
ΔGoods export intensity		0.3957***		0.2598***		0.2314***		0.1233***
		[6.02]		[4.92]		[4.30]		[2.67]
ΔShare of employees with higher education	-0.4470***	-0.4321***	-0.6589***	-0.6400***	-0.0676**	-0.0680**	-0.3303***	-0.3299***
	[-6.20]	[-6.00]	[-11.36]	[-11.05]	[-2.25]	[-2.27]	[-12.81]	[-12.80]
ΔShare of employees with vocational education	-0.1769***	-0.1743***	-0.4518***	-0.4460***	-0.0669***	-0.0675***	-0.3512***	-0.3513***
	[-3.77]	[-3.72]	[-11.97]	[-11.84]	[-3.37]	[-3.40]	[-20.64]	[-20.65]
Δlog(capital per employee)	0.0595***	0.0586***	-0.0868***	-0.0876***	0.0340***	0.0339***	-0.0877***	-0.0876***
	[7.68]	[7.58]	[-13.93]	[-14.09]	[10.33]	[10.31]	[-31.08]	[-31.06]
Observations	6547	6547	6547	6547	24968	24968	24968	24968
R-squared	0.0486	0.0539	0.0839	0.0892	0.1622	0.1628	0.0807	0.0810

Note: All regressions include industry dummies. t-statistics in brackets.*** indicates significance at 1% level, ** indicates significance at 5% level, and * indicates significance at 10% level.

Table 5: Decomposition of Productivity Growth, 2002-2008

	TFP					Value added per worker				
	Own	Realloc.	Entry	Exit	Total	Own	Realloc.	Entry	Exit	Total
Manufacturing sector	0.182	0.146	-0.011	0.025	0.342	0.240	0.035	-0.035	0.040	0.280
	0.038	*0.030*	*-0.005*	*0.010*	*0.073*	*0.050*	*0.007*	*-0.012*	*0.015*	*0.060*
Service sector	-0.024	0.210	-0.045	0.013	0.155	0.014	0.115	-0.111	0.052	0.070
	-0.019	*0.167*	*-0.025*	*0.008*	*0.131*	*0.011*	*0.091*	*-0.073*	*0.032*	*0.061*
Intra-sector (weighted)	0.019	0.197	-0.030	0.018	0.204	0.061	0.098	-0.085	0.048	0.122
Inter-sector (weighted)		0.039	-0.007	0.001	0.033		0.018	-0.022	0.012	0.008
Total (weighted)	0.019	0.236	-0.036	0.019	0.237	0.061	0.117	-0.108	0.059	0.130

Note: Numbers in italics are weighted contributions to the change in total productivity. They sum to the intra-sector contribution.

Table 6: Decompositions of Counterfactual Scenarios

	TFP			Value added per worker		
	Own	Realloc.	Total	Own	Realloc.	Total
Counterfactual A: No change in exporting variables:						
Manufacturing sector	0.166	0.146	0.312	0.224	0.034	0.258
change compared to realized outcome	*-0.016*	*0.000*	*-0.016*	*-0.016*	*-0.001*	*-0.017*
Service sector	-0.043	0.192	0.149	-0.004	0.101	0.097
change compared to realized outcome	*-0.019*	*-0.018*	*-0.037*	*-0.018*	*-0.014*	*-0.032*
Counterfactual B: No change in goods exporting variables:						
Manufacturing sector	0.150	0.137	0.288	0.208	0.025	0.233
change compared to realized outcome	*-0.032*	*-0.008*	*-0.040*	*-0.032*	*-0.010*	*-0.042*
Service sector	-0.038	0.196	0.158	0.000	0.103	0.103
change compared to realized outcome	*-0.014*	*-0.014*	*-0.028*	*-0.014*	*-0.012*	*-0.026*
Counterfactual C: No change in service exporting variables:						
Manufacturing sector	0.198	0.155	0.354	0.256	0.044	0.300
change compared to realized outcome	*0.016*	*0.010*	*0.026*	*0.016*	*0.009*	*0.025*
Service sector	-0.029	0.206	0.177	0.010	0.112	0.122
change compared to realized outcome	*-0.004*	*-0.004*	*-0.009*	*-0.004*	*-0.003*	*-0.007*
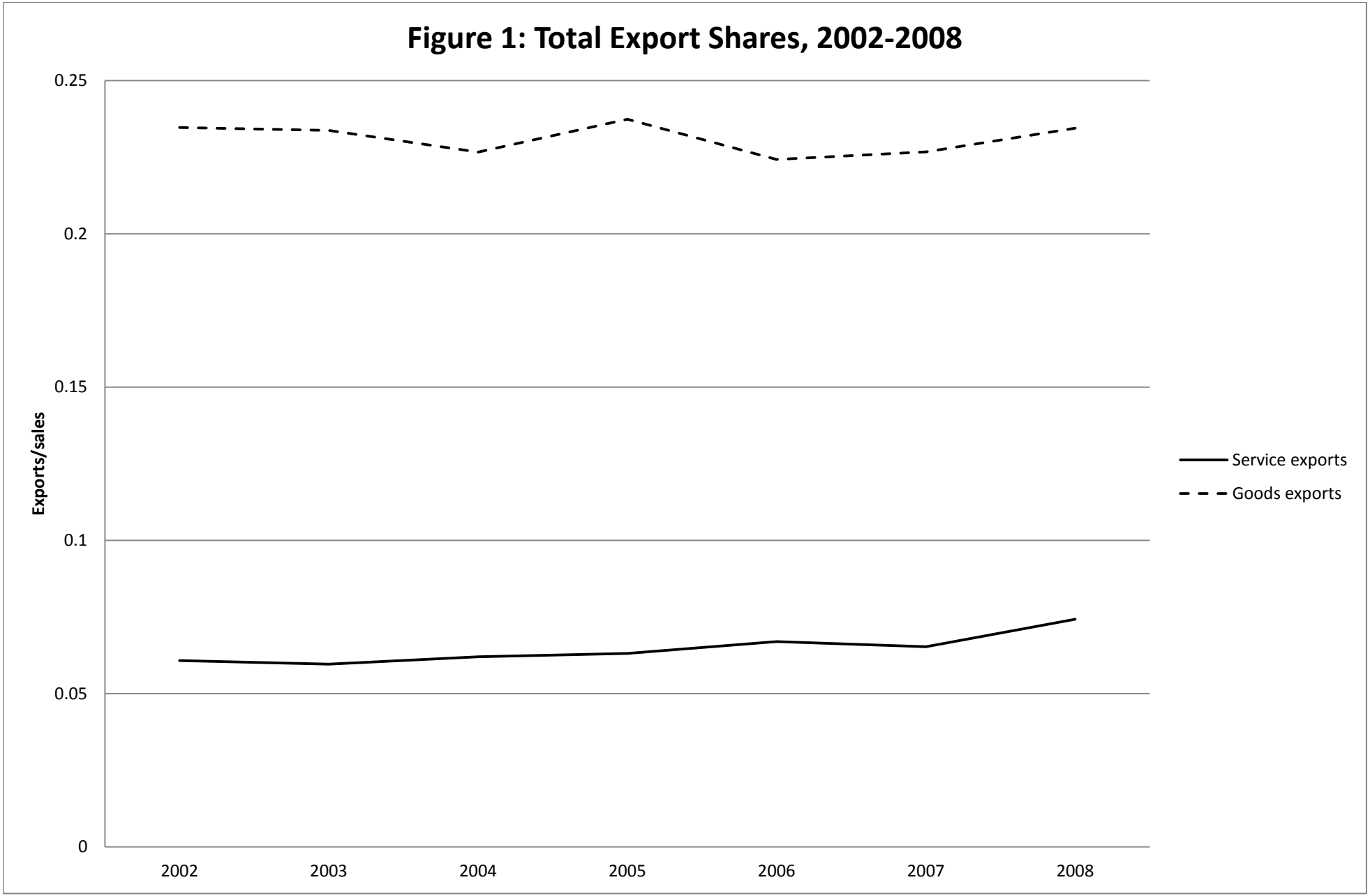
Figure 1: Total Export Shares, 2002-2008