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Exports and Profitability –

First Evidence for German Business Services Enterprises

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Abstract:

We use the unique recently released German business services statistics panel to conduct the first comprehensive empirical study on the relationship between exports and profitability for the business services sector. We document a negative profitability differential of services exporters compared to non-exporters that is statistically significant, though rather small, when observed firm characteristics and unobserved firm specific effects are controlled for. We find that export-starters in services are less profitable than non-starters, even two years before they begin to export, pointing to self-selection of less profitable firms into export markets. We use a recently developed continuous treatment approach to investigate the causal impact of exports on profits. The estimated dose-response function shows an s-shaped relationship between profitability in 2005 and firms' export-sales ratio in 2004. Enterprises with a very small share of exports in total sales have a lower rate of profit than non-exporting firms. Then, with an increase in export intensity the rate of profit increases, too. However, even at the maximum the average profitability of the exporters is not, or only slightly, higher than the average rate of profit of the non-exporting firms. Given that Germany is one of the leading actors on the world market for services, the evidence provided here is interesting on its own. Furthermore, it can serve as a benchmark for future studies using comparable data for firms from services industries in other countries.

Keywords: Exports, profitability, business services enterprises, Germany
JEL classification: F14, D21, L80

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1. Motivation

For manufacturing firms, a huge and emerging literature on the micro-econometrics of international trade provides evidence for a number of stylized facts: Exporting firms are more productive than otherwise identical firms that sell on the national market only.[1] Exporting firms have to bear extra costs due to, among others, market research in foreign countries, adaptation of products to local regulations, or transport costs. These extra costs are one reason for a self-selection of the more productive firms on international markets. Furthermore, exporting firms tend to pay higher wages than non-exporting firms.[2]

While this empirical evidence for manufacturing firms is widely known for some time now, comparable information for firms from services is scarce and of a more recent vintage. Vogel (2009a) finds that in Germany – that ranked as number three on the world market for services exports in 2007 (Bundesministerium für Wirtschaft und Technologie (2009)) - exporting firms from the business services sector have a significantly and substantially higher productivity than non-exporting firms, and pay significantly and substantially higher wages, after controlling for firm size and industry.

Does the productivity advantage found for exporting firms lead to a profitability advantage, or is it compensated by the extra costs facing exporters and by higher wages paid? Research in this topic has only recently started in a paper by Fryges

[1] See Bernard et al. (2007) for the U.S., Mayer and Ottaviano (2007) for European countries, Wagner (2007) for a survey of studies from countries all over the world, and The International Study Group on Exports and Productivity (2008) for strictly comparable results from 14 countries.

[2] See Schank, Schnabel and Wagner (2007) for a survey.

and Wagner (2008a).[3] For German manufacturing enterprises they document that the positive profitability differential of exporters compared to non-exporters is statistically significant, though rather small, when observed firm characteristics and unobserved firm specific effects are controlled for. In contrast to nearly all empirical studies on the relationship between productivity and exports Fryges and Wagner do not find any evidence for self-selection of more profitable firms into export markets. However, they show that exporting improves the profitability almost over the whole range of the export-sales ratio. Only firms that generate 90 percent and more of their total sales abroad do not benefit from exporting in terms of an increased rate of profit. This means, that the usually observed higher productivity of exporters is not completely absorbed by the extra costs of exporting or by higher wages paid by internationally active firms from manufacturing industries.

Comparable evidence for firms from services is lacking. This paper contributes to the literature by using the unique recently released German business services statistics panel to conduct the first comprehensive empirical study on the relationship between exports and profitability for the business services sector. Unless otherwise stated, business services are defined in this paper as NACE divisions 72 (computers and related activities, including, among others, hardware and software consultancy,

[3] Note that in the literature on international management the empirical investigation of the relationship between internationalisation and firm performance has a long tradition. However, given that the samples used in these studies tend to be small cross-section samples that do not allow to control for unobserved heterogeneity by including fixed firm effects, and that various measures of both internationalisation and performance are used (see Bausch and Krist (2007), p. 332), we cannot find an answer to our question – whether the productivity advantage of exporting services firms does lead to a profitability advantage of exporters compared to otherwise identical non-exporters even when exporters are facing extra costs and pay higher wages – from this literature (see Fryges and Wagner 2008a for an overview).

data processing, software publishing and database activities), 73 (research and development), and 74 (other business activities, including, for example, business, management and tax consultancy, advertising, legal activities, market research, and architectural and engineering activities). Even though the business services sector covers a wide range of activities, business services are traded more than most other services,[4] and these activities have in common that they provide primarily intermediate inputs.

To investigate the relationship between exports and profitability we follow the now standard approach in the micro-econometric literature on exports and productivity (see The International Study Group on Exports and Productivity (2008)). First, we document a negative profitability differential of services exporters compared to non-exporters that is statistically significant, though rather small, when observed firm characteristics and unobserved firm specific effects are controlled for. Based on these negative export profitability premia we analyse in a second step a possible self-selection of less profitable firms into export markets and find that export-starters in services are less profitable than non-starters, even two years before they begin to export. Finally, we analyse the effect of exporting on profitability. Unfortunately, the data used in our empirical study cover the years 2003 to 2005 only. Therefore, we cannot test whether services firms that started to export performed better or worse in the years after the start than their otherwise identical counterparts that did not start to export. Instead, we use a recently developed continuous treatment approach

[4] According to the German balance of payments, business services (defined as advertising, engineering, commercial and computer services) have by far the highest trade volume of any service other than travel and transport (cf. Deutsche Bundesbank (2008)). In addition, Jensen and Kletzer (2006) classified nearly all business services as tradable, based on the geographic concentration of service activities in the United States.

(described in detail in section 6 below) to investigate the causal impact of exports on profits. The estimated dose-response function for all business services sectors (NACE 72 to 74) shows an s-shaped relationship between profitability in 2005 and firms' export-sales ratio in 2004, and the same picture is found when looking at the more disaggregated two-digit NACE level separately. Enterprises with a very small share of exports in total sales have a lower rate of profit than non-exporting firms. Then, with an increase in export intensity the rate of profit increases, too. However, even at the maximum of the dose response function the average profitability of the exporters is not or only slightly higher than the average rate of profit of the non-exporting firms. Beyond the maximum, firms exhibit a decrease in profitability compared to firms with lower export intensities. This decrease might be a result of additional costs of exporting, for instance due to rising costs of coordination and control of a firm's export activities or higher travel or transportation costs due to the increasing geographical distance of the foreign markets a firm has entered.

These findings for German service sector exporters stand in stark contrast to the results from the investigation of exporters from German manufacturing industries reported by Fryges and Wagner (2008a). Given that Germany is one of the leading actors on the world market for both goods and services, the evidence provided here is interesting on its own. Furthermore, it can serve as a benchmark for future studies using comparable data from other countries.

The rest of the paper is organised as follows: Section 2 introduces our data base, the German statistics on business services. Section 3 presents results from descriptive comparisons of exporting and non-exporting business services firms. Section 4 reports estimations of exporter profitability premia after controlling for observed and unobserved differences between exporters and non-exporters. Section 5 documents whether differences between export starters and non-exporters exists

even before the future exporters starts to export and Section 6 investigates the causal effect of exporting on profitability using the recently developed generalised propensity score (GPS) methodology. Section 7 concludes.

2. Data

To investigate the relationship between export and profitability of German business services enterprises, we use the business services statistics (*Strukturerhebung im Dienstleistungsbereich*) established by the German Federal Statistical Office and the statistical offices of the Federal States (*Länder*). The statistics were first compiled for the year 2000 on the initiative of the European Union. The data covers the enterprises and professions (*Freie Berufe*) of the NACE divisions I (transport, storage and communication) and K (real estate, renting and business activities) with an annual turnover of €17,500 or more. A stratified random sample is used to select the enterprises. The stratification is based on the federal states, 4-digit industries, and 12 size ranges (in terms of turnover or employees). For 2005, the following sample sizes are drawn from the three industries analysed in this paper: 18.3% of all statistical units from the NACE division 72 (computer and related activities), 36.9% of all statistical units from the NACE division 73 (research and development) and 12.6% of all statistical units from the NACE division 74 (other business activities). Because the same enterprises that participated in 2003 also participated in 2004 and 2005, it is possible to merge the cross-sectional datasets to a panel dataset that covers the years 2003 to 2005.

The business services statistics include, among other data, information about the economic sector, the number of persons employed (not including temporary workers), total turnover, salaries and wages, and export – defined as turnover for business with companies located abroad, including exports to foreign affiliates.

Unfortunately, information on the target countries of exports is not included in the statistics. Also, no information is obtained about other forms of companies' activities abroad, such as cooperation, direct investments, or imports. Furthermore, small enterprises with an annual turnover lower than 250,000 € are given a shorter questionnaire, so important information, such as information about export activities, is missing for these enterprises. As a result, only enterprises with an annual turnover over 250,000 € are considered for the analyses.

These data are confidential but not exclusive. They can be used by researchers on a contractual basis via controlled remote data access inside the research data centres of the German Statistical Offices (see Zühlke et al. (2004) for details).[5] For more details about the German business services statistics panel see Vogel (2009b).

3. Descriptive analysis

3.1 Export participation of business services firms

The enterprises' export activities are measured by the export intensity, defined as the percentage of exports in total turnover. Regarding all business services industries, the share of exporters in all enterprises was about 14 percent in 2003 and about 16 percent in 2005. Table 1 shows that in both years the distribution of the export intensity was highly skewed – most of the exporters sold a relative small share of their total production abroad, and only a few firms exported a very high share. Looking at the more disaggregated industry level, the highest export participation

[5] To facilitate replication the Stata do-files used in the computations are available from the first author upon request.

was in the research and development sector (about 36 percent in 2005), followed by computer and related activities (about 25 percent in 2005).[6]

[Table 1 near here]

3.2 Profitability of exporting and non-exporting firms

As a first step in our empirical investigation we compare the profitability of exporting and non-exporting business services firms. The rate of profit of a firm is computed as a rate of return, defined as gross firm surplus (computed in line with the definition of the European Commission (1998) as gross value added at factor costs minus gross wages and salaries minus costs for social insurance paid by the firm) divided by total sales (net of VAT) minus net change of inventories.[7]

Our profit measure is a measure for the price-cost margin which, under competitive conditions, should on average equal the required rental on assets employed per money unit of sales (see Schmalensee (1989), p. 960f.). Differences in profitability between firms, therefore, can follow from productivity differences, but also from different mark-ups of prices over costs and from differences in the capital intensity. Given that our data set does not have information on the capital stock employed by the firms in our econometric investigations we control for differences in

[6] To explain the high export participation in the research and development sector it has to be mentioned that privately organised entities, owned by German research institutions such as the Max Planck Society, the Fraunhofer Society, Helmholtz Association of National Research Centres, and public research institutions of the federal and Länder governments are included. Usually, these institutions are intensively integrated in international networks (Eickelpasch (2008)).

[7] Note that the data set does not have any information on the capital stock, or the sum of assets or equity, of the firm, so that it is not possible to construct profit indicators based thereon like return on assets or return on equity.

the capital intensity by including a complete set of industry dummy variables at the most disaggregated (4-digit) level.

Table 2 reports the mean and selected percentiles of the distribution of the rate of profit for all business services enterprises within different classes of the export intensity. In contrast to the evidence from the manufacturing sector (see Fryges and Wagner 2008a) the descriptive results show that non-exporting enterprises tend to have a higher rate of profit than exporters. This holds for the mean profitability and for almost all considered percentiles. The results indicate that the mean profitability (or the percentiles of the profitability distribution) of firms that export only a small share of their total sales (less than 10 percent) falls below that of non-exporting firms. The pattern over the higher export intensity classes, however, does not reveal any clear pattern.

[Table 2 near here]

4. Exporter profitability premia

The next step in our empirical investigation consists of the estimation of so-called exporter profitability premia that indicate the ceteris paribus difference in profitability between exporting and non-exporting enterprises, controlling for other characteristics of the enterprises. In analogy with the now standard approach in the micro-econometric literature on exports and productivity (see The International Study Group on Exports and Productivity (2008)) pooled data are used to regress the rate of profit on the export activity of the enterprise plus a set of control variables including firm size (measured as the number of employees and its squared value), and a full set of interaction terms of the year of observation and the 4-digit industry the enterprise is active in.

Export activity of an enterprise is measured in four different ways, i.e. by a dummy variable that takes on the value of one if an enterprise is an exporter (and zero otherwise), by the share of exports in total sales, by the share of exports in total sales and its squared value, and by the share of exports in total sales plus its squared and its cubic value. While the dummy variable for exporting firms tests for the presence or not of an exporter profitability premium per se, the estimated coefficient of the share of exports in total sales shows whether or not this premium increases with an increase in the relative importance of exports for an enterprise. The quadratic terms test for the presence or not of a so-called threshold of internationalisation – whether the positive effects vanish and become even negative when the optimal share of exports in total sales is exceeded because increasing costs of exporting exceed the extra benefits. The cubic term tests for an s-shaped relationship between profitability and the share of exports in total sales that is suggested in recent studies from the international management literature.[8]

For all business services (NACE divisions 72 to 74) the results based on empirical models using pooled data without fixed enterprise effects are reported in columns 1 to 4 of Table 3. According to the results in column 1 exporting firms have a rate of profit that is nearly four percentage points lower ceteris paribus than in non-exporting firms (a difference that matches the order of magnitude showing up in the descriptive analysis that does not control for firm size, and industry and time effects, reported in Table 2), and from column 3 we see that the pattern of the relationship between export intensity and profitability is u-shaped with an estimated minimum at a level of exports to sales of 56 percent. According to column 4, there is evidence for a

[8] See Contractor (2007) for a discussion of this s-shaped relationship in a longitudinal perspective that investigates the relationship between internationalisation and performance when a firm increases its international activities over time.

s-shaped relationship, with an estimated inflection point at an export intensity level of 55 percent, a minimum at 32 percent, and a maximum at an export intensity of 78 percent. In both the quadratic and cubic function there exists no export intensity level where exporters have a higher predicted rate of profit than the average ceteris paribus profitability level of non-exporters.

If unobserved firm heterogeneity[9] is controlled for by including fixed enterprise effects, still a negative relationship between exporting and the rate of profit is found. From column 5 and 6 we see that the estimated coefficients of the exporter dummy and the export intensity variable are negative and statistically significant at a usual level. Exporters have on average a rate of profit that is 0.7 percentage points lower ceteris paribus than in non-exporting enterprises, and an increase in the exports-sales ratio of ten percentage points is accompanied by a decrease in the profit rate by 0.3 percentage points. However, from the models with fixed enterprise effects we do not have any evidence that the relationship between the share of exports in total sales and profitability is nonlinear.

[Table 3 near here]

When we look at the more disaggregated industry level, we find almost similar results in terms of signs and significance levels (see Table 4).[10] The highest

[9] These characteristics may include such factors as the age of the firm, the geographical scope of exports, financial constraints, or the degree of risk aversion and international orientation of the managers.

[10] Due to space restrictions only the estimated coefficients of the exporter dummy are presented in Table 4. The more detailed tables that include also the estimated coefficients of the share of exports in total sales are available on request.

difference concerning the rate of profit between exporting and non-exporting enterprises exists in the economic branch of architectural and engineering activities. Here, based on the pooled regression model exporters have a rate of profit that is seven percentage points lower than the profitability level of non-exporters. And even in the model with fixed effects, exporters show a economically and statistically significant lower profitability level of nearly three percentage points.

[Table 4 near here]

The negative exporter premia found in regression models using pooled data for exporters and non-exporters cannot be interpreted as indicators for a negative causal effect of exporting on profitability:

On the one hand, it might be the case that there is self-selection of less profitable firms into exporting, because exports are viewed as a chance to raise the rate of profit above the level that can be earned on the national market. Further, Vogel (2009a) shows for West German business services firms a self-selection into export markets of firms' that pay higher average wages, that reflects the importance of intangible assets by which it is possible to create a competitive advantage over national and international rivals. Particularly in the labour-intensive business service sector firms' need highly qualified human capital to generate competitive advantages in form of customer specific superior products. However, it is more difficult to absorb the higher average wages that are related with the need for highly qualified human capital by means of the firms' higher productivity. Thus, we would expect a self-

selection of enterprises that pay higher wages, are more productive, but are less profitable.[11]

On the other hand, exporting might decrease profitability by higher additional costs related to export activities itself, or due to the fact that foreign services markets are more competitive. Both directions of causality are possible. In the following, therefore, Section 5 investigates whether export starters are less profitable than non-exporters, even before they begin to export and Section 6 analyses the causal effect of a firm's export activity on its rate of profit.

5. Pre-entry profitability premia of export starters

Again following the now standard approach in the micro-econometric literature on exports and productivity (see The International Study Group on Exports and Productivity (2008)) the next step in our empirical investigation, consists in testing whether we can document that enterprises that begin to export are less profitable than non-exporters, even before they begin to export. To do so, we identify a group of firms that did not export over a time span of the two years t-2 to t-1. Some of these firms started to export in year t (these are called export starters of cohort t), some did not (these are called non-starters of cohort t). We then compare the export starters and the non-starters of cohort t

- in year t, and

- two years back in year t-2.

Given that our data cover the years 2003 to 2005, we can investigate the cohort for t = 2005 only. Results are reported in Table 5.

[11] Note that in this case one would expect a profitability level of export starters that is smaller than that of non-exporters, but not a negative rate of profit of export starters.

[Table 5 near here]

First, we compute the ceteris paribus percentage profitability difference between export starters and non-starters in 2005, the year of start. In line with the above presented pooled regression results, in all considered industries export starters are less profitable than non-starters in t. However, this negative profit premium for export starters is not statistically significant in NACE section 73 (where the number of observations is very small) and NACE section 74.1.

Second, the ex-ante profitability premia in year 2003 (t-2) is the estimated regression coefficient of a dummy variable (taking the value one for export starters in 2005, and zero for non-starters) from an OLS-regression of the rate of profit in 2003 on this dummy, controlling for firm size (number of employees and number of employees squared), and the 4-digit industry, all measured in year 2003.[12] This coefficient is negative for all considered industries and statistically significant (at least at the 5 percent level) for enterprises with architectural and engineering activities (NACE 74.2), and for other business activities (NACE 74 without 74.1 and 74.2). Therefore, we conclude that in contrast to nearly all empirical studies on the relationship between productivity and exports we have no evidence for self-selection of more profitable firms into exporting. In fact, we even have evidence that two years before the export starters begin to export, the non-starters have a higher level of profit than the starters. Regarding the coefficient for all business services (NACE 72 to 74) the difference is not only statistically significant but also economically large.

[12] At first sight it might confuse that we regress the rate of profit in t-2 on a dummy variable measured later in year t. Note, however, that this regression is not meant to "explain" past profits by today's exports – it is just a way to test whether or not profits did differ between today's starters and today's non-exporters two years before the start.

Thus, in 2003 (t-2) the rate of profit of the non-starters is on average four percentage points higher than the profitability of the export starters.

The negative profitability premium of exporters that was found in both the descriptive analyses reported in section 3.2 and as a result of the econometric investigation presented in Table 3 and 4 could be caused also by negative effects of exports on the rate of profit. However, due to the time frame of the data used we cannot test the hypothesis that firms which started to export performed worse in the years after the start compared to their counterparts that did not start. As pointed out in section 2, the German business services statistics panel covers only the years 2003 to 2005. Therefore, it is not possible to follow the cohort of starters from 2005 over the next year(s).

6. Causal effect of exports on profitability

In the last step of our analysis we examine whether there is a causal effect of a firm's export activity on its rate of profit. As stated in the previous section, we cannot evaluate post-entry differences in profitability between export starters and non-starters due to the time frame of the German business services statistics. Nonetheless, the question of whether exports have a negative effect on profitability is crucial for our analysis.

The hypothesis of a negative causal effect of exporting on profitability is tested using the generalised propensity score (GPS) methodology recently developed by Imbens (2000) and Hirano and Imbens (2004). The GPS methodology was introduced to the literature examining the export-performance relationship by Fryges (2008) and applied by Fryges and Wagner (2008a, 2008b) who estimated the relationship between exports and labour productivity growth, and the relationship between exports and profitability using a sample of German manufacturing firms.

The GPS methodology has a number of advantages compared to other econometric techniques. Firstly, the GPS method allows for continuous treatment, i.e., different levels of the firms' export-sales ratio. In this way, we are able to determine the causal relationship between profitability and the export-sales ratio (the treatment) at each value of firms' export intensity in the interval from zero to one. Thus, the second important advantage of the GPS method is that it enables us to identify the entire function of the rate of profit over all possible values of the continuous treatment variable. This property of the GPS methodology might be important in our case. The OLS regression of the determinants of the rate of profit in Table 3 pointed out that there might be a nonlinear relationship between profitability and the share of exports in total sales – at least if we restrict ourselves on the estimations without unobserved heterogeneity. The GPS methodology allows to test how the causal impact of exporting on profits varies along the range of the export-sales ratio from zero to one.

Thirdly, the continuous treatment approach allows us to analyse the level of the export intensity at which profitability is maximised (or minimised) or whether the relationship between the export-sales ratio and the rate of profit exhibits turning points or discontinuities (cf. Flores 2004). A detailed description of the GPS methodology is presented in Fryges/ Wagner (2008a, appendix A.1).

Using the GPS methodology, we do not compare export starters versus non-starters. Export starters that have entered the foreign market during the previous year generally show a very small export-sales ratio. Thus, restricting the analysis to export starters precludes a reliable estimation of the causal effect of medium-sized and large export-sales ratios on profitability. Our causal analysis in this section therefore includes export starters as well as firms that export for decades. We estimate the causal effect of the export-sales ratio measured in period t on the rate of

profit in t+1.[13] In this way, the GPS method is an appropriate econometric technique that provides an analysis of the causal effect of exporting on profitability despite the fact that, due to data restrictions, we cannot follow cohorts of starters over the next years after foreign market entry.

Hirano and Imbens (2004) suggest a three-stage approach to implement the GPS method. In the first stage, the conditional distribution of the treatment variable given the covariates is estimated. In our case, the distribution of the treatment variable, i.e. the export-sales ratio, is highly skewed. In particular, it has many limit observations at the value zero, representing firms without any exports. The latter group of firms decided that their optimal volume of exports was zero. Following Wagner (2001, 2003), we apply the fractional logit model developed by Papke and Wooldridge (1996) to estimate the export intensity of the firms in our sample.[14] In the second stage of the GPS method the conditional expectation of outcome (rate of profit in our case) is modelled as a function of the treatment and the (estimated) generalised propensity score. In the last stage, we estimate a dose-response function that depicts the conditional expectation of profitability given the continuous treatment (export-sales ratio) and the GPS, evaluated at any level of the continuous treatment variable in the interval from zero to one.

As stated above, we first estimate the conditional distribution of the export-sales ratio given the covariates, applying the fractional logit model. The exogenous

[13] We do not estimate the contemporaneous effect of the export-sales ratio in *t* on the rate of profit in *t*, because this raises the problem that wages per employee that are included in the fractional logit estimation of the export-sales ratio (see below) are endogenous since wages are a component of our measure of profitability. This problem is solved when the lagged effect of the export-sales ratio on profitability is estimated.

[14] Hirano and Imbens (2004) use a normal distribution for (the logarithm of) the treatment variable of their model. However, they emphasise that more general models may be considered.

covariates of the fractional logit model include firm size (measured as the log of number of employees and its squared value), the log of wages and salaries per employee, the share of part-time employees, the log of the firms' lagged labour productivity (measured as sales per employee in t-1), and the share of purchased goods and services for resale on total turnover (as a proxy for product diversification). The average wage per employee is used to proxy differences in firms' human capital. Because of the high level of interaction between user and provider, particularly in the service sector, employees must have good language skills and a high level of intercultural competence to establish and maintain certain contacts with the foreign market (cf. McLaughlin and Fitzsimmons (1996), Winstead and Patterson (1998)). Further, a firm with a highly qualified human capital is likely to generate intangible assets (e.g., a technologically superior product or costumer-specific superior products) leading to a competitive advantage of the firm over its (international) rivals and enabling the firm to realise a high export intensity. In order to control whether using the average wage per employee is misleading, we employ available information on the proportion of employees who work part time

The lagged labour productivity is included as a covariate in order to account for self-selection of more productive firms into the international market. While we did not find any evidence for a self-selection effect of more profitable firms (see section 5), most studies in the literature about the manufacturing sector confirm the self-selection hypothesis of firms with higher labour productivity (cf. Wagner (2007) for a survey) and also for the German business services sector evidence for self-selection

of more productive firms is found (cf. Vogel (2009a)).[15] Thus, firms with a higher labour productivity in t-1 are expected to generate a higher share of total sales abroad. The model was estimated for the export intensity in t = 2004, and the set of covariates finally contains 4-digit industry and legal status dummies, and an Eastern Germany dummy.

The results of the fractional logit model are presented in Table 6.[16] Firm size has a positive effect on the export-sales ratio; in the sectors research and development, architectural and engineering activities, and other business activities this effect, however, is not statistically significant. The negative sign of the squared value of the number of employees is insignificant in all of the considered industries. As hypothesised, firms with a higher average wage per employee have a higher export intensity, reflecting the importance of a firm's intangible assets by which it is able to create a competitive advantage over its international rivals. Except for architectural and engineering activities, this effect is significant in all business services industries. The lagged labour productivity is also positively correlated with the share of exports in total sales: Firms that exhibited a higher labour productivity in the past are able to bear the additional costs of exporting and to extend their international business activities. It can also be argued that more productive firms have a competitive advantage when compared with their (foreign) counterparts.

[15] Concerning the turnover per employed person Vogel (2009a) finds for West German business services enterprises significant differences between enterprises beginning to export and those that are not. Further, also positive pre-entry premia in terms of value added per employed person are found in the dataset, but these premia were not statistically significant.

[16] The sample we used to estimate the fractional logit model is restricted to those firms for which data on profitability in 2005 (t+1) and data on labour productivity in 2003 (t-1) is available in the data set. Due to the sampling frame of our data set, this reduces significantly the number of observations compared to Table 4.

Thus, more productive firms are more likely to generate a higher share of total sales abroad. However, in the industries computer and related activities, and research and development the positive coefficients are not significant at any conventional level.

[Table 6 near here]

The fractional logit model is estimated in order to calculate the generalised propensity score (GPS). As Imbens (2000) shows, adjusting for the GPS removes all the bias associated with differences in covariates between treated (exporting) and non-treated (non-exporting) firms. Thus, in the second stage of Hirano and Imbens' GPS methodology the conditional expectation of the rate of profit in 2005 (outcome) is modelled as a function of the export intensity in 2004 (treatment) and the estimated generalised propensity score. To approximate the predictor for the conditional expectation of the outcome we use a polynomial function with a cubic term of the treatment variable and a cubic term of the estimated GPS. In the last stage of the GPS method, the average expected outcome at each export intensity (treatment level) in the interval from zero to one is estimated, using the regression coefficients from the second stage of the GPS method. Thus we obtain an estimate of the entire dose-response function that shows the average potential outcome at each dose of the treatment and how average responses vary along the interval from zero to one. The confidence intervals of the dose-response functions in this paper are determined via bootstrapping.[17]

[17] Computations were done using Stata 10 and the Stata package for the estimation of dose-response functions (see Bia and Mattei (2008)) that was adjusted by the authors concerning the use of the fractional logit model in the first step of the GPS method.

The dose-response function that represents the expected profitability conditional on the export-sales ratio and the GPS is depicted in Figure 1.

[Figure 1 near here]

Due to the fact that only a small number of firms in the data set have an export intensity that is greater than 50 percent (see Table 2), we restrict our interpretation on the export intensity interval from zero to 50 percent. The estimated dose-response function for all business services sectors (NACE 72 to 74) shows an s-shaped relationship between profitability in 2005 and firms' export-sales ratio in 2004. The maximum value of the rate of profit is reached at an export-sales ratio of 44 percent, where the expected value of the rate of profit amounts to 18.5 percent. Enterprises that do not export show an expected rate of profit of 17.7 percent. The same picture arises when looking at the more disaggregated industry level: In enterprises with a very small share of exports in total sales the rate of profit falls below the profitability level of non-exporting firms. Then, with increasing export intensity the rate of profit increases, too. However, even at the maximum the average profitability of the exporters is at most slightly higher than the average rate of profit of the non-exporting firms.[18] Beyond the maximum, firms exhibit a decrease in profitability compared to firms with lower export intensities. This decrease might be a result of additional costs of exporting, for instance due to rising costs of coordination and control of a firm's

[18] Exceptions are the business consultancy, market research, etc. sector (NACE 74.1) and the research and development sector (NACE 73) where the profitability level of exporters at the maximum is 16 percentage points or 8 percentage points respectively higher than the value of non-exporters. However, note that the bootstrapped confidence intervals are very large at the maximum of these two sectors.

export activities, or higher travel or transportation costs due to the increasing geographical distance of the foreign markets a firm has entered.

The results we obtained in this section are very similar to those described in section 4. At least, the estimation results without fixed enterprise effects as reported in columns 1 to 4 of Table 3 show an s-shaped relationship between profitability and the export-sales ratio. Based on the estimated function for all business services industries on column 4, the rate of profit reaches its maximum for an export-sales ratio of 78 percent whereas according to the estimated dose-response function the rate of profit reaches its maximum for an export intensity of 44 percent. According to the results of section 4, even at the maximum, exporters have a lower predicted rate of profit than the average profitability level of non-exporters. By contrast, the analysis based on the estimated dose-response function shows a profitability level of exporters at the maximum that is slightly higher than the profitability level of non-exporters. However, due to the fact that this difference is smaller than one percentage point and that only a few firms in the business service sector have a export intensity that is higher than 40 percent this difference is not economically relevant.

7. Conclusion

This paper presents descriptive evidence and results from econometric investigations that suggest that – contrary to firms from manufacturing industries – German firms in business services industries do not benefit from exporting in terms of a higher rate of profit. Given that exporting firms are more productive than non-exporting firms in both manufacturing and services industries in Germany this means that in the services sector (but not in manufacturing) any cost advantage due to higher productivity is

"eaten up" by higher costs related to export activities, or by higher wages paid in exporting compared to non-exporting firms.

We document that the negative profitability differential of services exporters compared to non-exporters is very small when observed firm characteristics and unobserved firm specific effects are controlled for. Therefore, exporting seems to be a business that is neither better nor worse than selling on the national market. The estimated dose-response function shows an s-shaped relationship between profitability and firms' export-sales ratio. Enterprises with a very small share of exports in total sales have a lower rate of profit than non-exporting firms. Then, with an increase in export intensity the rate of profit increases, too. This might be interpreted as follows: If services firms that start to export do so by exporting a small share of their total sales only they will face a decline in their rate of profit due to extra costs caused by export activities. If the share of exports in total sales increases over time, profits will rise up to the level earned on the national market – or the firms will leave the export market. Unfortunately, however, it is not possible to test whether this interpretation holds with the short panel of service firms available.

Given that Germany is one of the leading actors on the world market for both goods and services, the evidence provided here is interesting on its own. Furthermore, it can serve as a benchmark for future studies using comparable data for firms from services industries in other countries.

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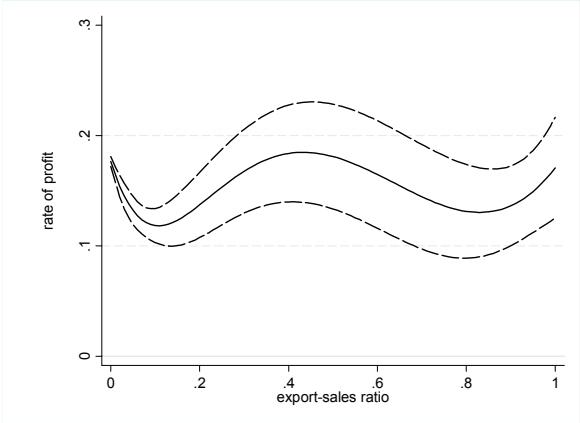
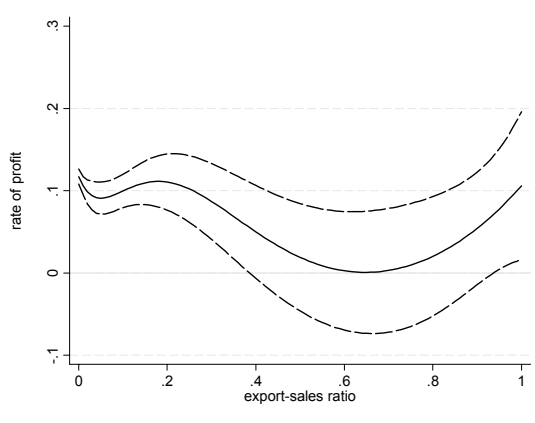
Figure 1: Estimated dose-response functions of the treatment export intensity in 2004 on the outcome rate of profit in 2005

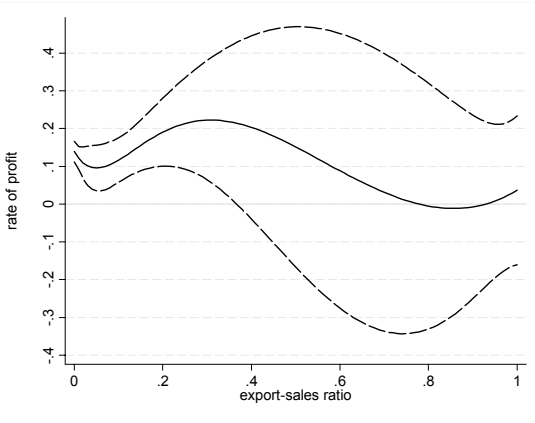
All business services (NACE 72 to 74)



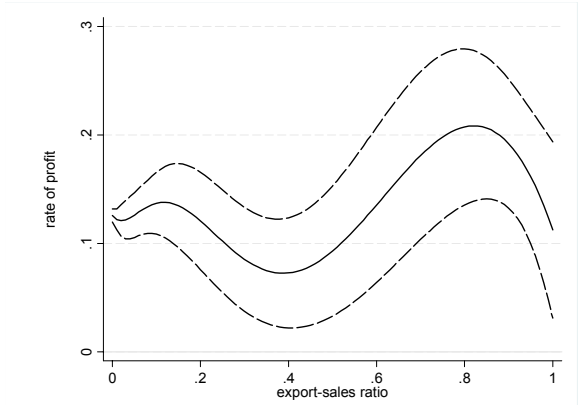
Computer and related activities (NACE 72)



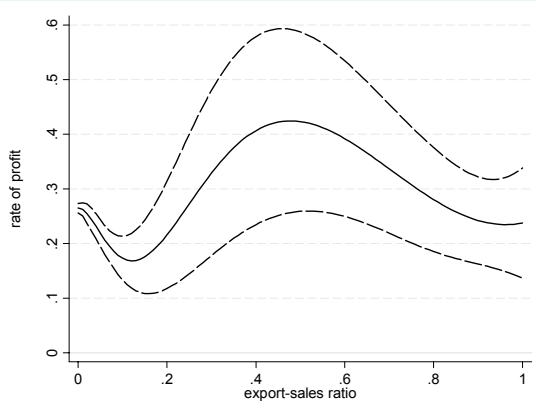
Research and development (NACE 73)



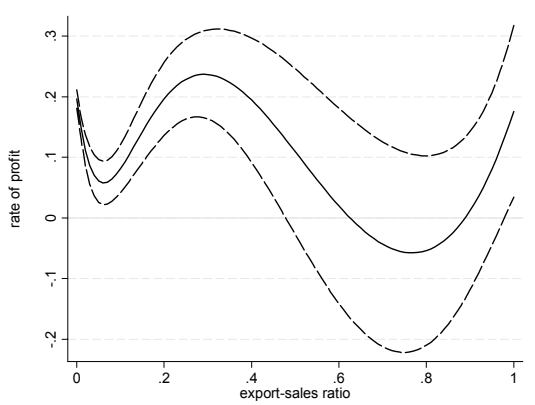
Other business activities (NACE 74 without 74.1 and 74.2)



Business consultancy, market research, etc* (NACE 74.1)



Architectural and engineering activities (NACE 74.2)



Note:
The solid lines indicate the estimated conditional expectation of enterprises' profits given the export intensity in t and the estimated generalised propensity score (GPS). The dotted lines indicate the simulated confidence bounds at 95% (based on bootstrapping with 100 replications). Only enterprises of the NACE division 72 to 74 with a turnover greater than €250,000 are considered. The 1st and 99th percentiles of the rate of profit distribution are excluded from all computations. (*) NACE code 74.1 includes legal, accounting, book-keeping and auditing activities; tax consultancy; market research and public opinion polling; and business and management consultancy.

Table 1: Export activities of business services enterprises 2003 and 2005 - Share of exporting enterprises in all enterprises (percentage)

Year	Export intensity	All business services (NACE 72 to 74)	Computer and related activities (NACE 72)	Research and development (NACE 73)	Other business activities (NACE 74 without 74.1 and 74.2)	Business consultancy, market research, etc* (NACE 74.1)	Architectural and engineering activities (NACE 74.2)
		Share of exporting enterprises on all enterprises in percentages					
2003	0%	86.29	75.39	65.90	87.79	86.96	90.99
	> 0% and < 5%	6.38	10.00	8.47	6.10	6.97	3.14
	≥ 5% and < 10%	1.92	4.04	5.22	1.53	1.71	1.35
	≥ 10% and < 25%	2.22	4.23	5.64	1.66	1.93	2.13
	≥ 25% and < 50%	1.58	3.67	6.47	1.44	1.20	0.94
	≥ 50% and < 75%	0.79	1.57	4.27	0.81	0.57	0.49
	≥ 75%	0.82	1.10	4.02	0.67	0.67	0.95
2005	0%	84.32	74.45	63.96	85.87	85.73	87.31
	> 0% and < 5%	7.05	9.52	9.00	7.15	7.12	4.80
	≥ 5% and < 10%	2.06	3.95	5.53	1.57	1.71	2.02
	≥ 10% and < 25%	2.66	5.47	7.03	2.31	2.10	2.14
	≥ 25% and < 50%	1.80	2.94	6.35	1.47	1.56	1.72
	≥ 50% and < 75%	0.97	1.76	3.78	0.81	0.86	0.70
	≥ 75%	1.13	1.92	4.35	0.82	0.92	1.31

Note:
(*) NACE code 74.1 includes legal, accounting, book-keeping and auditing activities; tax consultancy; market research and public opinion polling; and business and management consultancy.
Only enterprises of the NACE division 72 to 74 with a turnover greater than €250,000 are considered. All values are weighted with cross-sectional weights. The 1st and 99th percentiles of the rate of profit distribution are excluded from all computations.

Table 2: Rate of profite (percentage) for enterprises in different classes of the export intensity (2003 and 2005) – All business services

		All business services (NACE division 72 to 74)							
		Number of enterprises			Rate of profit (in percent)				
Year	Export intensity		Mean	Standard deviation	p1	p25	p50	p75	p99
2003	0%	19,279	27.46	25.96	-33.80	8.65	25.27	44.44	90.80
	> 0% and < 5%	1,759	25.13	23.72	-25.79	7.51	21.60	42.62	84.63
	≥ 5% and < 10%	521	23.90	27.00	-42.28	4.79	20.49	42.27	81.29
	≥ 10% and < 25%	669	19.25	25.48	-40.99	4.12	16.09	34.24	91.21
	≥ 25% and < 50%	423	23.50	27.72	-40.43	4.88	19.14	41.94	91.17
	≥ 50% and < 75%	205	18.63	28.99	x	4.14	18.53	36.66	x
	≥ 75%	220	14.43	27.79	x	2.05	13.65	26.38	x
2005	0%	20,416	25.16	26.67	-41.06	5.62	22.28	42.81	90.40
	> 0% and < 5%	2,033	21.20	23.81	-31.13	4.38	16.88	36.84	77.09
	≥ 5% and < 10%	620	17.06	22.74	-34.87	1.82	12.97	30.75	79.71
	≥ 10% and < 25%	810	18.67	27.62	-71.82	1.85	13.23	39.27	82.57
	≥ 25% and < 50%	521	17.27	27.28	-59.16	1.54	12.40	32.46	89.79
	≥ 50% and < 75%	238	22.66	30.12	x	3.47	23.89	42.91	x
	≥ 75%	296	19.99	30.23	x	2.58	14.75	40.16	x

Note:
(x) Due to the small number of observations these values were not revealed for publication by the statistical office. Only enterprises of the NACE division 72 to 74 with a turnover greater than €250,000 are considered. All values (except the number of enterprises) are weighted with cross-sectional weights. The 1st and 99th percentiles of the rate of profit distribution are excluded from all computations.

Table 3: Exports and profits: Evidence from regression models (2003 – 2005), all business services (NACE divisions 72 to 74)
Endogenous variable: Rate of profit (percentage)

		Pooled Data				Fixed enterprise effects			
	Model	1	2	3	4	5	6	7	8
Exogenous variable									
Exporter (Dummy; 1 = yes)	ß	-3.82				-0.71			
	p-value	0.000				0.052			
Export intensity (percentage)	ß		-0.0737	-0.2259	-0.4105		-0.0286	-0.0599	-0.0906
	p-value		0.000	0.000	0.000		0.021	0.119	0.206
Export intensity (squared)	ß			0.002	0.00906			0.000385	0.00155
	p-value			0.000	0.000			0.381	0.526
Export intensity (cubic)	ß				-0.000055				-0.000009
	p-value				0.000				0.631
Number of employees	ß	-0.00494	-0.00525	-0.00517	-0.00513	-0.00186	-0.00188	-0.00185	-0.00185
	p-value	0.000	0.000	0.000	0.000	0.232	0.230	0.235	0.236
Number of employees (squared)	ß	2.28e-07	2.39e-07	2.36e-07	2.35e-07	4.49e-8	4.51e-8	4.46e-8	4.45e-8
	p-value	0.001	0.001	0.001	0.001	0.189	0.186	0.191	0.192
Constant	ß	20.99	20.57	20.71	20.77	17.27	17.28	17.31	17.31
	p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Interaction terms of year and 4-digit industry		included	included	included	included	included	included	included	included
Number of observation		72,139	72,139	72,139	72,139	72,139	72,139	72,139	72,139
R^2		0.124	0.122	0.123	0.123	0.002	0.001	0.001	0.001

Note:
Only enterprises of the NACE division 72 to 74 with a turnover greater than €250,000 are considered. The p-values are based on cluster robust standard errors. The 1st and 99th percentiles of the rate of profit distribution are excluded from all computations.

Table 4: Profit premia of exporters (2003 – 2005): Evidence from regression models by service industries

		All business services (NACE 72 to 74)	Computer and related activities (NACE 72)	Research and development (NACE 73)	Other business activities (NACE 74 without 74.1 and 74.2)	Business consultancy, market research, etc* (NACE 74.1)	Architectural and engineering activities (NACE 74.2)
Profit premia (percentage points) of exporters (2003-2005)**							
Profit Premia of exporters	ß	-3.82	-3.23	-2.94	-2.72	-3.35	-7.32
(pooled model 2003 to 2005)	p-value	0.000	0.000	0.050	0.000	0.000	0.000
Profit Premia of exporters	ß	-0.71	-1.68	-1.06	-0.96	0.78	-2.88
(fixed effects model 2003 to 2005)	p-value	0.052	0.034	0.646	0.142	0.195	0.024
Number of observations		72,139	11,800	2,010	26,405	23,227	8,697

Note:
(*) NACE code 74.1 includes legal, accounting, book-keeping and auditing activities; tax consultancy; market research and public opinion polling; and business and management consultancy.
(**) Only enterprises of the NACE division 72 to 74 with a turnover greater than €250,000 are considered. The profit premia are estimated regression coefficients of a dummy variable (taking the value one for exporters, and zero for non-exporters) from an OLS-regression on the rate of profit on this dummy, controlling for the number of employees and its squared value, and a full set of interaction terms of year and 4-digit industry dummies. The p-values are based on cluster robust standard errors. The 1st and 99th percentiles of the rate of profit distribution are excluded from all computations.

Table 5: Profit premia of firms that start to export in 2005: Evidence from regression models by service industries

		All business services (NACE 72 to 74)	Computer and related activities (NACE 72)	Research and development (NACE 73)	Other business activities (NACE 74 without 74.1 and 74.2)	Business consultancy, market research, etc* (NACE 74.1)	Architectural and engineering activities (NACE 74.2)
Profit premia (percentage points) of enterprises that start to export in 2005**							
Profit premia of export starters in the start year	ß	-2.18	-3.64	-1.77	-3.73	-2.12	-8.71
	p-value	0.012	0.049	0.765	0.009	0.165	0.000
Pre-entry profit premia of export starters two years before start	ß	-3.97	-0.35	-0.65	-2.94	-0.63	-6.24
	p-value	0.000	0.846	0.874	0.050	0.681	0.016
Number of observations		12,915	1,763	253	5,095	4,157	1,647

Note:
(*) NACE code 74.1 includes legal, accounting, book-keeping and auditing activities; tax consultancy; market research and public opinion polling; and business and management consultancy.
(**) Only starters (enterprises with no export activities in 2003 and 2004, but export activities in 2005) and non-starters (enterprises that do not export between 2003 and 2005) of the NACE division 72 to 74 with a turnover greater than €250,000 are considered. The profit premia are estimated regression coefficients of a dummy variable (taking the value one for export starters, and zero for non-starters) from an OLS-regression on the rate of profit on this dummy, controlling for the number of employees and its squared value, and a set of 4-digit industry dummies. The p-values are based on robust standard errors. The 1st and 99th percentiles of the rate of profit distribution are excluded from all computations.

Table 6: Determinants of the export-sales ratio 2004 (endogenous variable) – results of fractional logit models

		All business services (NACE 72 to 74)	Computer and related activities (NACE 72)	Research and development (NACE 73)	Other business activities (NACE 74 without 74.1 and 74.2)	Business consultancy, market research, etc* (NACE 74.1)	Architectural and engineering activities (NACE 74.2)
Number of employees (log)	ß	0.2896	0.2970	0.2554	0.0601	0.5194	0.3255
	p-value	0.001	0.073	0.348	0.713	0.007	0.307
Number of employees (squared) (log)	ß	-0.0135	-0.0094	-0.0170	0.0076	-0.0412	-0.0052
	p-value	0.222	0.651	0.625	0.689	0.107	0.887
Wage per employee (log)	ß	0.3453	0.3895	0.5972	0.3697	0.3453	-0.0531
	p-value	0.000	0.035	0.015	0.002	0.005	0.861
Part-time workers (in percent)	ß	0.0006	0.0080	0.0009	-0.0031	0.0039	-0.0100
	p-value	0.728	0.065	0.875	0.315	0.224	0.114
Labour productivity (value added per employee) in t-1 (log)	ß	0.3244	0.1407	0.1322	0.2417	0.4386	0.5475
	p-value	0.000	0.178	0.472	0.000	0.000	0.000
Purchased goods and services for resale (in percent of turnover)	ß	0.0002	-0.0083	-0.0038	-0.0014	0.0011	0.0099
	p-value	0.920	0.017	0.665	0.607	0.760	0.014
Constant	ß	-10.8828	-8.8485	-11.5688	-9.4074	-14.0707	-10.2949
	p-value	0.000	0.000	0.000	0.000	0.000	0.002
Eastern-Germany, Legal status, and 4-digit industry dummies		included	included	included	included	included	included
Number of observations		16,520	2,735	465	6,195	5,111	2,014

Note:
(*) NACE code 74.1 includes legal, accounting, book-keeping and auditing activities; tax consultancy; market research and public opinion polling; and business and management consultancy.
Only enterprises of the NACE division 72 to 74 with a turnover greater than €250,000 are considered. The p-values are based on robust standard errors. The 1st and 99th percentiles of the rate of profit distribution are excluded from all computations.

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