WORKING PAPER

Determinants of Export Behaviour of German Business Services Companies

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University of Lüneburg
Working Paper Series in Economics

No. 123

March 2009

www.leuphana.de/vwl/papers

ISSN 1860 - 5508

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Abstract

The determinants of export behaviour at firm level have been widely investigated for manufacturing companies. By contrast, what has remained largely neglected is a detailed investigation in the service sector. As aggregate statistics show, international trade in services has grown significantly over the last few years. However, it is unclear why some companies export and others do not. This paper presents some initial results about the German business services sector at firm level. Using a unique panel dataset of enterprises from the business services sector (transport, storage and communication, real estate, renting and business activities) for the years 2003 to 2005, we analysed the impact of several firm-specific characteristics such as size, productivity, human capital, experience on the national market in Germany, etc. on the firms' export performance. Further, we used the pooled fractional probit estimator, recently introduced by Papke & Wooldridge, an approach that considers both the special nature of the export intensity variable and in addition unobserved time-invariant characteristics. When there is no control for fixed enterprise effects the overall results are in line with previous studies. When there is a control for unobserved heterogeneity, the positive effects of productivity and human capital disappear, indicating that these variables are not per se positively related to export performance, but rather to time-constant characteristics that are unobserved. Size and product diversification still have a positive and significant effect.

Keywords: Business services sector, export behaviour, firm performance
JEL classification: F14, F23, L80

Acknowledgements:
Particular thanks to Joachim Wagner for his readiness to discuss methodological questions, Anja Malchin and Ramona Pohl from the Research Data Centre in Berlin for providing the data, and Karl-Heinz Pesch from the Federal Statistical Office for valuable information concerning the specific characteristics of the business services statistics. To facilitate replication and extensions, the do-files used in this study are available on request.

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1 Motivation – Aim

In the last few years, the internationalisation of the economy has continued to increase undiminished. Accordingly, world trade is growing faster than the individual economies. This internationalisation is mainly determined by the exchange of goods, but more and more frequently by the exchange of services. The economies that wish to benefit from the growth of the world markets have to be successful not only in trading commodities but also services.

The growing internationalisation is mirrored in the German economy. This applies in particular to trading of products: in 2007, German companies exported 696 billion euros' worth of goods, according to the balance of payments. This was 62 percent more than in 2000 (in current prices). In addition, services were exported on a large scale. In 2007, the export of services (not including travel expenses) amounted to 135 billion euros. This was up 86 percent on 2000 (in current prices) and thus represented even greater growth than that of products.

In comparison with the export of commodities, the export of services makes other demands on the companies. Services are not generally standardised products: they are mostly customised and require intensive communication and interaction with clients. For this, geographical proximity is normally necessary. However, the limitations for export are reduced by developments in information and communication technologies. Companies are able to communicate with customers and suppliers long-distance.

Due to the above-mentioned developments, it is highly probable that the export orientation of service companies has increased over the last few years. However, there has only been limited information about the export behaviour of service companies, in contrast to that of manufacturing companies. Information on export behaviour is important in order to explore the prospects for internationalisation of companies.

To close this gap, this paper contributes to the literature by investigating for the first time the determinants of export behaviour in German business services enterprises at firm level. We focus our analysis on enterprises in selected lines of business such as transport, storage and communication, real estate, renting and business activities. With 680,000 firms, 6 million employees and a total turnover of 700 billion euros in 2005, these sectors are of particular importance for the German economy. The report is based on the official German statistics on business services (*Strukturerhebung im Dienstleistungsbereich*) which was launched in 2000. This is a unique set of data containing information on, inter alia, export,

turnover, labour costs, number of persons employed and gross investments. The statistics cover the period from 2000 to 2005.

We begin our analysis by applying a well-established methodology. We estimate the export behaviour using cross-sectional probit and fractional probit regressions. The first estimations investigate the probability of a company exporting or not exporting. The second approach also captures the export intensity of a company.

Further, we extend the analysis into a panel estimation by means of a recently introduced pooled fractional probit estimator developed by Papke & Wooldridge (2008) and rarely used to date. Thus, we are able to consider unobserved time-invariant characteristics of the enterprises involved in our analyses. This approach also takes into account the specific nature of the export intensity (percentage of exports to total turnover) as the dependent variable (Wagner 2008). For these panel econometric analyses, we use a balanced panel data set of the German business services statistics for the years 2003 to 2005.

Then Section 2 begins with an overview of the literature about the determinants of export performance. The German business services statistics are described in Section 3, while Section 4 describes our empirical model and estimation strategy. In Section 5 and 6, the results of the descriptive and econometric analyses are presented. The final section summarises the findings and discusses their implications.

2 The determinants of export performance: literature survey

Within the economics literature, determinants of export behaviour (namely the probability of being an exporter and export intensity, defined as the share of exports in total turnover) have been widely investigated in the manufacturing sector. Evidence is available, for example, for Germany (e.g. Arndt et al. 2008, Engelmann & Fuchs 2008, Roper & Love 2002, Wagner 2001, Wagner 2008), the United Kingdom (Bleaney & Wakelin 1999, Roper & Love 2002, Wakelin 1998), the United States (Bernard & Jensen 1999), Ireland and Northern Ireland (Roper et al. 2006), Italy (Sterlacchini 2001) and also for developing countries such as Indonesia (van Dijk 2002) and the Philippines (Dueñas-Caparas 2007). In contrast to studies of the manufacturing sector, there are only a few economics-based empirical studies about the determinants of export activities in the service sector (Ebling & Janz 1999 for Germany, Gourlay et al. 2005 for the United Kingdom, Chiru 2007 for Canada and Love & Mansury 2007 for the United States).

Even if the results differ according to industry (e.g. Wagner 2001), size (e.g. Sterlacchini 2001) and country, overall innovation, human capital, size and productivity are

important determinants of export performance as reported in this literature. These determinants are briefly reviewed below. The product cycle theory (Vernon 1966) and the technology gap theory (Krugman 1979) suggest that innovation provides countries and industries with comparative advantages and is therefore the driving force behind exports. Similar conclusions also emerge from studies at firm level. For the manufacturing sector overall, a positive effect of innovation (e.g. measured by R&D expenditures or innovative products) on exporting activities is found in Germany (e.g. Engelmann & Fuchs 2008, Roper & Love 2002, Wagner 2001) and other developed countries (e.g. Wakelin 1998, Sterlacchini 2001). In this context, capital intensity as an indicator of firm assets embodying past innovations and reflecting economies of scale is also expected to have a positive effect (Wakelin 1998). Similar to the manufacturing sector, in the business services sector, too, innovativeness is predominantly positively associated with the probability of exporting (Ebling & Janz 1999, Gourlay et al. 2005, Love & Mansury 2007) and the export intensity. (See Chiru 2007, Gourlay et al. 2005, but, conversely, Love & Mansury 2007 show a negative effect). Furthermore, a positive effect of human capital on export performance is expected due to the fact that skills are positive with respect to the technological capabilities of the firm and that highly educated employees have certain abilities that make it easier to establish and maintain certain contacts with the foreign market. 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 (cf. McLaughlin & Fitzsimmons 1996, Winstead & Patterson 1998). Overall, a positive relationship between human capital and exports is confirmed in the empirical literature on both the manufacturing sector (e.g. Roper et al. 2006, Wagner 2001, Wakelin 1998) and the business services sector (e.g. Ebling & Janz 1999, Gourlay et al. 2005, Chiru 2007).

Concerning a positive effect of firm size, it is argued in the literature that larger firms can, for instance, better absorb the risks associated with internationalisation, have better opportunities to raise financing and that they have more resources to overcome the fixed or sunk costs associated with foreign market entry. (See, for example, Aaby & Slater 1989, Wagner 1995, Bernard & Jensen 1999). To explain the frequently found inverted u-shaped size effect, it is argued that large firms may be more oriented towards the domestic market if, for instance, a domestic monopoly gives them no incentive to export (Wakelin 1998), and that there are limits to the advantage of size because coordination costs increase as the scale of operation increases, and, at some point, further expansion is not profitable (Wagner 2001). However, in the business services sector, there is mixed evidence regarding the effect of size

on export. Concerning the probability of exporting, Love and Mansury (2007) showed a hump-shaped relationship, Gourlay et al. (2005) found a linear positive effect, and Ebling and Janz (1999) found no significant effect. Concerning the export intensity, Chiru (2007) showed a u-shaped relationship, Gourlay et al. (2005) found a hump-shaped relationship, and Love and Mansury (2007) found no significant effect.

Explanations for the positive effect of productivity on exports are found in the more intensive competition in international markets as well as in additional costs entailed, for example, transportation, tariffs, market research, product adaptations and setting up new distribution networks. Only more productive firms are able to absorb these costs and to overcome the entry barrier (formally shown by Melitz 2003). A wide rage of empirical studies document productivity differences between exporting and non-exporting firms for the manufacturing sector (see Wagner 2007 for a survey) and also for the business services sector initial evidence shows a higher productivity for exporting firms than for non-exporting firms (e.g. Jensen 2008, Vogel 2009).

In addition to innovation, human capital, size and productivity, other determinants are also analysed in the economics literature. Since ownership may also be an important indicator of a firm's export potential, for example, by taking advantage of group resources for marketing or distribution (Roper et al. 2006), a positive effect of foreign ownership on exports is shown by Roper et al. (2006) for manufacturing firms in Ireland and North Ireland and by Engelmann and Fuchs (2008) for eastern German establishments. Gourlay et al. (2005) suggest a positive effect of product diversification on the basis that a more diversified firm is likely to have more products that will be profitable in foreign markets, but no significant influence was found. And recent studies show that financially constrained firms are less likely to export since they may be less able to cover the additional costs related to exporting than unconstrained firms (e.g. Arndt et al. 2008, Bellone et al. 2008). However, Wagner (2008, 2003) demonstrates the importance of unobserved heterogeneity for the manufacturing sector in an analysis of the export performance of firms. Thus, it is not the observed characteristics (such as human capital or R&D intensity) per se that make a successful exporter, but unobserved time-constant characteristics correlated with these observed characteristics (Wagner 2008).

There is also a wide range of studies on export performance in the management and marketing literature. Firm characteristics such as firm performance, size or innovation activities are important aspects in this literature, too. However, other internal determinants such as the marketing strategy or management characteristics as well as external determinants

such as characteristics of the foreign or domestic market seem to be equally important (See Sousa et al. 2008, Zou & Stan 1998 for an overview). According to traditional models of this literature, internationalisation is seen as an incremental process that depends on the ability to accumulate knowledge through exposure to foreign markets. Thus, the step-by-step internationalisation of firms begins in markets that are similar to the home market and continues with entry into new markets with successively greater psychic distance (Johanson & Vahlne 1977, 1990). Roberts (1999) presents evidence that also in the business services sector, firms progress through various stages in the process of internationalisation.

3 Data source: the German business services statistics

In order to investigate the export behaviour 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. This structural survey comprises service activities included in Section I ("Transport, storage and communication") and Section K ("Real estate, renting and business activities") according to the Statistical Classification of Economic Activities in the European Community NACE Rev. 1.1 (European Commission 2002). Companies from these lines of business may be asked to provide information to the statistical offices of the *Länder* on an annual basis. This applies to all companies that are subject to turnover tax and to professions (*Freie Berufe*) with a turnover of 17,500 euros or more per annum. 15 percent of these receive a questionnaire from the statistical offices and are asked to participate in the survey. The companies were randomly selected according to the sample criteria of federal state (*Land*), line of business and turnover. Because the same enterprises that participated in 2003 also participate in 2004 and 2005, it is possible to merge the cross-sectional data sets to a panel data set that covers the years 2003 to 2005 (Pesch 2007, Federal Statistical Office 2007).

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, the target countries of exports are not included in the statistics. Also, no information is obtained about other forms of companies' activities abroad, such as cooperation, direct investment or imports. Furthermore, small enterprises with an annual turnover lower than 250,000 euros 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 euros are considered for the analyses. For this study, the companies' responses for the years 2000 to 2005 were made anonymous and available to the authors by the research data centres of the Federal Statistical Office and the statistical offices of the *Länder*. For more details about the data access, see Zühlke et al. (2004).

In 2005, there were 680,000 companies active in Sections I and K, with 6 million employees and a total turnover of 700 billion euros. Almost 184,000 of the companies had a turnover of 250,000 euros per annum or more. These companies had an overall turnover of 625 billion euros, export amounting to almost 38 billion euros and just under 1.5 million employees.

4 Empirical model

The dependent variable export behaviour is specified in two ways. First, export behaviour is specified as a binary variable indicating the "export status" of the enterprise (1 if exporting, 0 if not). In a second variant, export behaviour is captured by the variable "export intensity" as the percentage of exports to total turnover.

The enterprise characteristics used here to explain the export performance are derived from the theoretical assumptions and empirical evidence reported in Section 2.

In line with previous studies, we expect size to have a positive relation to the export behaviour of the enterprises: Large firms have more resources to enter foreign markets than small companies have. This is mainly due to the fact that there are fixed costs needed for exporting such as gathering specific information about the respective foreign market, specific qualifications (languages, soft skills, etc.), marketing, travelling, operating plants, etc. Here, firm size is measured by the number of employees. However, in order to test for a possible non-linear relation to the export activity, the second order term of the number of employees has also been introduced.

Productivity as a determinant for export is widely tested in the literature. Based on the argument of additional costs caused by exporting that can only absorbed by more productive enterprises, a positive effect of productivity on export behaviour is expected. The variable is measured as labour productivity (value added per employed person). The empirical definition follows the definition applied for the "Structural Business Statistics" of the European Commission (European Commission 1998).

Human capital is a factor that also has a positive impact on the probability of companies to export, according to the literature. Most of the studies use per capita wages as a

proxy for human capital. We use the comprehensive definition of labour costs, made up of wages, salaries and employers' social security costs per employee. More appropriate would be the relation between labour costs and the hours worked. However, the data set does not contain information on hours worked. In order to control whether using the number of employees is misleading, we employ available information on the proportion of employees who work part time. In line with the literature, we expect a positive relationship between human capital and export propensity. For the control variable part-time work, we expect a negative relationship with export propensity.

To consider the influence of financial constraints on export activities (e.g. shown by Arndt et al. 2008), we use the legal status of a firm as an indicator to measure the possibility of financing business operations by external sources. There are three dummy variables, one if the firm is owned by a sole proprietor, one if the firm is a business partnership and one if the company is a limited liability company, such as a stock company or a limited company. Thus, the liability of the company's owner is indicated. Limited liability companies are expected to have a higher probability of exporting since it is easier for them to finance the additional (sunk) costs related with exporting by external sources compared to companies with a sole proprietor.

Following Gourlay et al. (2005), we test the potential role of product diversification on export performance. Based on the argument that a more diversified firm is likely to have more products that will be profitable in foreign markets, we expect a positive effect. There are different ways to measure product diversification. One way, which is taken here, is according to purchases of products or services that are not produced by the company itself but were purchased explicitly for resale in the same condition as received. We use the share of total turnover represented by this type of purchase as an indicator.

Our model also incorporates a variable on the market behaviour of companies which has not been taken into account in other studies to date. Following the idea of the stage model that regards internationalisation as an incremental process, we argue that for firms that are experienced in serving the nationwide market, the probability of entering international markets is higher than for firms only focused on the local or regional market. We capture the capability of companies to operate nationwide by the number of subsidiaries within Germany. It is expected that for companies with subsidiaries in Germany, the probability of exporting is higher than for companies without any subsidiaries.

Furthermore, we consider expectations of growth by including investment activities. Firms that expect to grow in the coming years and have reached the limits of their capacities

will invest in machinery, buildings, land and other assets. Although it is not known if the investments are targeted towards expansion on the domestic or foreign market, export activities may be either started or expanded. Investment activities are measured in this paper as the investment intensity, the relationship of gross investment to the number of employees. We expect a positive impact of investment intensity on export behaviour.

In order to account for regional differences, we include a dummy that indicates if the enterprise is located in eastern Germany or in western Germany. Taking into consideration that the eastern German economy, even almost 20 years after German reunification, is still weaker than the West German economy, a negative coefficient of the eastern German dummy is expected.

Finally, we control for specific market conditions of companies, including a set of dummies for the economic activities of the companies by using information about the companies' lines of business. To sum up, the above-mentioned variables and their expected effects are presented in Table 1.

Formally, our model can be expressed as

$$(1) \qquad Export_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 C_{it} + \varepsilon_{it}$$

where *i* is the enterprise index, *t* is the index of the year. The dependent variable *Export* is either the "export status" or the "export intensity", as defined. The vector *X* contains the explanatory variables, namely the number of employees and its squared value, labour productivity, the average wage, the share of part-time employees, dummies that indicate the legal status, the share of goods and services for resale, dummies for nationwide active firms, and per-capita-investments.[1] *C* indicates the control vector that contains the economic activity dummies, the region dummy, and, in the case of pooled analyses, a set of year dummies. β_0 represents the constant, β_1 and β_2 indicate the vectors of coefficients, and ε is the error term.

[Table 1 about here]

Our investigation of the export activities of business services firms is separated into two parts: first, we estimate the determinants of the "export status" (the probability of being

[1] To check the robustness of the results, in addition, we estimate a model where all explanatory variables *X* are lagged by one period to minimise problems of endogeneity with the dependent variable. Compared to the model without lagged explanatory variables, the results in terms of signs and significance levels are equal. However, also in the literature about the learning-by-exporting hypotheses, no clear evidence has been found that exporting fosters the performance of the enterprises. (See Wagner 2007 for a survey.)

an exporter) and the determinants of the "export intensity". To explain the binary variable "export status" we estimate Equation (1) using a probit regression model. We test for the years 2003 to 2005 separately and pooled for the respective years.[2] Thus, we can compare the results of our tests with other studies using similar methodology. Equation (1) is then estimated by a procedure that exhausts all the information about export behaviour by applying the fractional probit estimator developed by Papke and Wooldridge (1996). Wagner (2001) points out that, in contrast to a tobit regression or a two-step approach, like a probit regression followed by a truncated regression, the regression by Papke and Wooldridge considers both aspects for export behaviour, the fact that a firm does not distinguish between the decision if and how much it exports and that the export intensity is bounded between one and zero (with the possibility of observing values at the boundaries) by definition rather than as a result of censoring.

As a second step, we also control for unobserved time-invariant characteristics that could be correlated with the explanatory variables, by estimating a fractional response model for panel data (following Wagner 2008). Papke and Wooldridge (2008) show that in the case of a balanced panel dataset (with large cross-sectional dimension and only few time periods), it is controlled for fixed effects by adding the time averages of all explanatory variables to the fractional probit approach we applied in the first step. In line with this approach, we use a balanced panel dataset for the years 2003 to 2005. To facilitate the comparison with the results of the first step, we estimate both a variant without fixed effects that is similar to the cross-sectional analyses and a second variant where the time averages of all explanatory variables are added to a pooled form of Equation (1) to control for unobserved heterogeneity.

All models are estimated with robust or, in the case of pooled data, cluster-robust standard errors. The regressions were run using the Stata program (Version 10). According to Papke and Wooldridge's approach, regressions are estimated with the Stata command for generalised linear models.

2 The pooled analysis is only possible for the time period 2003 to 2005. However, to check the robustness of the results, we also used the years 2000 to 2002 for cross-sectional analyses. (The results are available in the Appendix).

5 Descriptive analysis

5.1 Export behaviour

In 2005, nearly 14.0 percent of the responding service companies were exporting (Fig. 1). However, most of the exporting companies export only a small proportion of their products. In previous years, the proportion of companies with exports was smaller. From 2000 to 2003, approximately 12.5 percent of the companies were exporters while in 2004 this figure was 13.3 percent. It is noteworthy that the proportion of exporting companies with a high export rate has increased from 3 percent of all companies in 2000 to 4 percent of all companies in 2005. (See also Eickelpasch 2008.)

[Figure 1 about here]

In order to illustrate the dynamics of export behaviour, we compare a company's export behaviour in 2005 with its export activities in 2004 and 2003. Of the companies that exported in 2005, 51.9 percent also exported in 2003 and in 2004. Of the companies with no exports in 2005, 92.4 percent also did not export in 2003 or 2004 (Table 2). Thus, 86.4 percent of all enterprises did not change their status in the time period considered.

It is remarkable that a substantial proportion of exporters in 2005 are newcomers. The share of companies that did not export in 2004 amounts to 28.5 percent of all enterprises exporting in 2005, and the share of companies that did not export in either 2004 or 2003 amounts to 20.6 percent.

In the sub-group of non-exporters in 2005, there is also some fluctuation to be seen: 4.2 percent of the non-exporters in 2005 had at least some export activities in 2004 and 5.3 percent of enterprises with no export activities in 2005 had at least some export activities in 2003.

[Table 2 about here]

5.2 Differences between exporting and non-exporting firms

Table 3 shows the means and the standard deviation of variables for the groups of the responding exporting and non-exporting services enterprises in 2005.[3] Not surprisingly, exporting enterprises are on average larger (in terms of the number of employees). In contrast to our expectations, labour productivity in exporting enterprises is lower than in non-exporting enterprises when it is not controlled for other firm characteristics. Exporting companies pay higher wages and consequently have a lower share of part-time employees. Their supply of services is on average more diversified than that of non-exporters. Furthermore, the share of sole proprietors and enterprises with no subsidiary is higher among non-exporting enterprises than those that do export. These results quite clearly correspond to the size of the companies. Contrary to our expectations, the gross investment per person employed in exporting enterprises is lower than in non-exporting enterprises. One explanation may be that exporting firms also invest in subsidiaries abroad and this type of investment is not captured in these statistics.

Exporting companies are more often located in western Germany (85.2 percent) than non-exporting companies (76.3 percent), suggesting that locational conditions in western Germany might be more favourable than in eastern Germany. With regard to the business lines of the enterprises, it is quite clear that in the group of non-exporters the share of business lines that normally serve local or regional markets is higher than in the group of exporters. This type of business lines include land transport, industrial cleaning, travel agencies, legal activities, labour recruitment, security, and real estate enterprises.[4] On the other hand, the share of business lines offering products potentially to local as well as national or international clients is higher in the group of exporters. Some examples are hardware and software consultancy, research and development, engineering and advertising.

[Table 3 about here]

[3] Some firms reported extremely high values of number of employees, average wage or investments, or very high positive or negative value added. Because of data protection rules, there was no way of verifying the responses the companies gave or investigating the reasons for these type of implausible figures. To avoid bias of the descriptive overview and the econometric estimations by outliers, the 99th percentiles of the distribution of the variables size, wage and investment per capita, and the 1st and the 99th percentiles of value added per employee are excluded from all computations.

[4] To check the robustness of the results, we computed all descriptive and econometric analyses without the real estate companies: however, the signs, significance levels, and mean differences are almost identical with the whole data set (including the real estate enterprises).

6 Estimation results

6.1 Determinants of the export behaviour: cross-section results

This section analyses factors that explain the export behaviour of companies. The export probability is estimated by a probit regression of the export status (1 if exporting, 0 if not) on several firm characteristics. To take into consideration the fact that the export intensity (exports as a percentage of total turnover) is bounded between zero and one (with a high number of observations at the lower bound), we use a quasi-likelihood estimation method for fractional dependent variables (Papke & Wooldridge 1996) to analyse the export intensity decision. The cross-sectional results for the years 2003 to 2005 are shown in Table 4 (probit regression) and Table 5 (fractional probit regression). A positive sign of the coefficients of the independent variables means that the variable increases the probability of exporting or the export intensity respectively. To facilitate comparison with the estimations in Section 6.2, pooled regressions based on the cross-sectional data sets for 2003 to 2005 were carried out.[5]

[Table 4 about here]

[Table 5 about here]

By and large, the results of the regressions according to the two specifications for each year as well as for the pooled version show the expected pattern of signs for most of the variables. We find a significant positive coefficient for the number of employees (size) and a negative sign for its squared value. However, due to the fact that only a few enterprises in the data set are larger than the maximum of the quadratic equation, this result indicates more a positive relationship between size and exports (with a slightly degressive character) rather than the frequently found inversely u-shaped relationship. The positive effect of labour productivity on export behaviour can also be confirmed by our estimations. However, this is only valid for the regression on export intensity while no significant influence of productivity is found on the export status. Further, the effect of human capital (in terms of average wages) on export behaviour is positive and significant. Also, the influence of part-time work is negative, as expected. Concerning the legal status, it turns out that private companies and public limited companies have a higher probability of being an exporter and choose a higher

[5] In addition, the results of the cross-sectional analyses of the years 2000 to 2002 are presented in Table A1 and A2 in the Appendix. However, the signs and significance levels are consistent with the results of the years 2003 to 2005 presented here.

volume of exports than sole proprietors. This is also in line with our expectations. Finally, product diversification has a positive impact on export behaviour. The eastern Germany dummy shows the expected negative sign in all estimations.

Regarding experience on the national market, the results are somewhat mixed: the probit regression indicates that enterprises that have one or more subsidiaries on the national market are more likely to export. Thus, in line with the stages model, the experience of serving different regional markets increases the export probability. However, the fractional probit regression does not confirm the results for all years. In 2005, a significant negative effect of having three and more subsidiaries on the decision of the export volume was even estimated. One possible explanation is that three or more subsidiaries could reflect a strong position on the domestic market. In this case, a company has only a weak incentive to export and a strong incentive to focus on the national market (Wakelin 1998).

The investment per employee, included in the model as a proxy for the expectations of growth of firms, very rarely has any significant effect on export behaviour. One reason for this might be the fact that it is not clear whether the investment target is expansion on the domestic or foreign market.

6.2 The role of unobserved time-invariant characteristics

In Section 6.1, we followed the widely used approach in empirical studies for the manufacturing and service sector to identify characteristics that are closely related with the export behaviour of companies. However, one limitation of this approach is that it focuses on observable enterprise characteristics only. Wagner (2003, 2008) shows for the manufacturing sector the importance of unobserved firm characteristics that are constant over time and correlated with the observed characteristics. To consider the importance of these unobserved effects, we extend our estimations carried out in Section 6.1 by adding the time averages of the explanatory variables. We follow Wagner (2008) and estimate a pooled fractional probit estimator introduced by Papke and Wooldridge (2008).

Due to the requirements of this method, we use a balanced panel subset of the business services statistics for the years 2003 to 2005 with complete information on all variables in each year and each enterprise. This implies that with this approach the number of observations and enterprises is much smaller than in the preceding cross-sectional probit regressions. In the pooled regressions for 2003 to 2005, almost 124,000 observations of just under 54,000 enterprises were considered, whereas in the following panel regression only 88,000 observations of 29,000 enterprises are allowed for.

In order to compare the results of the cross-sectional pooled regressions in Section 6.1 with the results obtained from the balanced panel data set, we estimate in an initial step a pooled fractional probit regression without fixed effects, i.e. without time averages of the explanatory variables. As a second step, we introduce the fixed effects into the panel regression in order to control for time-constant effects. The results are presented in Table 6.

[Table 6 about here]

First, as expected, we observe that the results of the panel regression without fixed effects are identical to the results of the pooled cross-sectional regression in Section 6.1 in terms of signs and significance levels.

This picture changes when – in a second step – we control for fixed effects by adding the time averages of the explanatory variables:[6] the relationship between export behaviour and productivity is not significant when controlling for unobserved heterogeneity. Similarly, the relationship between exports and human capital is not significant. However, we still find a positive effect of size (although less significant than without fixed effects) and product diversification on exports.

Similar results were found in a recent study on export behaviour of manufacturing companies (Wagner 2008). Obviously, the export performance of German business services enterprises is not positive per se related with productivity and human capital. There are further time-constant factors that could not be observed in this estimation and are correlated to productivity and human capital. What the determinants are is an open question. This might be the uniqueness of the product offered by a company, the integration of a service company in a supply chain network by large international companies, or the talent of the management.

7 Concluding remarks

A wide range of empirical studies have analysed the determinants of export behaviour of manufacturing companies. By contrast, only a few studies present an investigation of services firms. To close this gap, this paper examines the influence of several characteristics on the export performance of enterprises in the German business services sector. We allow for

[6] In the fixed effects model, the explanatory dummy variables are only identified by the enterprises changing status (namely enterprises that change their legal status, location, or number of subsidiaries in the considered time period). Since the group of status changers is very small, so as to avoid misleading interpretations, we do not present the coefficients for these dummy variables but include them in our model as control variables. However, the same signs and significant levels are obtained when the model is estimated without the dummy variables.

potential determinants such as size, productivity and human capital that are used in similar studies. In addition, we introduce other factors that have not been tested yet, such as the experience of companies on the national market.

The analyses is organised in two steps. First, we apply cross-sectional regressions in order to discuss the results with respect to previous studies (e.g. Ebling & Janz 1999, Gourlay et al. 2005, Chiru 2007, Love & Mansury 2007). Second, we apply the pooled fractional probit estimator (recently introduced by Papke & Wooldridge 2008), a new approach also taking into consideration unobserved time-invariant characteristics (fixed effects) and the special nature of the export intensity variable. These analyses are facilitated by the German business services statistics panel 2003 to 2005, a unique database recently released by the Federal Statistical Office and the statistical offices of the Federal States.

The results are as follows: in the probit estimations of the first step of our analyses, we find a positive relationship between export performance and size, productivity, human capital, and product diversification of an enterprise. In addition to these variables, we add experience on the national market to our model to include the idea of the stage model of internationalisation as well as the investment per employee as a proxy for the expectations of growth. As a result, a positive effect of the experience on the national market are only found when analysing the probability of being an exporter, and no significant effect of investments is found in any of the estimations.

When controlling for unobserved heterogeneity we find a different picture. In the model with fixed effects, the significance for the factors productivity and human capital disappears. This indicates that these variables are not positive per se related to the export performance, but rather related to unobserved time-constant characteristics. This result is in line with a similar estimation for the manufacturing sector (Wagner 2008). Size and product diversification on exports still have a positive and significant effect when controlling for unobserved heterogeneity.

Overall, our results support most of the explanations of export behaviour found in the literature for both service firms and manufacturing enterprises, such as size, human capital and productivity, and added further determinants for export behaviour, such as experience on the national market. However, we were also able to show that the influence of productivity and human capital on export performance is linked to unobserved factors that have not been investigated in this analysis. Thus, our study outlines an agenda for further research. It is obvious that we need to know more about the factors that lead service companies to export, such as innovation activities or market conditions. Also, information is required about other

forms of companies' activities abroad, such as cooperation, direct investment or imports. We also need to know which countries service companies export to: they probably tend to export to countries near to their home country in order to minimise transaction costs. A longer panel data set would be helpful for more detailed analyses and estimations. At the time of writing, no data set with such information and sufficient observations is available for Germany. However, the German business services statistics panel used in this paper will provide some information in the future. From 2008 onwards, companies will be asked about exports to EU and non-EU countries.

The results also give some hints for policy makers. It has become obvious that companies that go abroad are – as a general pre-requisite – economically strong and experienced in serving supra-regional markets. However, exporting bears risks. The policy should – if promotion for export is at all appropriate – focus more on providing information about the target countries and potential cooperation partners abroad rather than strengthening the company's human capital or productivity. This is the core task of a company and no-one else's.

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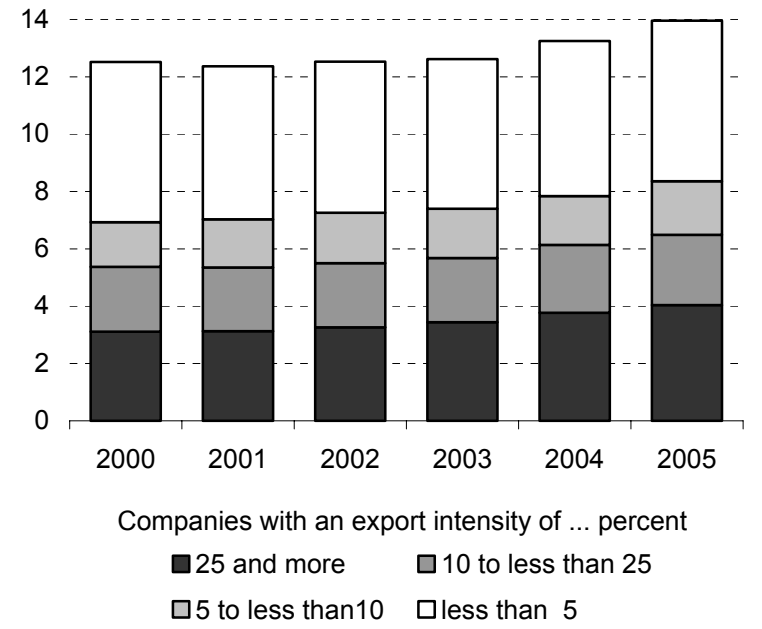
Tables and Figures

Fig. 1
Export activities of companies in the business-oriented service sector 2000 to 2005 - Share of exporting companies on all companies in percentages



Source: German business services statistics, calculations by the authors.

Table 1: Definition of the variables and expected signs

Variables	Definition (dimension)	Expected impact*
Dependent variables		
Export activity	Exporter (1), non-exporter (0)	
Export intensity	Exports (% of turnover)	
Independent variables		
Size	Persons employed (number)	+
Size squared	Persons employed squared (number)	-
Productivity	Value added per person employed (in €)	+
Human capital	Labour cost per employee (in €)	+
Part-time work	Part-time employees (% of persons employed)	-
Legal status	Private company (2), public limited company (3), other (4) (Dummies); reference group: Sole proprietor (1)	+
Product diversification	Purchased goods and services for resale (% of turnover)	+
Experience on the national market	Subsidiaries in Germany (1 to 3, 4 or more) (Dummies); reference group: no subsidiary	+
Investment	Gross investment per person employed (in €)	+
Location	Eastern Germany (Dummy)	-

*+ = encourages export, - = discourages export.

Table 2: Export activities of firms in 2005, and their export activities in the years 2004 and 2003, respectively

	Exporter in 2005 and ...			Non-exporter in 2005 and ...		
	Exporter in 2004	Non-exporter in 2004	Total	Exporter in 2004	Non-exporter in 2004	Total
Exporter in 2003	2,811 (51.9)	429 (7.9)	3,240 (59.8)	596 (1.9)	1,029 (3.3)	1,625 (5.3)
Non-exporter in 2003	1,061 (19.6)	1,116 (20.6)	2,177 (40.2)	710 (2.3)	28,551 (92.4)	29,261 (94.7)
Total	3,872 (71.5)	1,545 (28.5)	5,417 (100.0)	1,306 (4.2)	29,580 (95.8)	30,886 (100.0)

Notes: Reported are the number of cases and the total percentages within the groups of exporters and non-exporters 2005 in parenthesis ( ).
Source: German business services statistics, calculations by the authors.

Table 3: Descriptive statistics for non-exporters and exporters 2005

Variables	Non-Exporters in 2005		Exporters in 2005		p-value
	Mean	Standard Deviation	Mean	Standard Deviation	
Dependent variable					
Export intensity [in % of turnover]	0.0	0.0	20.7	27.9	0.000
Independent variables					
Size [number]	37	78	49	86	0.000
Size squared [number]	7,403	38,840	9,890	42,208	0.000
Productivity [value added per person employed in €]	91,624	188,131	81,289	131,840	0.000
Human capital [labour cost per employee in €]	33,901	22,691	42,435	23,148	0.000
Part-time work [in % of persons employed]	26.5	27.5	20.3	21.1	0.000
Legal status [Dummies]					
Sole proprietor	0.220	0.414	0.133	0.340	0.000
Private company	0.223	0.417	0.218	0.413	0.368
Public limited company	0.534	0.499	0.635	0.481	0.000
Other	0.022	0.147	0.013	0.114	0.000
Product diversification [purchased goods and services for resale in % of turnover]	10.8	21.3	17.8	25.5	0.000
Experience on the national market [Dummies]					
No subsidiary	0.882	0.323	0.800	0.400	0.000
1 or 2 subsidiaries	0.086	0.281	0.143	0.350	0.000
3 and more subsidiaries	0.032	0.176	0.057	0.231	0.000
Investment [gross investment per person employed in €]	10,695	48,226	7,539	34,778	0.000
Location [Dummies]					
Eastern-Germany	0.237	0.425	0.143	0.350	0.000
Western-Germany	0.763	0.425	0.852	0.356	0.000
Business lines [Dummies]					
Land transport; transport via pipelines	0.139	0.346	0.104	0.305	0.000
Water transport	0.018	0.135	0.027	0.162	0.000
Air transport	0.003	0.053	0.004	0.063	0.116
Cargo handling and storage	0.012	0.107	0.011	0.106	0.906
Other supporting transport activities	0.010	0.098	0.009	0.095	0.617
Activities of travel agencies	0.024	0.154	0.008	0.091	0.000
Activities of other transport agencies	0.058	0.234	0.115	0.319	0.000
Telecommunications	0.022	0.148	0.014	0.115	0.000
Real estate activities	0.140	0.347	0.012	0.108	0.000
Renting of machinery and equipment without operator and of personal and household goods	0.035	0.183	0.028	0.165	0.007
Hardware and software consultancy	0.047	0.211	0.117	0.321	0.000
Data processing	0.013	0.113	0.020	0.142	0.000
Other computer related activities	0.021	0.144	0.028	0.164	0.001
Research and development	0.013	0.112	0.044	0.205	0.000
Legal activities	0.097	0.296	0.065	0.247	0.000
Accounting, book-keeping and auditing activities; tax consultancy	0.042	0.201	0.065	0.247	0.000
Market research and public opinion polling, Business and management consultancy activities; Management activities of holding companies	0.036	0.187	0.067	0.250	0.000
Architectural and engineering activities and related technical consultancy	0.068	0.252	0.080	0.271	0.001
Technical testing and analysis	0.012	0.111	0.025	0.157	0.000
Advertising	0.038	0.191	0.063	0.242	0.000
Labour recruitment and provision of personnel	0.031	0.174	0.014	0.117	0.000
Investgation and security activities	0.013	0.115	0.002	0.041	0.000
Industrial cleaning	0.044	0.206	0.009	0.093	0.000
Secretarial and translation activities	0.003	0.051	0.008	0.087	0.000
Call centre activities	0.004	0.066	0.004	0.065	0.922
Miscellanous business actitvitites n.e.c.	0.056	0.230	0.058	0.235	0.442
Number of observations	35,735		6,586		

Notes: In the last column the p-values of mean comparisons (t-tests) between the two groups are presented.
Source: German business services statistics, calculations by the authors.

Table 4: Determinants of the export activity of companies in the German business services sector 2003 to 2005

	Probit regression of the export activity (1: exporter, 0: non exporter)			
	2003	2004	2005	pooled 2003-2005
Size	0.004 *** (0.000)	0.004 *** (0.000)	0.004 *** (0.000)	0.004 *** (0.000)
Size squared [10^{-3}]	-0.006 *** (0.000)	-0.006 *** (0.000)	-0.006 *** (0.000)	-0.006 *** (0.000)
Productivity [10^{-4}]	-0.001 (0.159)	0.001 (0.180)	0.000 (0.558)	-0.000 (0.849)
Human capital [10^{-3}]	0.005 *** (0.000)	0.004 *** (0.000)	0.004 *** (0.000)	0.004 *** (0.000)
Part-time work	-0.001 *** (0.001)	-0.002 *** (0.000)	-0.002 *** (0.000)	-0.002 *** (0.000)
Legal status				
Private company	0.118 *** (0.000)	0.105 *** (0.000)	0.084 *** (0.002)	0.102 *** (0.000)
Public limited company	0.180 *** (0.000)	0.148 *** (0.000)	0.120 *** (0.000)	0.149 *** (0.000)
Other	-0.034 (0.663)	-0.073 *** (0.000)	-0.074 (0.324)	-0.061 (0.315)
Product diversification	0.006 *** (0.000)	0.005 (0.348)	0.006 *** (0.000)	0.006 *** (0.000)
Experience on the national market				
1 or 2 subsidiaries	0.174 *** (0.000)	0.224 *** (0.000)	0.185 *** (0.000)	0.194 *** (0.006)
3 and more subsidiaries	0.085 ** (0.049)	0.132 *** (0.002)	0.064 (0.130)	0.093 *** (0.000)
Investment [10^{-4}]	0.001 (0.722)	0.002 (0.250)	0.001 (0.523)	0.002 (0.282)
Location				
Eastern-Germany	-0.291 *** (0.000)	-0.236 *** (0.000)	-0.234 *** (0.000)	-0.253 *** (0.000)
Constant	-2.553 *** (0.000)	-2.539 *** (0.000)	-2.506 *** (0.000)	-2.564 *** (0.000)
Year dummies	-	-	-	yes
Business lines [Dummies]	yes	yes	yes	yes
Pseudo R-squared	0.12	0.12	0.12	0.12
Number of observations	40,170	41,433	42,321	123,940
Number of enterprises	40,170	41,433	42,321	53,876

Notes: Presented are the estimated coefficients, the p-values in parenthesis and the level of significance (*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level, based on (cluster) robust standard errors) of cross-sectional probit regressions of the export status (1 if exporting, 0 if not) on several regressors.
Source: German business services statistics, calculations by the authors.

Table 5: Determinants of the export intensity of companies in the German business services sector 2003 to 2005

	Fractional probit regression of the export intensity (exports as percent of turnover)			
	2003	2004	2005	pooled 2003-2005
Size	0.002 *** (0.000)	0.002 *** (0.000)	0.002 *** (0.000)	0.002 *** (0.000)
Size squared [10^{-3}]	-0.003 *** (0.000)	-0.003 *** (0.000)	-0.003 *** (0.000)	-0.003 *** (0.000)
Productivity [10^{-4}]	0.001 (0.135)	0.002 *** (0.000)	0.003 *** (0.000)	0.002 *** (0.000)
Human capital [10^{-3}]	0.006 *** (0.000)	0.005 *** (0.000)	0.005 *** (0.000)	0.005 *** (0.000)
Part-time work	-0.001 ** (0.022)	-0.001 ** (0.036)	-0.001 * (0.080)	-0.001 *** (0.003)
Legal status				
Private company	0.119 *** (0.001)	0.091 *** (0.008)	0.084 ** (0.012)	0.097 *** (0.000)
Public limited company	0.156 *** (0.000)	0.160 *** (0.000)	0.133 *** (0.000)	0.150 *** (0.000)
Other	-0.099 (0.294)	-0.013 (0.897)	-0.029 *** (0.749)	-0.045 (0.488)
Product diversification	0.004 *** (0.000)	0.004 *** (0.000)	0.004 *** (0.000)	0.004 *** (0.000)
Experience on the national market				
1 or 2 subsidiaries	0.019 (0.512)	0.049 * (0.084)	0.040 (0.158)	0.037 * (0.090)
3 and more subsidiaries	-0.120 ** (0.014)	-0.071 (0.132)	-0.174 *** (0.000)	-0.121 *** (0.001)
Investment [10^{-4}]	0.000 (0.919)	0.006 ** (0.022)	0.003 (0.208)	0.003 ** (0.035)
Location				
Eastern-Germany	-0.199 *** (0.000)	-0.165 *** (0.000)	-0.162 *** (0.000)	-0.174 *** (0.000)
Constant	-3.028 *** (0.000)	-3.022 *** (0.000)	-3.041 *** (0.000)	-3.061 *** (0.000)
Year dummies	-	-	-	yes
Business lines [Dummies]	yes	yes	yes	yes
Number of observations	40,170	41,433	42,321	123,924
Number of enterprises	40,170	41,433	42,321	53,873

Notes: Presented are the estimated coefficients, the p-values in parenthesis and the level of significance (*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level, based on (cluster) robust standard errors) of fractional probit regressions (Papke & Wooldridge 1996) of the export intensity (share of exports on total turnover) on several regressors.
Source: German business services statistics, calculations by the authors.

Table 6: Determinants of the export intensity of companies in the German business services sector considering unobserved time-constant characteristics 2003 to 2005

	Pooled fractional probit regression of the export intensity (exports as percent of turnover) Balanced Panel 2003 to 2005	
	without fixed effects	fixed effects model
Size	0.002 *** (0.000)	0.002 * (0.055)
Size squared [10^{-3}]	-0.003 *** (0.000)	-0.004 ** (0.013)
Productivity [10^{-5}]	0.030 *** (0.000)	-0.002 (0.784)
Human capital [10^{-4}]	0.057 *** (0.000)	-0.001 (0.770)
Part-time work	-0.001 *** (0.002)	0.000 (0.674)
Legal status		
Private company	0.085 *** (0.009)	yes
Public limited company	0.146 *** (0.000)	yes
Other	-0.060 (0.386)	yes
Product diversification	0.004 *** (0.000)	0.001 *** (0.002)
Experience on the national market		
1 or 2 subsidiaries	0.037 (0.115)	yes
3 and more subsidiaries	-0.114 *** (0.007)	yes
Investment [10^{-4}]	0.001 (0.685)	-0.001 (0.676)
Location		
Eastern-Germany	-0.193 *** (0.000)	yes
Constant	-3.105 *** (0.000)	-3.212 *** (0.000)
Year dummies	yes	yes
Time averages of all exogenous variables	no	yes
Business lines [Dummies]	yes	yes
Number of observations	88,002	88,002
Number of enterprises	29,334	29,334

Notes: Presented are the estimated coefficients, the p-values in parenthesis and the level of significance (*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level, based on (cluster) robust standard errors) of pooled fractional probit regressions (Papke & Wooldridge 2008) of the export intensity (share of exports on total turnover) on several regressors.
Source: German business services statistics, calculations by the authors.

Appendix

Table A1: Determinants of the export activity of companies in the German business services sector 2000 to 2002

	Probit regression of the export activity (1: exporter, 0: non exporter)		
	2000	2001	2002
Size	0.003 *** (0.000)	0.005 *** (0.000)	0.004 *** (0.000)
Size squared [10^{-3}]	-0.005 *** (0.000)	-0.007 *** (0.000)	-0.006 *** (0.000)
Productivity [10^{-4}]	0.001 (0.144)	0.001 *** (0.000)	0.000 0.567
Human capital [10^{-3}]	0.003 *** (0.000)	0.002 *** (0.000)	0.005 *** (0.000)
Part-time work	-0.002 *** (0.001)	-0.002 *** (0.000)	-0.001 *** (0.001)
Legal status			
Private company	0.076 *** (0.007)	0.064 ** (0.021)	0.095 *** (0.001)
Public limited company	0.203 *** (0.000)	0.127 *** (0.000)	0.196 *** (0.000)
Other	-0.183 * (0.064)	-0.104 (0.257)	-0.053 (0.518)
Product diversification	0.004 *** (0.000)	0.003 *** (0.000)	0.005 *** (0.000)
Experience on the national market			
1 or 2 subsidiaries	0.211 *** (0.000)	0.167 *** (0.000)	0.187 *** (0.000)
3 and more subsidiaries	0.217 *** (0.000)	0.200 *** (0.000)	0.191 *** (0.000)
Investment [10^{-4}]	-0.001 (0.695)	-0.003 (0.229)	0.001 0.757
Location			
Eastern-Germany	-0.351 *** (0.000)	-0.350 *** (0.000)	-0.309 *** (0.000)
Constant	-2.497 *** (0.000)	-2.378 *** (0.000)	-2.546 *** (0.000)
Year Dummies	-	-	-
Business lines [Dummies]	yes	yes	yes
Pseudo R-squared	0.12	0.12	0.12
Number of observations	32,894	35,901	37,981
Number of enterprises	32,894	35,901	37,981

Notes: Presented are the estimated coefficients, the p-values in parenthesis and the level of significance (*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level, based on (cluster) robust standard errors) of cross-sectional probit regressions of the export status (1 if exporting, 0 if not) on several regressors.
Source: German business services statistics, calculations by the authors.

Table A2: Determinants of the export intensity of companies in the German business services sector 2000 to 2002

	Fractional probit regression of the export intensity (exports as percent of turnover)		
	2000	2001	2002
Size	0.001 *** (0.003)	0.002 *** (0.000)	0.001 *** (0.000)
Size squared [10^{-3}]	-0.001 (0.104)	-0.003 *** (0.000)	-0.002 *** (0.001)
Productivity [10^{-4}]	0.001 *** (0.000)	0.002 *** (0.000)	0.001 * 0.054
Human capital [10^{-3}]	0.003 *** (0.000)	0.004 *** (0.000)	0.006 *** (0.000)
Part-time work	-0.002 *** (0.004)	-0.001 ** (0.043)	-0.001 (0.251)
Legal status			
Private company	0.091 ** (0.013)	0.081 ** (0.027)	0.035 (0.327)
Public limited company	0.205 *** (0.000)	0.143 *** (0.000)	0.159 *** (0.000)
Other	-0.404 *** (0.000)	-0.240 ** (0.020)	-0.251 *** (0.003)
Product diversification	0.003 *** (0.000)	0.001 *** (0.001)	0.004 *** (0.000)
Experience on the national market			
1 or 2 subsidiaries	0.064 ** (0.050)	0.011 (0.715)	0.039 (0.185)
3 and more subsidiaries	-0.024 (0.634)	-0.024 (0.643)	-0.022 (0.678)
Investment [10^{-4}]	-0.004 (0.222)	-0.004 (0.097) *	0.002 (0.475)
Location			
Eastern-Germany	-0.234 *** (0.000)	-0.212 *** (0.000)	-0.201 *** (0.000)
Constant	-2.948 *** (0.000)	-2.882 *** (0.000)	-3.148 *** (0.000)
Year Dummies	-	-	-
Business lines [Dummies]	yes	yes	yes
Number of observations	32,894	35,901	37,981
Number of enterprises	32,894	35,901	37,981

Notes: Presented are the estimated coefficients, the p-values in parenthesis and the level of signifi-cance (*** siginficant at the 1% level, ** significant at the 5% level, * significant at the 10% level, based on (cluster) robust standard errors) of fractional probit regressions (Papke & Wooldridge 1996) of the export intensity (share of exports on total turnover) on several regressors.
Source: German business services statistics, calculations by the authors.

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