Exporter Performance and the Determinants of Export Performance in the German Business Services Sector

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Zusammenfassung

Ein Großteil der empirischen Studien zur Performance von Exporteuren sowie über Determinanten der Exportaktivität auf Firmenebene beschränkt sich auf die Analyse des industriellen Sektors, da nur sehr wenige Datensätze eine detaillierte Untersuchung des Dienstleistungssektors ermöglichen. Im Jahr 2008 wurde jedoch mit der Panelversion der Strukturerhebung im Dienstleistungsbereich ein Datensatz durch die Statistischen Ämter des Bundes und der Länder bereitgestellt, der erstmals adäquate Panelanalysen der Exporttätigkeit von unternehmensnahen Dienstleistern in Deutschland ermöglicht. Dieser Datensatz wird im ersten Papier der Dissertation näher vorgestellt. Darauf aufbauend nutzen vier weitere Papiere den Datensatz und erweitern die mikroökonometrische Literatur zum internationalen Handel um Evidenz aus dem deutschen unternehmensnahen Dienstleistungssektor.

In Bezug auf die Unterschiede zwischen Exporteuren und Nicht-Exporteuren dokumentiert die Studie „*Exporter Performance in the German Business Services Sector*", dass analog zum industriellen Sektor exportierende unternehmensnahe Dienstleister größer und produktiver sind als nicht exportierende Unternehmen sowie dass Exporteure höhere Durchschnittslöhne als Nicht-Exporteure zahlen. Dies gilt selbst dann, wenn für Größe und Industriezweige kontrolliert wird. Wird zusätzlich für zeitkonstante unbeobachtete Effekte kontrolliert, können keine signifikanten Differenzen hinsichtlich der Produktivität und den Durchschnittslöhnen von Exporteuren und Nicht-Exporteuren gefunden werden. Signifikante Exportprämien bezüglich der Größe bestehen weiterhin, jedoch auf niedrigerem Niveau. Weiterhin zeigt sich, dass es im unternehmensnahen Dienstleistungssektor ähnlich wie im industriellen Sektor zu einer Selbst-Selektion großer Firmen hin zu Exportaktivitäten kommt. Hinsichtlich der Produktivität sowie den Durchschnittslöhnen konnte eine statistisch signifikante Selbst-Selektion jedoch nur für Westdeutschland gefunden werden.

Neben diesen Ähnlichkeiten mit der Evidenz aus dem industriellen Sektor, präsentiert die Untersuchung „*Exports and Profitability: First Evidence for German Business Services Enterprises*" Ergebnisse, welche darauf hindeuten, dass unternehmensnahe Dienstleister im Gegensatz zu Firmen des Verarbeitenden Gewerbes nicht von ihrer Exportaktivität in Form einer höheren Rentabilität profitieren. Vielmehr

zeigen Exporteure im unternehmensnahen Dienstleistungssektor eine geringere Rentabilität als nicht exportierende Firmen. Und auch schon vor Exportbeginn weisen angehende Exporteure eine niedrigere Rentabilität auf als Firmen, die weiterhin nur auf dem nationalen Markt aktiv sind. Zur Analyse des kausalen Effektes von Exporten auf die Rentabilität wurde zusätzlich eine Dose-Response-Funktion geschätzt, welche einen s-förmigen Zusammenhang zwischen der Rentabilität und der Exportintensität der Firmen zeigt. Firmen mit einer sehr geringen Exportintensität haben eine geringere Rentabilität als Nicht-Exporteure. Dann, mit ansteigender Exportintensität, nimmt auch die Rentabilität zu. Selbst im Maximum liegt die durchschnittliche Rentabilität der Exporteure jedoch nicht oder nur knapp über dem Wert für Nicht-Exporteure.

Die Studie „*Determinants of Export Behaviour of German Business Services Companies*“ analysiert die Frage nach den Determinanten der Exportperformance von unternehmensnahen Dienstleistungsunternehmen, indem ein Model der Exportintensitätsentscheidung auf Firmenebene geschätzt wird. Insgesamt bestätigen die Ergebnisse bisherige Erkenntnisse, wie etwa den positiven Einfluss von Größe, Humankapital und Produktivität. Dieses Bild ändert sich jedoch, wenn zusätzlich für unbeobachtete Heterogenität kontrolliert wird. Insbesondere zeigt sich, dass eine höhere Produktivität und ein höheres Humankapital nicht per se positiv mit der Exportperformance in Verbindung stehen. Vielmehr scheinen diese Variablen mit den unbeobachteten zeitkonstanten Firmeneigenschaften zu korrelieren. Die Größe hat weiterhin einen signifikant positiven Einfluss auf die Exportintensitätsentscheidung.

Abschließend wird in der Studie *„The impact of the 2004 EU-enlargement on enterprise performance and exports of service enterprises in the German eastern border region“* der Einfluss der EU Osterweiterung im Mai 2004 auf unternehmensnahe Dienstleister in der östlichen Grenzregion Deutschlands betrachtet. Die Ergebnisse auf Basis von regressionskorrigierte Difference-in-Differences-Schätzern legen einen negativen Einfluss der Erweiterung auf die Exportintensität und den Umsatz von großen Unternehmen nahe. Gleichzeitig konnte kein Einfluss auf die Exportbeteiligung sowie auf die Rentabilität dieser Unternehmen festgestellt werden. Für kleine Unternehmen in der östlichen Grenzregion zeigt sich ein leichter Anstieg des Umsatzes sowie ein Rückgang der Rentabilität im Vergleich zu anderen kleinen Unternehmen.

Abstract

The majority of empirical studies that centre on exporter performance and the determinants of export performance have focused mainly on the manufacturing sector, largely because there are very few datasets that facilitate a detailed investigation into the service sector. In 2008, however, the German Federal Statistical Office and the statistical offices of the Federal States released the German business services statistics panel (this dataset is described in more details in Chapter 2). Thus, for the first time, appropriate panel analyses of the export behaviour of German business services firms became possible. This thesis uses this panel dataset and contributes to the literature on the microeconometrics of international trade by providing evidence concerning the German business services sector.

Overall, the results noted for exporter performance in the German business services sector correspond with those from the manufacturing sector. Chapter 3 shows that, similar to the manufacturing sector, exporting German business services firms are more productive and clearly larger (in terms of turnover and number of employed persons) than non-exporters, even when it is controlled for size and industry. Further, business services enterprises that export pay higher average wages (even when controlling for size and industry). When controlling for unobserved, time-invariant characteristics, the significant differences between exporters and non-exporters relative to productivity or average wages disappear, while significant export premia associated with the size variables continue to exist, but on a much smaller scale. Concerning the hypothesis that better performing enterprises self-select into export markets, the results indicate that in the business services sector as in the manufacturing sector, enterprises that begin to export are larger than non-exporters, even two years before they commence exporting operations. Regarding productivity (in terms of turnover per employed person) and average wages, the results were statistically significant only for business services enterprises in Germany's western region.

Aside from these similarities with the manufacturing sector, Chapter 4 presents evidence which suggests that, contrary to firms in the manufacturing industries, German business services firms do not benefit from exporting in terms of

higher rates of profit. Chapter 4 documents a negative profitability differential of services exporters compared to non-exporters, and finds that export-starters in the business services sector are less profitable than non-exporters, even two years before they begin to export. Further, the estimated dose-response function, which is used to investigate the causal impact of exports on profits, 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 as well. However, even at the maximum, the average profitability of the exporters is not, or is only slightly, higher than the average rate of profit of the non-exporting firms.

Chapter 5 investigates the question which factors determine the export performance of German business services firms by estimating a model of the firms' export intensity decision. Overall, the results support most of the explanations of export behaviour found in the literature for both service firms and manufacturing firms, such as the positive effects of size, human capital, and productivity. Yet when controlling for unobserved heterogeneity, the picture changes; notably, in the model with fixed effects, the significance of productivity and human capital disappears. This indicates that these variables are not positively related to the export performance per se, but are related instead to unobserved time-constant characteristics. Size still has a significant positive effect on exporting when controlling for unobserved effects.

Finally, Chapter 6 considers the impact of the 2004 EU enlargement on service enterprises close to Germany's eastern border by using regression-adjusted difference-in-differences estimators. The results suggest a small negative impact associated with the EU enlargement on export intensity and the turnover of large enterprises with an annual turnover of €250,000 or more, and no effect on the share of exporters and the turnover profitability of these enterprises. For small enterprises close to Germany's eastern border, an increase in turnover and a decrease in profitability relative to other small enterprises are noted.

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1 Introduction

1.1 Motivation and Overview

The traditional view that “any item that could be put in a box and shipped (roughly, manufactured goods) was considered tradable, and anything that could not be put in a box (such as services) or was too heavy to ship (such as houses) was thought of as nontradable” (Blinder 2006, p. 115) has changed in the recent past. In contrast to goods, even if services are usually immaterial, not storable, highly customized, and require direct contact between user and provider, three modes of delivery are possible (following WTO, 1994; Copeland & Mattoo, 2008): the foreign user consumes the service at the domestic location of the supplier, the service provider opens a foreign commercial presence (foreign direct investment), and the services are supplied by independent or employed natural persons in the foreign country. Further, there are also exceptions to these characteristics. If services can be stored in some medium (e.g., paper or CD), then cross-border delivery is possible, and new forms of telecommunication and information technology facilitate the long-distance delivery of services that were once restricted to a physical place. Thus, in Germany—which was ranked third in the world market for service exports in 2007 (Bundesministerium für Wirtschaft und Technologie, 2009)—the trade with non-residents for services represents nearly 20% of the trade with non-residents in goods (according to the balance of payments; see Deutsche Bundesbank, 2009).

Because the international exchange of services has increased and the service sector is of particular economic importance in developed countries, the internationnalisation of services is increasingly noted by policy makers. Further, research into this topic by economists, business economists, and other disciplines has recently increased as well. Examples for this development include the research program “Tradability and Internationalisation of Services” (*Exportfähigkeit und Internationalisierung von Dienstleistungen)* of the German federal ministry of education and research (see Bundesministerium für Bildung und Forschung, 2004), the recently published handbook of international trade in services (see Mattoo et al., 2007), and special issues of international journals concerning this topic (e.g., the special issue on international trade in services of the Journal of Industry, Competition and Trade

(2008), or the special issue on the internationalisation of service firms of the International Journal of Service Industry Management (2007)).

At present, however, very little is known about the export activities of services at the micro level. A substantial, emerging body of literature in the microeconometrics of international trade provides evidence on a wide range of developed and developing countries (e.g., Bernard & Jensen, 1999; Mayer & Ottaviano, 2008; Wagner, 2007; International Study Group on Exports and Productivity, 2008); however, most of the data is focused on manufacturing firms. Thus, evidence has been derived almost solely from the manufacturing sector. With regard to the economic effect of sector-support programs and the particular importance of the services sector, it would be important to learn whether the findings advanced in this literature can translate to the service sector as well.

To close this gap, this thesis contributes to the literature by focusing on exporter performance and the determinants of export performance in the German business services sector. For this study, the German business services sector has been selected for three specific reasons. First, even though the business services sector covers a wide range of activities, they all provide intermediate inputs.[1] Second, business services are traded more frequently than most other services,[2] and internationalisation in the business services sector demonstrates some similarities with the manufacturing sector (see Roberts, 1999). Finally, in 2008, two new panel datasets were released by the German Federal Statistical Office and the statistical offices of the Federal States (*Länder*). For the first time, this allows detailed panel analyses of the export activities of German business services companies at the firm level, over time.

In February 2008, the German Federal Statistical Office and the statistical offices of the Federal States released the German turnover tax statistics panel 2001-2005 (see Vogel & Dittrich, 2008, for a detailed description of this dataset). This data allowed the first ever analyses of the relationship between exports and productivity in the German business services sector, which are comparable to the results from the manufacturing sector. Using this panel dataset, Vogel (2009) transferred the

[1] For a detailed definition of the business services sector, see the introductions of the papers that are presented in Chapters 3 to 6.

[2] 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, 2009). 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.

standard empirical approach in the microeconometric literature on exports and productivity (see International Study Group on Exports and Productivity, 2008) to the business services. Similar to the manufacturing sector, it was found that exporting business services enterprises are more productive than non-exporters, and that the more productive business services enterprises self-select into export markets. Concerning the hypothesis that exporting increases productivity, no evidence was found. However, Vogel's (2009) investigation was limited significantly by the fact that the German turnover tax statistics contain only the values of the firms' exports of goods and not of their exports of services. Therefore, the export activities of business services enterprises had to be proxied by the export of goods, which prompts the question of whether the data is appropriate to allow a comparison of manufacturing and business services firms.

The possibility of evaluating the robustness of these results appeared in August 2008, when the German Federal Statistical Office and the statistical offices of the Federal States released the German business services statistics panel 2003-2005 (see Chapter 2 for a detailed description of this dataset). Even though this panel dataset covers only three years, it offers two advantages over the turnover tax statistics panel. First, it includes the exports of services and the exports of goods produced by business services firms. Second, it allows more detailed analyses of exporter performance, since it not only contains information about the firms' productivity but also about several other performance indicators. Based on the German business services statistics panel, Chapter 3 confirms the evidence from Vogel (2009) that exporting business services firms are more productive than non-exporters, even when controlling for size and industry. However, the exporter productivity premia disappear when controlling for unobserved effects. Concerning the self-selection of more productive firms into export markets, only weak evidence is found. Furthermore, Chapter 3 provides the first evidence that, similar to the manufacturing sector, German business services firms that export are clearly larger—relative to turnover and number of employees—and pay higher wages than non-exporting business services firms, and that large enterprises self-select into export markets. A self-selection of firms that pay higher average wages is found only for western Germany. In contrast to the evidence related to the manufacturing sector (see Fryges & Wagner, 2009), the results suggest that exporters in the business services sector seem to have a lower profitability than non-exporters.

The observation that exporters in the business services sector seem to achieve lower profitability than non-exporting firms motivates the more detailed investigation of this phenomenon in Chapter 4. Based on the German business services statistics panel, Chapter 4 conducts the first comprehensive, empirical study of the relationship between exports and profitability for several separate business service sectors. In line with the results of Chapter 3, a negative profitability differential was found for business services exporters compared to non-exporters, and evidence for a self-selection of less profitable firms into export markets was found as well. In addition, a recently developed continuous treatment approach is used 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 lower rates of profit than non-exporting firms. Then, with an increase in export intensity, the rate of profit increases as well. However, even at the maximum, average profitability among exporters is not, or is only slightly, higher than the average rate of profit for the non-exporting firms.

Chapter 5 focuses on the determinants of export performance in the German business services sector by estimating a model of the firms' export intensity decision. For the first time, 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 are analysed for the German business services sector. To achieve this, a pooled fractional probit estimator (introduced recently by Papke & Wooldridge, 2008) is used, which is an approach that considers both the special nature of the export intensity variable and unobserved time-invariant characteristics. When there is no control for fixed enterprise effects, the effects of the overall results are in line with previous studies. Yet when controlling for unobserved heterogeneity, the positive effects of productivity and human capital disappear, thus indicating that these variables are not positively related to export performance per se, but are instead related to time-constant characteristics that remain unobserved. Size still has a positive and significant effect.

With the focus on the impact of the 2004 EU enlargement on the export behaviour of German business services firms in Germany's eastern border region, Chapter 6 analyses another determinant of exporting activities. Furthermore, Chapter 6 considers for the first time the impact of this enlargement on enterprise

performance. For this purpose, regression-adjusted difference-in-differences estimators on matched samples are used to model the impact of the enlargement on exports, turnover, and profitability. The results suggest that the EU enlargement had a small negative impact on export intensity and the turnover of large enterprises in the border region. Concerning the share of exporters and the turnover profitability of these enterprises, no effect was found. For small enterprises, Chapter 6 shows significant changes in turnover and profitability.

The last chapter, Chapter 7, contains the overall conclusion and discusses the need for further research.

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2 The German Business Services Statistics Panel*

2.1 Introduction

The majority of empirical studies on the firm level have focused only on the manufacturing sector, largely because there are few datasets that allow a detailed investigation of the service sector. However, the German structural survey in the services sector ("Strukturerhebung im Dienstleistungsbereich"), hereafter called the "German business services statistics", contains a dataset that gives a better picture about enterprises and professional persons in the business-related services sector, namely, firms that are active in the German WZ2003 Sections I (transport, storage and communication) and K (real estate, renting and business activities).[1] This dataset includes information about the number of employed persons, turnover, salaries and wages, investments, subsidies, and variations in stocks. Because the sample of enterprises and professional persons required to give information in 2003 was also used in 2004-2007, it is possible to merge the cross-sectional datasets into a panel dataset that covers the reporting years 2003-2007. The combination is done within the AFiD project[2] of the research data centre of the statistical offices of the Federal States. The resulting "AFiD-Panel Services", hereafter called the "German business services statistics panel", allows panel analyses of the German business services sector for the first time.

In the remainder of this paper, Section 2.2 gives an overview of the business services statistics. Section 2.3 describes the variables included in the panel dataset, and in Section 2.4 selected studies that have worked with the German business services statistics panel are presented to show the research potential of the dataset. Section 2.5 gives a short overview of upcoming changes to the services statistics in

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1 The German WZ2003 is based on the Statistical Classification of Economic Activities in the European Community NACE Revision 1.1 (European Commssion, 2002).

2 The acronym AFiD stands for the German "*A*mtliche *Fi*rmendaten für *D*eutschland" (Official Firm Data for Germany). For more information about the project, see Malchin and Voshage (2009).

the reporting year 2008. Section 2.6 closes the paper with information about the way of data access.

2.2 About the data

Based on an initiative by the European Union (European Council, 1996), the statistical offices have collected annual services statistics ("Strukturerhebung im Dienstleistungsbereich") since the year 2000 (cf. Pesch, 2007) through a structural survey of service activities included in Sections I and K of the German WZ2003, which is based on the Statistical Classification of Economic Activities in the European Community NACE Rev. 1.1 (European Commission, 2002). In particular the statistics contain the sectors of land transport, transport via pipelines (WZ 60), water transport (WZ 61), air transport (WZ 62), supporting and auxiliary transport activities, activities of travel agencies (WZ 63), post and telecommunications (WZ 64), real estate activities (WZ 70), renting of machinery and equipment without operator and of personal and household goods (WZ 71), computer and related activities (WZ 72), research and development (WZ 73), and other business activities (WZ 74) such as legal activities, market research, business and management consultancy activities, advertising, and architectural and engineering activities. Enterprises and professional persons (statistical units) whose main activity is in one of these sectors and that have an annual turnover of EUR 17,500 or more may be asked to provide information to the statistical offices of the Federal States on an annual basis.

The statistical units are selected through a stratified random sample drawn from the business register that is kept by the Federal Statistical Office and the statistical offices of the Federal States. The stratification is based on the Federal States, 4-digit industries and 12 size ranges (in terms of turnover or employees). At most, 15 percent of the statistical units receive a questionnaire from the statistical offices and are asked to participate in the survey. Enterprises and professional persons that are a part of the population under consideration (i.e., statistical units in the German WZ2003 Sections I and K with an annual turnover of EUR 17,500 and higher) have an obligation to provide information if asked. For more details about the sample design, see Federal Statistical Office (2008a, p. 2f).

Because the sample of enterprises and professional persons required to give information in 2003 was also used in 2004-2007[3] (see Federal Statistical Office, 2008a), the cross-sectional datasets (using the ID from the business register) can be merged to a panel dataset that covers the reporting years 2003-2007. The combination of the surveys to a panel data set is done within the AFiD project of the research data centre of the statistical offices of the Federal States (see Malchin and Voshage, 2009).

Table 2.1
The five most frequent patterns of participation 2003-2005

No.	Reporting year			Number of statistical units	% of statistical units
	2003	2004	2005		
All enterprises and professional persons					
1	yes	yes	yes	69,968	57.20
2			yes	14,214	11.62
3		yes	yes	12,834	10.49
4	yes			10,045	8.21
5	yes	yes		9,250	7.56
Enterprises and professional persons with an annual sum of turnover and other operating income greater than or equal to EUR 250,000 (full questionnaire)					
1	yes	yes	yes	36,303	56.51
2			yes	7,268	11.31
3		yes	yes	6,690	10.41
4	yes			5,540	8.62
5	yes	yes		4,719	7.35
Enterprises and professional persons with an annual sum of turnover and other operating income lower than EUR 250,000 (reduced questionnaire)					
1	yes	yes	yes	28,063	42.96
2			yes	10,096	15.45
3	yes			7,807	11.95
4		yes	yes	7,799	11.94
5	yes	yes		6,034	9.24

Data base: The German Business Services Statistics Panel 2003 to 2005.
Note: "yes" indicates that the statistical unit participated in the respective reporting year; a blank indicates that the enterprise did not participate in the respective reporting year. Considered are enterprises and professional persons in the German WZ2003 Sections I and K that had to report to the German business services statistics in at least one of the three years under consideration.

[3] In addition to the sample of enterprises that were required to give information in 2003, samples of new enterprises were annually drawn as a stratified sample from new entries to the business register in the years 2004 to 2007.

For the reporting years 2003-2005[4] the panel dataset contains nearly 70,000 enterprises and professional persons with information in all three reporting years (see Table 2.1). This corresponds to 57.2 percent of all enterprises that participated in the survey at least in one of the three reporting years under consideration. More than 36,000 statistical units had an annual sum of turnover and other operating income that was EUR 250,000 or higher in all three periods. These enterprises and professional persons had to provide information on the full questionnaire for the reporting years 2003-2005. (See Section 2.3 for more information about the questionnaire.)

2.3 Variables included

The business services statistics panel includes information about the economic sector, the number of employed persons, total turnover, salaries and wages, investment, and variations in stocks. However, small statistical units with an annual sum of turnover and other operating income lower than EUR 250,000 are given an abbreviated questionnaire, so more detailed information, like information on non-domestic turnover, is missing for these statistical units. A complete list of the variables included for enterprises and professional persons with an annual sum of turnover and other operating income that is smaller than EUR 250,000 and for those with an annual sum of turnover and other operating income that is equal or greater than EUR 250,000 can be found in Table 2.2. The questionnaire that is presented here was used in the reporting years 2003-2007.

The variables included in the business services statistics follow the Commission Regulation concerning the definitions of characteristics for structural business statistics (European Commission, 1998). As a result, it is possible to compute, for example, the value-added at factor costs (i.e., the gross income from operating activities after adjusting for operating subsidies and indirect taxes) and the gross operating surplus (i.e., the surplus that is generated by operating activities after the labour factor input has been recompensed) in line with the definition by the European Commission (1998, p. 55f).

[4] As of this writing the panel dataset is available only for the reporting years 2003 to 2005. The 2003-2006 version of the panel will be available in the spring of 2009, and the 2003-2007 version of the panel will be probably released at the beginning of 2010. See Section 2.6 for more information about data access.

Table 2.2

Variables included in the

German business services statistics panel 2003 to 2007

	Variables included in questionnaire for enterprises and professional persons with an annual sum of turnover and other operating income that is:	
	smaller than EUR 250,000	greater than or equal to EUR 250,000
Economic sector	X	X
Legal form	X	X
Number of subsidiaries	X	X
Turnover and other operating income (VAT excluded)	X	X
- turnover		X
- exports		X
- other operating income		X
Number of persons employed (on 30.9.)	X	X
- part-time employed persons		X
- female employed persons		X
- employees (i.e., wage and salary earners)	X	X
- apprentices		X
(Gross) Wages and salaries	X	X
Social security costs	X	X
Material expenses (deductible VAT excluded)	X	X
- for goods and services purchased for resale in the same condition as received		X
- for raw materials and consumables		X
- other operating charges		X
- charges for rents and operational leasing	X	X
Stocks at the beginning and the and of the year (valued at acquisition costs/deductible with VAT excluded)	X	X
- stocks of goods and services purchased for resale in the same condition as received		X
- stocks of raw materials and consumables		X
- stocks of finished self-produced goods and work in progress (valued at cost of production)		X
Gross investment	X	X
- in machinery and equipment		X
- in buildings and structures		X
- in land		X
- capitalised production		X
- in intangible assets		X
- in software		X
Taxes on production, public fees and charges	X	X
Subsidies	X	X
For statistical units with subsidiaries in more than one Federal State: turnover, wages and salaries, investment, employed persons broken down by Federal States		X

Note: The original questionnaire can be found in Federal Statistical Office (2008b, p. 11ff).

Some additional notes: The number of persons employed covers all persons employed by the enterprises and professional persons[5] on 30 September of the reporting year, excluding agency workers, freelancers (Freie Mitarbeiter), and persons employed abroad. The information on the number of employees is not yet stated in full-time equivalent units. Exports are defined as the amount of turnover with customers abroad (including also exports to foreign subsidiaries).[6] Unfortunately, the dataset contains no information about the target countries for exports or other international activities such as partnerships, direct investments or imports. Finally, cross-sectional weights are provided for the business services statistics, although longitudinal weights are not available.

2.4 Research potential

The German business services statistics panel dataset has enough observations to allow detailed analyses of business services enterprises and professional persons over time. Thus, it is possible to test whether findings that have been derived almost solely from the manufacturing sector are transferable to the business services sector.

A case in point is the huge amount of literature on the micro-econometrics of international trade, which provides evidence mainly for the manufacturing sector. In contrast to other regularly collected, non-exclusive datasets from German data production facilities[7], the business services statistics panel contains a sufficient number of observations, as well as information about the firms' total exports. The availability of this data offers the chance to contribute to the literature on international trade by analysing export activities of business services firms over time. Thus, several studies were based on the business services statistics panel for 2003-2005. Braakmann and Vogel (2009) considered the impact of the 2004 EU enlargement on

5 Included are working proprietors, partners working regularly in the enterprise and unpaid family workers, full- and part-time workers, employees, persons who work outside, civil servants, apprentices, trainees and voluntary workers.

6 In the case of multinational companies, the turnover of foreign subsidiaries is excluded.

7 For example, the Establishment Panel of the Institute for Employment Research of the Federal Labour Services in Germany (*Institut für Arbeitsmarkt- und Berufsforschung der Bundesagentur für Arbeit*/ IAB) contains business services establishments and these establishments' percentage of exports to total turnover (see Kölling, 2000). However, the small sample size of business services establishments does not allow for detailed analyses of business services establishments that export. In particular, the number of enterprises beginning export activities is very small, which inhibits, for example, the analysis of the self-selection into export markets. Further, the turnover tax statistics panel from the German Federal Statistical Office and the statistical offices of the Federal States includes all business services enterprises whose annual total turnover exceeds EUR 17,500. However, the analysis of business services enterprises that export is limited by the fact that the dataset contains only the exports of goods and not the exports of services (see Vogel and Dittrich, 2008).

enterprise performance and on the export behaviour of business services enterprises and professional persons in Germany's eastern border region, while Eickelpasch and Vogel (2009) analysed the impact of several firm-specific characteristics on the firms' export performance. Vogel's (2009) investigation was in line with empirical models used to analyse the manufacturing sector in terms of whether export premia and self-selection into export markets exist in the German business services sector. Finally, Vogel and Wagner (2009) conducted an empirical study on the relationship between exports and profitability in the business services sector.

Further research topics could include investigation of the heterogeneity of enterprises within business services sectors in terms of their growth in several performance indicators, or analyses of the differences between the developments in the East and West German business services sectors on the enterprise level. In addition, regional references—the Federal State is directly included and the district (Kreis) is available via the business register—allow the integration of regional context variables such as the gross domestic product, the rate of unemployment, and the tax rates of the region where the enterprise is located.

2.5 Prospects

Because of the German WZ2008, the NACE Revision 2 (see European Parliament, 2006) and the revised regulations concerning structural business statistics (see European Parliament, 2008), the design of the business services statistics will change with the reporting year 2008. According to Redling (2008), the considered business lines will be extended to more services sectors (including sectors that were seen as manufacturing sectors in the NACE Revision 1.1), and a completely new sample will be drawn. The statistics will also include new variables, namely, the number of employees expressed in full-time equivalent units, payments for agency workers, and more detailed information about turnover (e.g., information about the exports to EU and non-EU countries). However, more detailed information about turnover will be recorded only for statistical units with more than 20 employed persons and only for selected business lines. (See Redling, 2008, for more details.) Consequently, this major change in the services statistics inhibits the continuation of the business services statistics panel beyond 2007. However, starting with 2008, a new services statistics panel will offer new research possibilities concerning a wider range of service activities, as well as new variables.

2.6 Data access

The access to micro-data of official statistics is provided by the research data centres of the German Federal Statistical Office and the statistical offices of the Federal States.[8] At the beginning of 2009, the German business services statistics panel 2003-2006 became available via controlled remote data processing, which facilitates analysis of the formally anonymised original data. It is also possible to work with the de facto anonymised dataset of the business services statistics panel on safe scientific workstations on the protected premises of the statistical agencies. The panel for the reporting years 2003-2007 will probably be released at the beginning of 2010.

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3 Exporter Performance in the German Business Services Sector*

3.1 Motivation

A wide range of empirical studies has analysed exporter performance, especially the relationship between exports and productivity in the manufacturing sector, but a detailed investigation of the service sector remains largely neglected, even though the service sector has particular importance for the economy. Nearly 70% of the gross value-added in Germany is contributed by the tertiary sector, and it engages more than 70% of employed persons (see Federal Statistical Office, 2008). Furthermore, services are no longer non-tradable; according to the German balance of payments, the trade with non-residents for services is 20% of the trade with non-residents for goods (see Deutsche Bundesbank, 2009).

Despite their importance for the economy and the fact that services have become tradable, very little is known about the determinants of international trade of services on the micro level. Empirical evidence about the link between exporting and enterprise performance has been derived almost solely from the manufacturing sector. Previous research in the manufacturing sector has shown that exporters are larger (based on employees and total turnover) and more productive than non-exporters, and that they pay higher wages. Furthermore, high-performing firms self-select into export markets (e.g., Bernard & Jensen, 1999; Mayer & Ottaviano, 2008). It would be useful to know if these findings are transferable to the service sector, especially with regard to the economic effect of sector-support programmes.

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To close this gap, this paper contributes to the literature by focusing on the relationship between exporters and enterprise characteristics of average wages paid, productivity, size and turnover profitability (a performance dimension that is only rarely investigated in the manufacturing sector; see Fryges & Wagner, 2009) for the German business services sector.[1] Even though the business services sector covers a wide range of activities, business services are traded more than most other services,[2] and these activities have in common that they provide primarily intermediate inputs. The purpose of the paper is to determine whether export premia and self-selection into export markets exist in German business services enterprises. To ensure the comparability of the results, empirical models used to analyse the manufacturing sector (e.g., Bernard & Jensen, 1999) are transferred to business services.

The study uses a dataset from the recently released German business services statistics panel 2003-2005, which contains, among other things, information about the export activities, number of persons employed, total turnover, and average wage of more than 20,000 business services enterprises per year. This data facilitates performance analyses of exported German business services on an enterprise level over time. The dataset also contains information about the regional location of each enterprise, which can be used to compare the export behaviours of East and West German firms, considering that the East German economy, even 18 years after the German reunification, still differs from the West German economy.

The paper begins with an overview of the literature about exports and performance in the manufacturing sector and presents considerations and studies of the export activities in the business services sector. The dataset and data preparations are then described while the following section presents the empirical results, starting with a descriptive overview, followed by the econometric analyses of the export premia and the test of the self-selection hypothesis. The paper offers conclusions.

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1 Unless otherwise stated, business services are defined in this paper as NACE divisions 72 (e.g., hardware and software consultancy, data processing, software publishing and database activities), 73 (i.e., research and development) and 74 (e.g., business, management and tax consultancy, advertising, legal activities, market research, and architectural and engineering activities).

2 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, 2009). 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.

3.2 Exports and performance

Performance differences between non-exporters and exporters have been widely investigated in the manufacturing sector. Recent surveys show strong evidence that firms that export are more productive than non-exporting firms and that more productive firms self-select into export markets. (Greenaway & Kneller, 2007; Wagner, 2007). Even when further performance dimensions are considered, exporters in the manufacturing sector show superior performance, and superior performing firms self-select into export markets. For example, exporting firms are larger in terms of employees and total turnover, generate higher value-added (e.g., Bernard & Jensen 1999 for the U.S.; Bernard & Wagner, 1997 for Germany; Mayer & Ottaviano, 2008 for a number of European countries), pay higher wages (e.g., Schank, Schnabel & Wagner, 2007 for a survey), and have slightly higher profitability (Fryges & Wagner, 2009).

Explanations for the self-selection of the most efficient firms into export markets are found in the more intensive competition in international markets as well as in additional costs expended for, for example, transportation, tariffs, market research, product adaptations, and setting up new distribution networks. Only the more productive firms can expect good results from entering a more competitive market, and only more productive firms are able to absorb the additional costs and to overcome the entry barrier. In the economics literature, more recent models of internationalisation have shown that the self-selection of more productive firms into export markets is due to sunk entry costs and per-unit trade costs (e.g., Melitz, 2003 as the workhorse of this literature, and Bernard et al., 2003). Higher wages in enterprises that export or will soon export are expected because of the link between productivity and wages. For example, rent-sharing motives could determinate the wage preferences of the workers, such that the fair wage depends, in addition to other effects, on the productivity level of the enterprise (an extension of the Melitz, 2003, framework by Egger & Kreickemeier, 2009). More productive enterprises employ workers with more skills, so exporting enterprises tend to pay higher wages (cf. Yeaple, 2005). On the other hand, the effect could be reversed, as higher wages could cause higher productivity (Akerlof & Yellen, 1986). Higher monitoring costs in larger firms could also lead to higher wages in enterprises that export or plan to

export (e.g., Davis & Harrigan, 2007, based on Melitz, 2003, and the efficiency wage model of Shapiro & Stiglitz, 1984).

A different approach to explaining internationalisation is found in the business and management literature. According to traditional models, internationalisation is an incremental process that depends on the ability to accumulate knowledge through exposure to foreign markets. The business and management literature has also recognised that additional costs and uncertainties are inevitable when an enterprise enters a foreign market, but the literature has focused on the processes that explain how potential barriers are overcome. A more recent focus on 'born global' enterprises has also included resources and capabilities as crucial, but has also considered other aspects, such as the role of joint-ventures as a means to overcome initial resource and competency gaps, e.g., sunk entry costs (see Harris & Li, 2005, for a review of this literature). The management literature has used resource-based theory to explain the relationship between exporting and enterprise size and has argued that larger enterprises have a greater ability to engage effectively in export activities and that larger enterprises can better absorb the risks associated with internationalisation (e.g., Aaby & Slater, 1989; Javalgi, Griffith, & White, 2003). Further, enterprise size plays a critical role in influencing the attitudes of the management toward internationalisation (e.g., Javalgi, Griffith, & White, 2003).

In contrast to goods, services are usually immaterial, not storable, and highly customized and they require direct contact between user and provider. Thus, three modes of delivery are possible (following WTO, 1994; Copeland & Mattoo, 2007): the foreign user consumes the service at the domestic location of the supplier, the service provider opens a foreign commercial presence (foreign direct investment), and the services are supplied by independent or employed natural persons in the foreign country. There are also exceptions to these characteristics: If services can be stored in some medium (e.g., paper, CD), cross-border delivery is possible, and new forms of telecommunication and information technology also allow long-distance delivery of services that were once limited to a physical place.

The key differentiating factor for the internationalisation of services firms and manufacturing firms seems to be the inseparability between consumer and producer (Erramilli 1990). However, due to the characteristics of business services, exports in form of personnel travelling to foreign markets, the provision of services to foreign costumers in the home market but also in form of embodied (e.g. reports, letters) and

wired (e.g. telephone conversations, data transfers) services play a significant role in the internationalisation process of business services enterprises (see for example Roberts, 1999). Thus, the paper focuses on a part of the services sector, where exporting has some similarity to the export of goods.

Considering the self-selection hypothesis, the business service sector is comparable to the manufacturing sector in terms of three types of costs and barriers. First, the need for resources (for example Javalgi et al., 2003; Winstead & Patterson, 1998) and the need for knowledge concerning marketing, foreign markets (i.e., market research), and so on (for example Winstead & Patterson, 1998) are important barriers in both sectors. Second, while shared with the manufacturing sector, cultural and language differences represent barriers and costs that are more critical in the business services sector since, because of the high level of interaction between user and provider, exporters of services must have good language skills, a high level of intercultural competence, and the ability to customize and adapt services to the specific market (McLaughin & Fitzsimmons, 1996; Winstead & Patterson, 1998). Regulatory barriers, like the need for locally recognised professional qualifications or other country-specific requirements, can also affect the fixed costs of entering an export market and the variable costs of servicing that market to a greater extent for service enterprises than for manufacturing enterprises (Kox & Nordås, 2007). Finally, while shared with manufacturing enterprises, elements that represent a lower cost barrier for service enterprises include transportation costs. While service enterprises may see additional costs in the form of personal transport costs if the service is supplied by a person in a foreign country, transportation costs tend to play a secondary role in the case of cross-border delivery of services, primarily because of communication technology, while they play a primary role in the delivery of goods. Lower transportation costs could allow less productive service firms to enter export markets (Melitz, 2003). However, due to similarities in internationalisation between the business services and manufacturing sectors (Roberts, 1999) a similar self-selection effect of business services enterprises into export markets that are larger and more productive and that pay higher wages is expected.

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. Similar to the manufacturing sector, innovativeness in the service sector (e.g., measured by an innovator dummy or the intensity of innovation

expenditures) is positively associated with the likelihood of exporting activity (Chiru, 2007; Ebling & Janz, 1999; Gourlay, Seaton, & Suppakitjarak, 2005; Love & Mansury, 2007). The effect of size on the probability of exporting in the service sector has only mixed evidence: Love and Mansury (2007) showed a hump-shaped relationship, Gourlay et al. (2005) found a linear positive effect, Chiru (2007) showed a u-shaped relationship, and Ebling and Janz (1999) found no significant effect. Empirical studies about the relationship between exports and productivity showed that a higher productivity in period *t* (Love & Mansury, 2007) or *t-1* (Harris & Li, 2007) increased the likelihood of an enterprise's being an exporter in period *t*. However, the literature still lacks a detailed investigation of export premia and self-selection effects related to different performance dimensions that is directly comparable to the approaches used for the manufacturing sector.

3.3 The data

Only three regularly collected, non-exclusive datasets that include information about the export activities in the service sector are available from German data production facilities. First, the Establishment Panel of the Institute for Employment Research of the Federal Labour Services in Germany (Institut für Arbeitsmarkt- und Berufsforschung der Bundesagentur für Arbeit/ IAB), an annual representative survey of establishments, contains nearly 2,000 business services establishments (NACE code K) each year, including these establishments' percentage of exports to total turnover (Kölling, 2000). However, the small sample size of business services establishments does not allow detailed analyses of business services establishments that export. In particular, the number of enterprises beginning export activities is small, which inhibits analysis of the self-selection hypothesis.[3]

The turnover tax statistics panel from the German Federal Statistical Office and the statistical offices of the Federal States, secondary statistics based on the monthly and quarterly advance turnover tax returns (i.e., the turnover tax prepayments of the enterprises), include all German business services enterprises whose annual total turnover exceed €17,500. However, the analysis of business services enterprises that export is limited by the fact that the dataset contains only the exports of goods and not the exports of services (Vogel & Dittrich, 2008).

[3] The panel contains fewer than 15 business services enterprises that began exporting in 2003 and had no exports between 2000 and 2002, and fewer than 25 business services enterprises that began exporting in 2004 and had no exports between 2001 and 2003.

Finally, the German Federal Statistical Office and the statistical offices of the Federal States recently released the business services statistics panel 2003-2005. Even if the statistics cover only three years, it is the only dataset that contains enough observations and enough information about the total non-domestic turnover to analyse the export activities of business services enterprises over time. This paper uses this dataset.

Based on an initiative by the European Union (European Council, 1996), the statistical offices of the Federal States and the German Federal Statistical Office have collected the annual business services statistics ('*Strukturerhebung im Dienstleistungsbereich*') since the year 2000. The data covers enterprises and professional persons ('*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 ('*Bundesländer*'), 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 sample of enterprises that were required to give information in 2003 was also used in 2004 and 2005, it is possible to merge the cross-sectional datasets to a panel dataset that covers the reporting years 2003 to 2005 (Pesch, 2007; Federal Statistical Office, 2007).

The business services statistics panel includes, among other data, information about the economic sector, the number of employed persons (not including agency workers), total turnover, salaries and wages, and variations in stocks. However, small enterprises with an annual sum of turnover and other operational income that is lower than €250,000 are given an abbreviated questionnaire, so important information, like that concerning export activities, is missing for these enterprises. As a result, only those enterprises with an annual sum of turnover and other operational income greater than or equal to €250,000 are considered for the analyses. Further, the analysis includes only enterprises with one or more employees (i.e., one or more wage and salary earners).

In the business services statistics exports are defined as the amount of turnover with costumers abroad, including both exports of services and goods.[4] The enterprises' export activities are measured by an export dummy (1 if exporting; 0 if not) and export intensity (percentage of exports in total turnover). Unfortunately, the dataset contains no information about the target countries for exports or other international activities such as partnerships, direct investments or imports.

The turnover profitability is generated as gross firm surplus, which is the surplus generated by operating activities after the labour factor input has been recompensed (see European Commission, 1998), divided by total turnover, minus the change in stocks of goods and services. The average wage of an enterprise is computed by the total amount of wages and salaries, divided by the number employees, and labour productivity is measured as value-added (computed in line with the definition by the European Commission, 1998) per employed person and turnover per employed person. The number of persons employed covers all persons that are employed by the enterprises on 30 September of the reporting year. The information on the number of employees is not stated in full-time equivalent units. This difference has to be considered while interpreting the average wage, the value-added per employed person, and the turnover per employed person, because the values of these variables are underestimated in the case of enterprises with a high share of part-time employed persons. To minimize this problem, the share of part-time employed persons is included in the estimations as a control variable.

3.4 Empirical analyses

This Section investigates whether a relationship between exporting activity and performance (described earlier) exists in the German business services sector. A descriptive overview about the intensity of export activity, the participation in export activity, and the differences between exporting and non-exporting business services enterprises is followed by more detailed analyses of self-selection into export markets.[5]

[4] In the case of multinational companies, the turnover of foreign subsidiaries is excluded.

[5] Some additional notes: In all analyses, values are stated in 2003 prices. To avoid bias by outliers, the 1st and 99th percentiles of the wage, turnover profitability and value added distributions, as well as the 99th percentile of the distributions of turnover and employed persons are excluded from all computations. Finally, the federal state of Berlin is included in the East Germany analysis.

3.4.1 Descriptive overview

All three business service industries (computer and related activities, research and development, and other business activities) showed a slight increase in the percentage of exporting enterprises (export participation) as well as in terms of exports to total turnover (export intensity) between 2003 and 2005 (see Table 3.1).[6] Although it is increasing, the share of exporting enterprises in the business services sector is far below that of the manufacturing sector. However, many products that are exported by manufacturing firms include components of both services and goods, so one important aspect of export activities of services enterprises, especially business services enterprises, is also the indirect export of services via manufactured goods and the servicing of exports (for example Daniels, 2000). Data about such indirect exports, however, is hard to collect.

The highest export participation was in the research and development sector, followed by computer and related activities. But even the heterogeneous sector of 'other business activities' contains industries whose percentage of exporting enterprises is around 20%; these are legal activities, market research and public opinion polling, business and management consultancy, technical testing and analysis, and advertising. Overall, the business services enterprises in East Germany showed a lower export participation compared to the West German enterprises.

[6] A more detailed presentation of the export participation between 2000 and 2005 based on the cross-sectional business services statistics can be found in Eickelpasch (2008).

TABLE 3.1
EXPORT PARTICIPATION OF BUSINESS SERVICES ENTERPRISES
IN WEST AND EAST GERMANY

Industries (NACE Code)	share of exporting enterprises (in %)		average export intensity (in %)			
			all enterprises		exporters only	
	2003	2005	2003	2005	2003	2005
West Germany						
Total business services sector (72, 73, 74)	14.6	16.9	2.5	3.2	17.3	19.1
Computer and related activities (72)	25.6	26.6	4.9	5.3	19.2	20.0
Research and Development (73)	33.6	36.7	10.7	12.1	31.8	32.9
Other business activities (74)	12.7	15.1	2.1	2.8	16.2	18.2
Legal activities (74.11)	19.5	18.4	2.3	2.5	11.6	13.7
Accounting, book-keeping and auditing activities; tax consultancy (74.12)	7.7	10.0	0.4	0.6	5.2	6.4
Market research, public opinion polling, business and management consultancy (74.13, 74.14)	20.5	24.9	5.3	7.2	25.7	28.9
Management activities of holding companies (74.15)	11.0	10.5	3.4	4.6	31.1	44.1
Architectural and engineering activities (74.2)	9.8	14.0	2.0	3.1	20.2	21.9
Technical testing and analysis (74.3)	18.9	29.6	4.2	7.0	22.1	23.7
Advertising (74.4)	19.4	22.7	2.5	2.5	12.7	11.1
Labour recruitment (74.5)	6.4	8.4	1.1	1.1	16.6	12.8
East Germany						
Total business services sector (72, 73, 74)	9.2	11.0	1.7	2.1	18.4	18.8
Computer and related activities (72)	19.8	20.0	3.4	4.7	17.3	23.8
Research and Development (73)	34.2	38.1	7.9	10.3	23.3	27.1
Other business activities (74)	7.2	8.8	1.3	1.4	18.1	16.1
Legal activities (74.11)	12.1	14.0	0.6	1.2	4.8	8.6
Accounting, book-keeping and auditing activities; tax consultancy (74.12)	4.5	5.9	0.5	0.4	11.3	7.2
Market research, public opinion polling, business and management consultancy (74.13, 74.14)	15.4	16.2	3.8	4.8	24.6	29.3
Management activities of holding companies (74.15)	5.0	2.7	1.9	0.4	37.6	16.3
Architectural and engineering activities (74.2)	6.4	7.9	1.7	1.7	26.3	21.9
Technical testing and analysis (74.3)	14.0	18.3	1.9	3.0	13.8	16.7
Advertising (74.4)	8.4	13.1	0.3	0.8	3.5	6.1
Labour recruitment (74.5)	4.2	5.8	1.1	0.9	26.2	14.7

Source: Authors' calculations; Data base: The German Business Services Statistics Panel 2003 to 2005.
Note:
Only enterprises with a sum of turnover and other operating income greater than or equal to €250,000 and with one or more employees are considered. All values are weighted with cross-sectional weights.

Table 3.2 reports the results from the comparison of exporting and non-exporting business services enterprises. Because of lower average wage and productivity levels in East Germany, the results are presented separately for both parts of Germany. The average values of the performance variables, as well as index values of the variables are compared between exporters and non-exporters in order

to consider the different nature of the activities inside the heterogeneous services industries. These index values are computed as the percentage difference of the respective variable in an enterprise from the average value of all enterprises from the same 4-digit industry. Thus, the values are controlled for different levels of the variables among the business services activities.

TABLE 3.2
EXPORTERS VS. NON-EXPORTERS IN THE WEST AND EAST GERMAN BUSINESS SERVICES SECTOR 2005

	Non-exporters		Exporters	
	Mean	index (in %)	mean	index (in %)
West Germany				
Number of persons employed	22.0	92.2	23.1	138.7
Turnover (in € 1,000)	1,272.8	87.6	2,445.2	161.5
Average wage (in € 1,000)	27.8	97.7	34.0	111.5
Turnover per employee (in € 1,000)	109.2	97.6	135.2	112.1
Value added per employee (in € 1,000)	59.2	99.6	61.6	102.0
Turnover profitability (in %)	24.6	103.4	20.1	83.1
Number of observations (unweighted)	14,232		3,577	
East Germany				
Number of persons employed	22.9	94.9	26.7	141.3
Turnover (in € 1,000)	1,087.6	92.2	2,017.5	163.9
Average wage (in € 1,000)	23.2	98.7	28.2	110.4
Turnover per employee (in € 1,000)	87.4	99.1	98.1	107.4
Value added per employee (in € 1,000)	45.4	99.9	47.0	100.5
Turnover profitability (in %)	21.1	102.0	16.3	83.7
Number of observations (unweighted)	4,181		603	

Source: Authors' calculations; Data base: The German Business Services Statistics Panel 2003 to 2005.
Note:
The index is computed as the percentage difference of the respective variable in an enterprise, compared to the average value of all enterprises from the same 4-digit industry. T-tests show statistically significant (alpha=1%) differences for all index comparisons except the productivity variables in East Germany. Only enterprises with a sum of turnover and other operating income greater than or equal to €250,000 and with one or more employees are included. The 1st and 99th percentiles of the wage, turnover profitability and value added distributions, as well as the 99th percentile of the distributions of turnover and employed persons are excluded from all computations. All values are in 2003 prices and weighted with cross-sectional weights.

On average, business services enterprises that export are larger (i.e. have higher total turnover and more persons employed), more productive (i.e. have a higher turnover and value added per employed person) and pay higher average wages than enterprises that serve only the domestic market. For West Germany, t-tests show statistically significant (alpha=1%) differences for all 4-digit industry based

index comparisons while this is not true for the productivity variables for East German enterprises.

In contrast to the manufacturing sector, where a higher turnover profitability of exporting enterprises is shown (Fryges & Wagner, 2009), East German and West German business services exporters both have a statistically significant lower turnover profitability than do non-exporting enterprises. One possible reason for this is that, in the more labour-intensive business services sector, it is more difficult for exporters to absorb completely the extra cost of exporting or higher wages by means of their higher productivity. However, this performance dimension is a very new point in the manufacturing literature as well (cf. Fryges & Wagner, 2009), so more research is necessary to assess this result.

3.4.2 Export premia

Following Bernard and Jensen (1999) and the International Study Group on Exports and Productivity (2008) the exporter premia are investigated in this section by computing the ceteris paribus percentage differences of several enterprise attributes between exporters and non-exporters. These premia are computed from a regression of several variables (*X*) on the current export status dummy and a set of control variables:

$$(1)\ X_{it} = ß_0 + ß_1\ export_{it} + ß_2\ control_{it} + e_{it},$$

where *i* is the enterprise index, *t* is the index of the years between 2003 and 2005, *e* is the error term, and *X* indicates the enterprise characteristics, namely the turnover profitability in percent as well as the logarithm of the number of employed persons, turnover, average wage, turnover per employed person, and value added per employed person (with all values given in 2003 prices). In the first model, the vector *control* contains in a full set of interaction terms of year and economic activity (4-digit) dummies. In the second model, the number of employed persons, its squared value, and the share of part-time employed persons are also included, except in the case of the employment regression.

Two variants are estimated for the *export* variable. First, equation 1 is estimated with an export dummy indicating the export status of the enterprise (1 if exporting, 0 if not). Concerning the turnover profitability, the exporter premia ($ß_1$) shows the average difference between exporters and non-exporters in percentage points, controlling for the characteristics included in the vector control. In the case of

the logarithmised variables, the exporter premia (computed as 100*(exp($ß_1$)-1)) shows the average percentage difference of the characteristics between exporting and non-exporting enterprises, controlling for the characteristics included in the vector control. In a second variant, the export intensity is included in the equation in order to investigate whether the export premia increases with an increase in the percentage of exports to total turnover. To account for a possible non-linear relationship, both the export intensity and its squared value are included.

In addition to the pooled regression of equation 1, the panel structure of the dataset is used to estimate a fixed effects model that controls for unobserved, time-invariant heterogeneity.[7]

Table 3.3 reports the results of the estimations of the enterprise characteristics on the export status, and Table 3.4 reports the results for the estimations on the export intensity. Even for business services enterprises, the results of the pooled regression show statistically and economically significant positive export premia for every characteristic except turnover profitability in the years 2003 to 2005. By far the largest differences between exporting and non-exporting enterprises occurred in the size variables; in both parts of Germany exporters have a number of employed persons that is around 50% higher and a total turnover that is around 40% higher (when it is controlled for the number of persons employed and industries) than non-exporters. The differences in the average wage and the labour productivity variables range in East Germany from more than 5% to nearly 18% and in West Germany from more than 10% to 20%. As discussed in Section 3.4.1, exporters show a turnover profitability that is around three percentage points lower than the turnover profitability of non-exporting enterprises.

After controlling for unobserved heterogeneity by including fixed enterprise effects, the analyses show that differences in size are still present, even though on a much lower scale. For all other characteristics, there are no significant differences between exporters and non-exporters. The much smaller export size premia and the insignificant differences concerning the other characteristics in the fixed effects model (compared to the pooled regression) suggest that the exporter status variable is positively correlated with the unobserved effect. This drop in the premia is

[7] Both the pooled regression and the fixed effects model are estimated with cluster robust standard errors, relaxing the assumption of independence of the observations. Independence is assumed only between enterprises. To control for unobserved, time-invariant heterogeneity, a first differences model was also estimated. Because results were similarity to the results of the fixed effects model, these results are not presented.

consistent with the idea that enterprises that are more ‘able’ are also more likely to export. Such unobserved effects that are correlated with both the export status and the considered performance variables might be for example the talent of the management, the uniqueness of the product offered, or the ability to accumulate knowledge (in line with the management literature). Thus, in the pooled regression, a large part of the export premia reflect that, even if they were not exporting, exporting enterprises would be more productive and would pay higher wages.

A second variant of the estimation shows the relationship between the enterprise characteristics and the export intensity. In both parts of Germany, the results are similar to the estimation on the export status dummy: If the export intensity increases, based on the pooled regression, the results show a significant increase (with a slight degressive character) of the export premia of all characteristics, except the turnover profitability. Again, the size variables show the highest differences. When controlling for unobserved, time-invariant characteristics, no significant differences occur (Table 3.4).

In summary, German business services enterprises that export are clearly larger (in terms of turnover and employed persons) than business services enterprises that do not export. In line with the manufacturing sector, business services enterprises that export are more productive and pay higher average wages, even when controlled for size and industry. In contrast to the evidence for the manufacturing sector, however, exporters in the more labour-intensive business services sector have a lower turnover profitability. The comparison of the results from the pooled regression and the fixed effects model indicates some evidence that the more ‘able’ enterprises are more likely to export. When it is controlled for unobserved, time-invariant characteristics, e.g., the ability of the management or the firms’ ability to accumulate knowledge, no significant difference between exporters and non-exporters concerning productivity, profitability and average wages is found. The question concerning whether enterprises that are larger and more productive and that pay higher wages self-select into export markets is investigated in the next section.

TABLE 3.3
EXPORT PREMIA OF BUSINESS SERVICES ENTERPRISES
IN WEST AND EAST GERMANY (2003-2005)

	Estimation of enterprise characteristics on export status and controls in t			
	pooled regression		fixed effects model	
	1	2	1	2
West Germany				
Number of persons employed (log)	56.8**	-	2.5**	-
Turnover (log)	85.1**	41.7**	2.4**	2.0**
Average wage (log)	17.8**	14.5**	-0.1	0.4
Turnover profitability (in percent)	-3.2**	-2.2**	-0.8+	-0.8+
Turnover per employee (log)	18.1**	20.4**	-0.1	0.5
Value added per employee (log)	11.8**	11.7**	-1.5	-1.0
Number of observations	51,780			
East Germany				
Number of persons employed (log)	49.8**	-	0.9	-
Turnover (log)	70.6**	38.4**	3.1*	3.3*
Average wage (log)	15.1**	14.6**	-0.8	-1.0
Turnover profitability (in percent)	-3.8**	-3.1**	-1.1	-1.1+
Turnover per employee (log)	13.9**	17.7**	2.2	1.9
Value added per employee (log)	5.1*	6.4**	-3.4	-3.6
Number of observations	13,845			

Source: Authors' calculations; Data base: The German Business Services Statistics Panel 2003 to 2005.
Note:
The estimated regression coefficients and the levels of significance (+ indicates significance at the 10% level, * at the 5% level, and ** at the 1% level, based on cluster robust standard errors) are presented from two estimations of the turnover profitability and the logarithmised number of employed persons, turnover, average wage, turnover per employed persons and value added per employed persons on the export status at t. Model 1 controls for a full set of interaction terms of year and economic activity (4-digit) dummies. Model 2 also controls for the number of employed persons, its squared values, and the share of part-time employed persons. To facilitate the interpretation, the estimated coefficient for the export dummy on the logarithmised variables has been transformed by 100(exp(ß)-1). The transformation shows the average percentage difference of the respective variables (ceteris paribus) between exporters and non-exporters. The 1st and 99th percentiles of the wage, turnover profitability and value added distributions, as well as the 99th percentile of the distributions of turnover and employed persons are excluded from all computations.

TABLE 3.4
EXPORT PREMIA OF BUSINESS SERVICES ENTERPRISES
IN WEST AND EAST GERMANY (2003-2005)

	Estimation of (the log of) enterprise characteristics on the export intensity and controls in t							
	pooled regression				fixed effects model			
	1		2		1		2	
	export inten-sity	export inten-sity^2	export inten-sity	export inten-sity^2	export inten-sity	export inten-sity^2	export inten-sity	export inten-sity^2
West Germany								
Number of persons employed (log)	2.49**	-0.03**	-	-	0.20**	0.00**	-	-
Turnover (log)	3.61**	-0.04**	2.12**	-0.02**	0.14	0.00+	0.10	0.00
Average wage (log)	1.02**	-0.01**	0.82**	-0.01**	0.00	0.00	0.04	0.00
Turnover profitability (in percent)	-0.17**	0.03**	-0.11**	0.00*	-0.10*	0.00	-0.10*	0.00
Turnover per employee (log)	1.09**	-0.01**	1.15**	-0.01**	-0.06	0.00	-0.01	0.00
Value added per employee (log)	0.85**	-0.01**	0.80**	-0.01**	-0.18	0.00	-0.14	0.00
Number of observations	51,780							
East Germany								
Number of persons employed (log)	2.10**	0.37**	-	-	0.15	0.00	-	-
Turnover (log)	2.68**	-0.03**	1.70**	-0.01**	0.09	0.00	0.07	0.00
Average wage (log)	0.94**	-0.01**	0.89**	-0.01**	-0.25+	0.00*	-0.24*	0.00*
Turnover profitability (in percent)	-0.33**	0.00**	-0.30**	0.00**	-0.10	0.00	-0.10	0.00
Turnover per employee (log)	0.57*	0.00	0.70**	0.00	-0.06	0.18	-0.04	0.00
Value added per employee (log)	0.18	0.00	0.21	0.00	-0.45	0.00	-0.43	0.00
Number of observations	13,845							

Source: Authors' calculations; Data base: The German Business Services Statistics Panel 2003 to 2005.
Note:
The estimated regression coefficients and the levels of significance (+ indicates significance at the 10% level, * at the 5% level, and ** at the 1% level, based on cluster robust standard errors) are presented from two estimations of the turnover profitability and the logarithmised number of employed persons, turnover, average wage, turnover per employed persons and value added per employed persons on the export status at t. Model 1 controls for a full set of interaction terms of year and economic activity (4-digit) dummies. Model 2 also controls for the number of employed persons, its squared values, and the share of part-time employed persons. To facilitate the interpretation, the estimated coefficient for the export intensity on the logarithmised variables has been transformed by 100(exp(ß)-1). The transformation shows the average percentage difference of the respective variables (ceteris paribus) between exporters and non-exporters. The 1st and 99th percentiles of the wage, turnover profitability and value added distributions, as well as the 99th percentile of the distributions of turnover and employed persons are excluded from all computations.

3.4.3 Self-selection hypothesis

The estimated export premia concerning the differentials between exporting and non-exporting enterprises provide no information about the causality between exporting and the performance variables under consideration. Therefore, this section reports on tests of whether the export premia reflect a self-selection of better performing enterprises into export markets.[8] Following the standard approach from the literature of the manufacturing sector (International Study Group on Export and Productivity, 2008), the hypothesis that enterprises that begin exporting perform better than non-exporters, even two years before they begin to export, is investigated. Therefore, with only those enterprises with no export activities between *t-2* and *t-1* taken into consideration, the average differences of several enterprise characteristics in periods *t-2*, *t-1* and *t* from enterprises that start to export in period *t* and enterprises that do not export in any period are estimated. These pre-entry differences are estimated from a regression of several variables (*X*) in *t, t-1*, and *t-2* on an export starter dummy (in *t*) and a set of control variables:

$$(2)\ X_{it-\rho} = ß_0 + ß_1\ \text{export starter}_{it} + ß_2\ \text{control}_{it-\rho} + e_{it}, \quad \text{with } 0 \le \rho \le 2$$

and where *i* is the enterprise index, *t* represents the starting year 2005, *ρ* represents the time-lag to the starting year, e is the error term and *X* indicates the considered characteristics, namely the turnover profitability in percent as well as the logarithm of the number of employed persons, turnover, average wage, turnover per employed person, and value added per employed person (with all values given in 2003 prices). In the first model, the vector *control* contains dummies for the economic activities (4-digit), while the second model also contains the number of employed persons, that number's squared value, and the share of part-time employed persons as well, except in the employment regression.

Export starter is a dummy variable that indicates the export status in *t* (1 if the enterprise starts to export, 0 if it does not). Regarding the turnover profitability, the estimated coefficient $ß_1$ shows the average difference between exporter starters and non-starters in percentage points at *t-2, t-1* and *t*. In the case of the logarithmised variables, the average percentage differences in the specific characteristics at *t-2, t-1*

[8] In addition to the self-selection hypothesis, it has been hypothesised in the literature that exporting improves the performance of the enterprises (cf., e.g., Bernard & Jensen, 1999). The manufacturing sector has demonstrated only mixed evidence concerning this hypothesis (cf., e.g., Wagner, 2007). However, because the dataset covers only a short time period, it is not possible to test this learning-by-exporting hypothesis.

and *t* between enterprises that begin to export at *t* and enterprises that do not is computed from the estimated coefficient $ß_1$ by 100*(exp($ß_1$)-1).

Table 3.5 presents the pre-entry premia of enterprises that began to export in 2005 for two years before starting to export, one year before starting to export and at the starting year. In West Germany, prospective exporters are, on average, 25% larger (in terms of employed persons and turnover), pay nearly 10% higher average wages, and have a 10% higher turnover per employed person than do non-starters, even in the periods before the prospective exporters begin to export. In contrast, the turnover profitability of future exporters is around two percentage points lower than the profitability of non-starters for all time lags. These results are statistically significant, at least at the 0.1 level. For the second productivity variable, the value added per employed person, positive pre-entry premia are found for the enterprises in the dataset, but these premia are not significant at any conventional level when controlled for size and industry dummies. Further, the pre-entry premia of the several performance variables is nearly constant between *t-2* and *t-1*, the two considered pre-entry years.

A similar picture is found for the East German enterprises in the dataset. However, only the positive differences in the size variables are statistically significant. That there is no significance in the positive differences in the average wage and the productivity variables may be because of the small number (less than 100) of East German business services enterprises that began to export. In contrast to the West German results, in East Germany, a two percentage point higher turnover profitability of prospective exporters is found two years before exporting starts, but the coefficient is not significant.

TABLE 3.5
SELF-SELECTION INTO EXPORT MARKETS OF BUSINESS SERVICES ENTERPRISES 2005

	OLS estimation of the (logarithmised) characteristics on export start in t=2005 and controls in t, t-1 and t-2					
	Two years before starting (t-2)		One year before starting (t-1)		In the starting year (t)	
	1	2	1	2	1	2
West Germany						
Number of employed persons (log)	24.5**	-	25.4**	-	26.6**	-
Turnover (log)	38.5**	24.3**	41.5**	24.4**	44.7**	27.4**
Average wage (log)	9.5**	6.6**	8.8**	5.1+	10.1**	7.9**
Turnover profitability (in percent)	-2.3**	-1.8+	-2.3*	-1.9+	-3.2**	-2.7**
Turnover per employee (log)	11.2**	10.6**	12.8*	11.1**	14.3**	14.0**
Value added per employee (log)	5.7+	4.3	6.3*	3.7	7.3**	6.1+
Number of export starters	530					
Number of non-starters	8,712					
East Germany						
Number of employed persons (log)	24.1*	-	24.0*	-	34.6**	-
Turnover (log)	30.3**	19.1*	31.5**	21.7**	43.4**	24.1**
Average wage (log)	5.6	6.3	7.5	8.2+	7.7	8.2+
Turnover profitability (in percent)	1.9	2.3	-2.5	-2.2	-2.3	-1.9
Turnover per employee (log)	5.1	7.5	6.1	8.4	6.5	9.7+
Value added per employee (log)	8.7	10.5+	5.4	6.7	0.8	2.4
Number of export starters	99					
Number of non-starters	2,581					

Source: Authors' calculations; Data base: The German Business Services Statistics Panel 2003 to 2005.
Note:
The estimated regression coefficients and the levels of significance (+ indicates significance at the 10% level, * at the 5% level, and ** at the 1% level, based on robust standard errors) are presented from two OLS estimations of the turnover profitability and the logarithmised number of employed persons, turnover, average wage, turnover per employed persons and value added per employed persons at t-2, t-1 and t. Model 1 controls for a full set of economic activity (4-digit) dummies. Model 2 also controls for the number of employed persons, its squared values, and the share of part-time employed persons. To facilitate the interpretation, the estimated coefficient for the export starter dummy on the logarithmised variables has been transformed by 100(exp(ß)-1).The transformation shows the average percentage difference in the respective variables at t-2, t-1 and t between enterprises that begin exporting ("export starters") at t and enterprises that do not start to export. The 1st and 99th percentiles of the wage, turnover profitability and value added distributions, as well as the 99th percentile of the distributions of turnover and employed persons are excluded from all computations.

Thus, in line with evidence from the literature about the manufacturing sector, the results for both parts of Germany indicate that larger enterprises in the business services sector self-select into export markets. Further, the West German results indicate a self-selection into export markets of enterprises that pay higher wages. In terms of productivity, only for the turnover per employed person significant differences between enterprises beginning to export and those that are not are found. Nonetheless, also the positive pre-entry premia in terms of value added per employed person found in the dataset suggests weak evidence that self-selection of more productive enterprises to export is present in the business services sector, just as it is in the manufacturing sector.

3.5 Conclusion

The relationship between exports and enterprise performance has been widely investigated in the manufacturing sector, but no detailed investigation of the services sector has been performed. To close this gap, this paper provides first evidence about export premia and the self-selection into export markets in the German business services sector.

Similar to the manufacturing sector (Bernard & Jensen, 1999; Mayer & Ottaviano, 2008), German business services enterprises that export are clearly larger (in terms of turnover and employed persons) than are non-exporting business services enterprises. Business services enterprises that export are also more productive and pay higher average wages, even when controlled for size and industry. This finding is also in line with studies of the manufacturing sector (Wagner, 2007; Schank, Schnabel & Wagner, 2007) and with previous productivity studies of the service sector (Harris & Li, 2005; Love & Mansury, 2007). In contrast to the evidence for the manufacturing sector (Fryges & Wagner, 2009), exporters in the business services sector seem to have a lower turnover profitability, indicating, for example, that it is more difficult for business service exporters to absorb completely the extra costs of exporting, and especially higher wages, by means of their higher productivity. However, when it is controlled for unobserved, time-invariant characteristics, there are no significant differences between exporters and non-exporters concerning productivity, profitability or average wages. Thus, the export variable may be correlated with these unobserved characteristics, which may provide some evidence that the more ‘able’ enterprises (e.g. in terms of management ability

or, following the ideas of the management literature, the firms' ability to accumulate knowledge) are more likely to export.

To analyse whether the export premia reflect the self-selection of better performing enterprises into export markets, the hypothesis is tested that enterprises that begin exporting perform better than non-exporters, even two years before they begin to export. In line with evidence from the literature about the manufacturing sector, the results indicate that in the business services sector, as in the manufacturing sector, large enterprises self-select into export markets. Regarding the productivity and average wages, a self-selection was found for the enterprises in the dataset, but the results were only statistically significant for West German business services enterprises (in terms of average wage and turnover per employed person).

Because of the very short time period of the data, the question of whether the export premia considered here reflect a learning-by-exporting effect remains open. Even in the manufacturing sector, only mixed evidence concerning this hypothesis is available (cf., e.g., Wagner, 2007), so further research based on longer panel data is needed in this area. Future research could also consider the specific export markets to analyse any differences between enterprises that export to neighbours and those that export to more distant markets. However, as of this writing, no dataset with such information and enough observations is available for Germany.

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4 Exports and Profitability – First Evidence for German Business Services Enterprises*

4.1 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

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[1] See Bernard et al. (2007) for the U.S., Mayer and Ottaviano (2008) 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 (2009).[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, 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.

[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 (2009) for an overview).

[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 (2009)). 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.

Our investigation considers export activities defined as the first, the second and the fourth mode of delivery mentioned in the General Agreement on Trade in Services (see WTO 1994, p. 285). Thus, our export measure covers cross-border delivery of services (using e.g. new forms of telecommunication and information technology), services that are used by foreign clients at the domestic location of the supplier, and services that are supplied by natural persons in the foreign country. Mode 3 (i.e. the provider produces the service in a foreign subsidiary after foreign direct investment) is not considered in our analysis.

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 (described in detail in Section 4.6 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 (2009). 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 4.2 introduces our data base, the German statistics on business services. Section 4.3 presents results from descriptive comparisons of exporting and non-exporting business services firms. Section 4.4 reports estimations of exporter profitability premia after controlling for observed and unobserved differences between exporters and non-exporters. Section 4.5 documents whether differences between export starters and non-exporters exists even before the future exporters starts to export and Section 4.6 investigates the causal effect of exporting on profitability using the recently developed generalised propensity score (GPS) methodology. Section 4.7 concludes.

4.2 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, exports via commercial presence, 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 dataset see Vogel (2009b).

4.3 Descriptive analysis

4.3.1 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 4.1 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 was in the research and development sector (about 36 percent in 2005), followed by computer and related activities (about 25 percent in 2005).[6]

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

[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)).

Table 4.1: 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.

4.3.2 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]

$$rate\,of\,profit = \frac{gross\,value\,added - gross\,wages - costs\,for\,social\,insurance}{total\,sales - net\,change\,of\,inventories}$$

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 the capital intensity by including a complete set of industry dummy variables at the most disaggregated (4-digit) level.[8]

Table 4.2 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 2009) 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.

[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.

[8] One important problem with the profitability measurement we use, arises due to the fact that two main components of profitability, profits and capital costs, need not to show a monotone relationship between each other. This may bias the results.

Table 4.2: 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.

4.4 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 of an exporter profitability premium per se, the estimated coefficient of the share of exports in total sales shows whether this premium increases with an increase in the relative importance of exports for an enterprise. The quadratic terms test for the presence 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.[9]

For all business services (NACE divisions 72 to 74) the results based on empirical models using pooled data without fixed enterprise effects are reported as models 1 to 4 in Table 4.3. According to the results in model 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,

[9] 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.

reported in Table 4.2), and from model 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 model 4, there is evidence for a 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[10] is controlled for by including fixed enterprise effects[11], we still find a negative relationship between exporting and the rate of profit. From model 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.[12]

When we look at the more disaggregated industry level, we find almost similar results in terms of signs and significance levels (see Table 4.4).[13] The highest 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.

[10] 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.

[11] To control for unobserved heterogeneity we estimate a fixed-effects model using the Stata xtreg, fe command. This procedure is equivalent to a regression that includes an indicator variable for each firm, allowing for a different intercept term for each firm (see e.g. Nichols 2007 for an intuitive description).

[12] Note, however, that this regression is not meant to “explain” profits. The dataset is not rich enough for estimating a complete model of profitability. Our empirical model is just a way to test whether or not profits did differ between exporters and non-exporters, or by export intensity.

[13] Due to space restrictions only the estimated coefficients of the exporter dummy are presented in Table 4.4. The more detailed tables that include also the estimated coefficients of the share of exports in total sales are available on request.

Table 4.3: 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 4.4: 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 (pooled model 2003 to 2005)	ß	-3.82	-3.23	-2.94	-2.72	-3.35	-7.32
	p-value	0.000	0.000	0.050	0.000	0.000	0.000
Profit Premia of exporters (fixed effects model 2003 to 2005)	ß	-0.71	-1.68	-1.06	-0.96	0.78	-2.88
	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.

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.[14]

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 4.5 investigates whether export starters are less profitable than non-exporters, even before they begin to export and Section 4.6 analyses the causal effect of a firm's export activity on its rate of profit.

4.5 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

[14] 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.

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 4.5.

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 (research and development; where the number of observations is very small) and NACE section 74.1 (business consultancy, market research, etc.).

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.[15] 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. 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.

[15] 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.

Table 4.5: 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.

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 4.3 and 4.4 could be caused also by negative effects of exports on the rate of profit (e.g. by higher additional costs or more competitive markets). 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 4.2, 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).

4.6 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 (2008, 2009) 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. First, 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 4.3 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 and Wagner (2009, 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.[16] 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.[17] 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)

[16] 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.

[17] 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.

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 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 log of the firms' lagged labour productivity (measured as sales per employee in t-1), the share of part-time employees[18], and the share of purchased goods and services for resale on total turnover[19]. 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 customer-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 4.5), most studies in the literature about the manufacturing sector confirm the self-

[18] The information on the number of employees is not stated in full-time equivalent units. This difference has to be considered while interpreting the coefficients of the log of number of employees, the average wage, and the labour productivity variable, because the values of these variables are underestimated in the case of enterprises with a high share of part-time employed persons. To minimize this problem, the share of part-time employed persons is included in the estimation as a control variable.

[19] The share of turnover represented by goods and services that were purchased explicitly for resale in the same condition as received is included in our model to control for a possible effect of products and services that are not produced by the company itself on the export and export intensity decision, Unfortunately, we can not distinguish between purchased goods for resale and purchased services for resale. Thus we can not directly control for the effect that a high export intensity might reflect a high share of purchased goods for resale (that might be easier to export than services). However, we use this control variable at least as a proxy for this effect and expect therefore a positive coefficient.

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)).[20] 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 4.6.[21] 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. 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.

[20] 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.

[21] 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 4.4.

Table 4.6: 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.

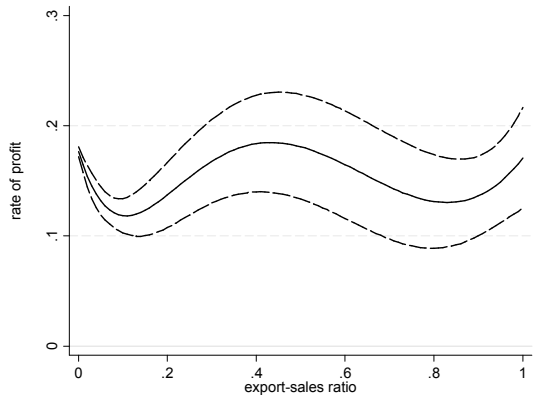
The fractional logit model is estimated in order to calculate the generalised propensity score (GPS). As Imbens (2000) shows, adjusting for the GPS removes all the bias associated with differences in covariates between treated (exporting) and non-treated (non-exporting) firms. Thus, in the second stage 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.[22]

The dose-response function that represents the expected profitability conditional on the export-sales ratio and the GPS is depicted in Figure 4.1.

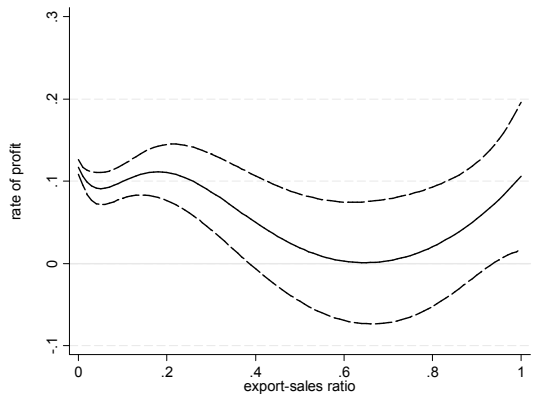
[22] Computations were done using Stata 10 and the Stata package for the estimation of dose-response functions (see Bia and Mattei (2008)) that was adjusted by the authors concerning the use of the fractional logit model in the first step of the GPS method.

Figure 4.1: Estimated dose-response functions of the treatment export intensity in 2004 on the outcome rate of profit in 2005

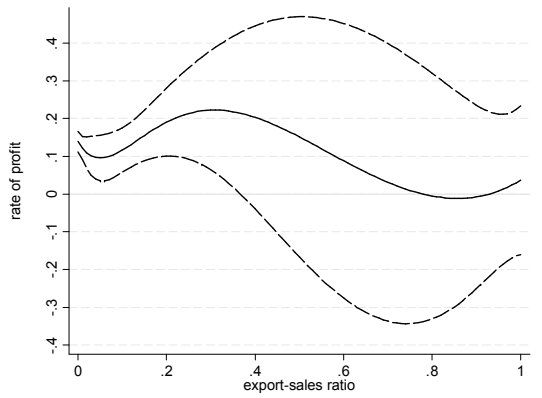
All business services (NACE 72 to 74)



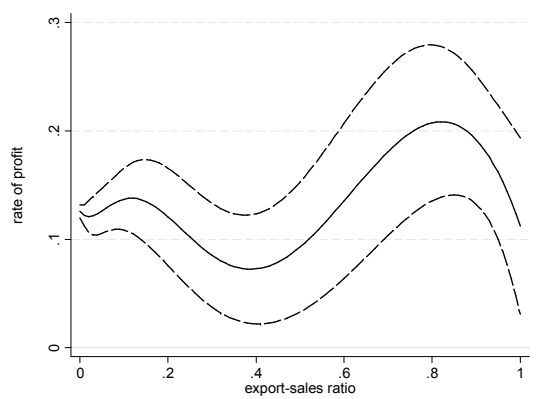
Computer and related activities (NACE 72)



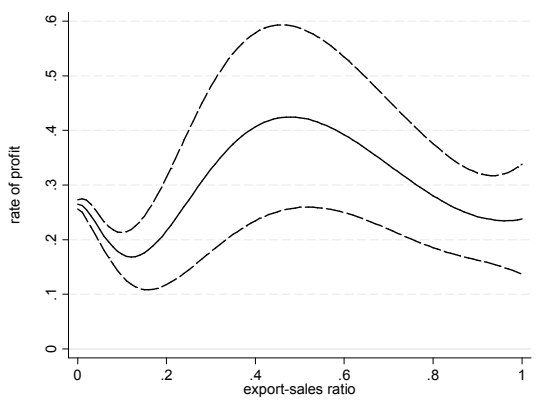
Research and development (NACE 73)



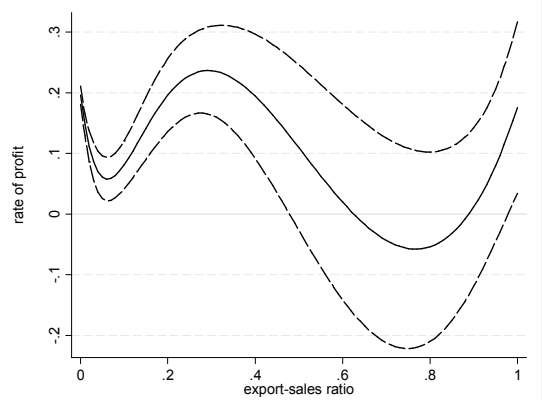
Other business activities (NACE 74 without 74.1 and 74.2)



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% level (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.

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 4.2), 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.[23] 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.

The results we obtained in this section are very similar to those described in Section 4.4. At least, the estimation results without fixed enterprise effects as reported in model 1 to 4 of Table 4.3 show an s-shaped relationship between profitability and the export-sales ratio. Based on the estimated function for all business services industries on model 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 4.4, 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

[23] 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.

sector have a export intensity that is higher than 40 percent this difference is not economically relevant.

4.7 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 the results suggest that in the services sector (but not in manufacturing) any cost advantage due to higher productivity might be "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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5 Determinants of Export Behaviour of German Business Services Companies*

5.1 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 2008, German companies exported 992 billion euros' worth of goods, according to the balance of payments. This was 66 percent more than in 2000 (in current prices). In addition, services were exported on a large scale. In 2008, the export of services (not including travel expenses) amounted to 143 billion euros. This was up 96 percent on 2000 (in current prices) and thus represented even greater growth than that of products (see Deutsche Bundesbank 2009).

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

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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 the firm level. In our analysis we focus 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 5.2 begins with an overview of the literature about the determinants of export performance. The German business services statistics are

described in Section 5.3, while Section 5.4 describes our empirical model and estimation strategy. In Section 5.5 and 5.6, the results of the descriptive and econometric analyses are presented. The final section summarises the findings and discusses their implications.

5.2 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 as a whole, 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 positively related 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.

5.3 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.

5.4 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 5.2.

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 be 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). This 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.

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.

To control for a possible effect of products and services that are not produced by the company itself on the export and export intensity decision, we include the share of turnover represented by goods and services that were purchased explicitly for resale in the same condition as received in our model. Unfortunately, we can not distinguish between purchased goods for resale and purchased services for resale. Thus we can not directly control for the effect that a high export intensity might reflect a high share of purchased goods for resale (that might be easier to export than services). However, we use this control variable at least as a proxy for this effect and expect therefore a positive coefficient.

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.[1]

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 5.1.

Formally, our model can be expressed as

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

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, dummies for nationwide active

[1] In addition to the region dummy that we include in the estimations for greater Germany, we take the structural differences between East and West Germany into consideration by estimating all models for East and West Germany separately. Summaries of these results are presented in footnotes in each section. The detailed result tables can be found in the Appendix (Tables 5.A2 to 5.A7).

firms, and per-capita-investments.[2] *C* indicates the control vector that contains the share of goods and services for resale, 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 5.1: 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)	+
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)	-
Goods and services for resale	Purchased goods and services for resale (% of turnover)	+

*+ = encourages export, - = discourages export.

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 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. 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

[2] 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).

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 unobserved time-invariant heterogeneity 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 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.

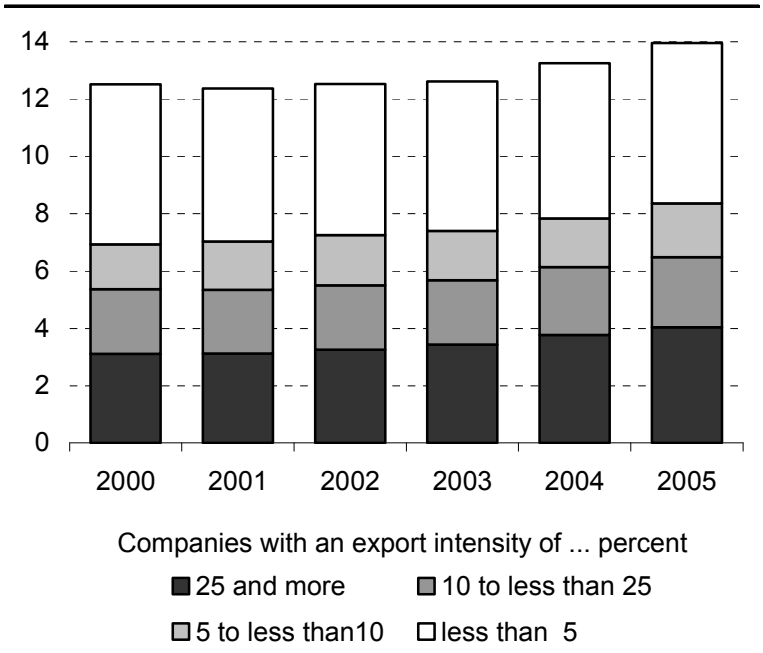
All models are estimated with robust or, in the case of pooled data, cluster-robust standard errors. The regressions were run using the Stata program (Version 10). According to Papke and Wooldridge's approach, regressions are estimated with the Stata command for generalised linear models.

5.5 Descriptive analysis

5.5.1 Export behaviour

In 2005, nearly 14.0 percent of the responding service companies were exporting (Fig. 5.1). 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.)

Fig. 5.1
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.

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 5.2). 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 5.2: 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.

5.5.2 Differences between exporting and non-exporting firms

Table 5.3 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

[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.

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. They show on average a higher share of turnover from purchased goods and services for resale than 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.[4]

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.[5] 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.

[4] When looking at the descriptive statistics for East and West Germany separately (see Tables 5.A2 and 5.A3 in the Appendix) the picture is almost similar. In both parts of Germany exporters are significant larger (in terms of the number of employed persons), pay higher wages, have a lower share of part-time employees, have a lower productivity and have a higher share of turnover from purchased goods and services for resale. Concerning the gross investment per employed person no significant differences between exporters and non-exporters occur. In contrast, West German exporters show a significant lower gross investment per employed person. Compared to the West German enterprises, East German firms are on average smaller, have a lower productivity level, pay lower average wages and have a higher share of part-time employees.

[5] 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).

Table 5.3: 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
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
Purchased goods and services for resale [in % of turnover]	10.8	21.3	17.8	25.5	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.

5.6 Estimation results

5.6.1 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 5.4 (probit regression) and Table 5.5 (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 5.6.2, pooled regressions based on the cross-sectional data sets for 2003 to 2005 were carried out.[6]

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

[6] Table 5.A6 in the Appendix presents the results of the probit regression and the fractional probit regression for East and West Germany separately. Concerning the probit regression of the export activity the signs and significance levels of almost all variables are equal for both parts of Germany. Concerning the fractional probit of the export intensity the separate results suggest that the all-German results are mainly driven by the West German enterprises. Thus, the East German results show – in contrast to the West German results – no significant size effect, no significant coefficient of the share of part-time workers and no significant effect of the private company dummy.

exporter and choose a higher volume of exports than sole proprietors. This is also in line with our expectations. Finally, the share of turnover from purchased goods and services for resale has a significant positive coefficient and 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 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.

Table 5.4: 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)
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)
Goods and services for resale	0.006 *** (0.000)	0.005 (0.348)	0.006 *** (0.000)	0.006 *** (0.000)
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 5.5: 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)
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)
Goods and services for resale	0.004 *** (0.000)	0.004 *** (0.000)	0.004 *** (0.000)	0.004 *** (0.000)
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.

5.6.2 The role of unobserved time-invariant characteristics

In Section 5.6.1, 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 5.6.1 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.[7]

In order to compare the results of the cross-sectional pooled regressions in Section 5.6.1 with the results obtained from the balanced panel data set, we estimate in an initial step a pooled fractional probit regression without time averages of the explanatory variables. As a second step, we introduce the time averages of the explanatory variables into the panel regression in order to control for time-constant effects. The results are presented in Table 5.6.[8]

First, as expected, we observe that the results of the panel regression without time averages are identical to the results of the pooled cross-sectional regression in Section 5.6.1 in terms of signs and significance levels.

[7] Descriptive panel statistics of the balanced dataset can be found in Table 5.A1 in the Appendix. Theses statistics indicate that in the German business services sector 2003-2005 the export intensity variable shows a considerable high within variation. (In addition Tables 5.A4 and 5.A5 show the descriptive panel statistics for the East and West Germany separately.)

[8] In addition Table 5.A7 presents the estimation results for East and West Germany separately. Again the separate results suggest that the all-German results are mainly driven by the West German enterprises.

This picture changes when – in a second step – we control for unobserved time-invariant effects by adding the time averages of the explanatory variables:[9] 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 controlling for unobserved heterogeneity) and the share of turnover from purchased goods and services for resale 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 positively related to productivity and human capital per se. There are further time-constant factors that could not be observed in this estimation and are correlated to productivity and human capital. What exactly these determinants are is an open question. They 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.

[9] In the model with control for unobserved heterogeneity, 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.

Table 5.6: 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 time averages of all exogenous variables	with time averages of all exogenous variables
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
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)
Goods and services for resale	0.004 *** (0.000)	0.001 *** (0.002)
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.

5.7 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 consider potential determinants such as size, productivity and human capital that were 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 compare the results with 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 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 fractional probit estimations of the first step of our analyses, we find a positive relationship between export performance and size, productivity and human capital. 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 included time-averages of the regressors, 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 similar estimates for the manufacturing sector (Wagner 2008). Size still has a positive and significant effect on exports 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.

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5.9 Appendix

5.9.1 Descriptive panel statistics 2003-2005 (Germany)

Table 5.A1: Descriptive panel statistics (balanced panel) 2003-2005

Variables	Balanced Panel 2003-2005			
	Mean	Standard Deviation		
		Overall	Between	Within
Dependent variable				
Export intensity [in % of turnover]	2.9	12.3	10.4	6.5
Export intensity [in % of turnover] - exporters only*	12.4	22.9	18.5	13.4
Independent variables				
Size [number]	43	81	80	13
Productivity [value added per person employed in €]	82974	149007	132835	67515
Human capital [labour cost per employee in €]	35413	21393	20007	7574
Part-time work [in % of persons employed]	24.5	25.7	23.8	9.8
Investment [gross investment per person employed in €]	9744	40297	33003	23122
Purchased goods and services for resale [in % of turnover]	11.0	21.1	18.8	9.7
Number of observations	88,002			
Number of enterprises	29,334			

Notes: (*) The export intensity of exporters is only based on enterprises that have in at least one of the three periods an export intenstiy greater than zero

5.9.2 Results for East and West Germany separately

Table 5.A2: Descriptive statistics for non-exporters and exporters in East Germany 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	18.5	26.1	0.000
Independent variables					
Size [number]	32	67	44	81	0.000
Size squared [number]	5562	30824	8427	36854	0.001
Productivity [value added per person employed in €]	74858	140787	55718	69794	0.000
Human capital [labour cost per employee in €]	28054	16994	33656	17798	0.000
Part-time work [in % of persons employed]	20.4	25.2	15.3	19.1	0.000
Legal status [Dummies]					
Sole proprietor	0.269	0.443	0.176	0.381	0.000
Private company	0.167	0.373	0.138	0.345	0.020
Public limited company	0.531	0.499	0.667	0.472	0.000
Other	0.033	0.177	0.019	0.138	0.026
Experience on the national market [Dummies]					
No subsidiary	0.863	0.344	0.814	0.389	0.000
1 or 2 subsidiaries	0.105	0.307	0.140	0.347	0.001
3 and more subsidiaries	0.032	0.175	0.046	0.210	0.018
Investment [gross investment per person employed in €]	10153	39648	9565	43507	0.664
Purchased goods and services for resale [in % of turnover]	10.3	19.9	15.0	23.1	0.000
Number of observations	8,482		978		

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 5.A3: Descriptive statistics for non-exporters and exporters in West Germany 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	21.0	28.2	0.000
Independent variables					
Size [number]	38	81	50	87	0.000
Size squared [number]	7976	41000	10145	43071	0.000
Productivity [value added per person employed in €]	96843	200314	85748	139394	0.000
Human capital [labour cost per employee in €]	35721	23902	43966	23628	0.000
Part-time work [in % of persons employed]	28.4	27.9	21.1	21.3	0.000
Legal status [Dummies]					
Sole proprietor	0.205	0.404	0.126	0.332	0.000
Private company	0.241	0.428	0.232	0.422	0.174
Public limited company	0.535	0.499	0.630	0.483	0.000
Other	0.019	0.136	0.012	0.109	0.000
Experience on the national market [Dummies]					
No subsidiary	0.887	0.316	0.798	0.402	0.000
1 or 2 subsidiaries	0.081	0.272	0.144	0.351	0.000
3 and more subsidiaries	0.032	0.176	0.058	0.235	0.000
Investment [gross investment per person employed in €]	10863	50599	7185	33013	0.000
Purchased goods and services for resale [in % of turnover]	10.9	21.7	18.3	25.9	0.000
Number of observations	27,253		5,608		

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 5.A4: Descriptive panel statistics (balanced panel) East Germany 2003-2005

Variables	Balanced Panel 2003-2005			
	Mean	Standard Deviation		
		Overall	Between	Within
Dependent variable				
Export intensity [in % of turnover]	1.6	9.0	7.4	5.2
Export intensity [in % of turnover] - exporters only*	10.5	21.2	16.2	13.5
Independent variable				
Size [number]	37	70	69	11
Productivity [value added per person employed in €]	72691	127488	118086	48064
Human capital [labour cost per employee in €]	28665	15692	14501	6000
Part-time work [in % of persons employed]	18.7	23.7	21.8	9.5
Investment [gross investment per person employed in €]	10495	37764	30145	22747
Purchased goods and services for resale [in % of turnover]	10.1	19.3	17.3	8.5
Number of observations	19,143			
Number of enterprises	6,381			

Notes: (*) The export intensity of exporters is only based on enterprises that have in at least one of the three periods an export intenstiy greater than zero

Table 5.A5: Descriptive panel statistics (balanced panel) West Germany 2003-2005

Variables	Balanced Panel 2003-2005			
	Mean	Standard Deviation		
		Overall	Between	Within
Dependent variable				
Export intensity [in % of turnover]	3.3	13.1	11.1	6.8
Export intensity [in % of turnover] - exporters only*	12.8	23.2	18.9	13.4
Independent variable				
Size [number]	45	83	82	13
Productivity [value added per person employed in €]	85832	154340	136521	71996
Human capital [labour cost per employee in €]	37288	22366	20903	7957
Part-time work [in % of persons employed]	26.1	26.0	24.0	9.9
Investment [gross investment per person employed in €]	9536	40972	33753	23227
Purchased goods and services for resale [in % of turnover]	11.2	21.6	19.2	10.0
Number of observations	68,856			
Number of enterprises	22,952			

Notes: (*) The export intensity of exporters is only based on enterprises that have in at least one of the three periods an export intenstiy greater than zero

Table 5.A6: Determinants of the export activity and the export intensity of companies in the German business services sector in West and East Germany 2003-2005

	Probit regression of the export activity (1: exporter, 0: non exporter)		Fractional probit regression of the export intensity (exports as percent of turnover)	
	pooled (2003 - 2005)			
	East Germany	West Germany	East Germany	West Germany
Size	0.004 *** (0.000)	0.004 *** (0.000)	0.000 (0.752)	0.002 *** (0.000)
Size squared [x 10^3]	-0.006 *** (0.000)	-0.006 *** (0.000)	0.000 (0.796)	-0.003 *** (0.000)
Productivity [x 10^4]	-0.002 (0.381)	0.000 (0.887)	-0.002 (0.411)	0.002 (0.381)
Human capital [x 10^3]	0.007 *** (0.000)	0.004 *** (0.000)	0.007 *** (0.000)	0.005 *** (0.000)
Part-time work	-0.002 *** (0.004)	-0.002 *** (0.004)	-0.001 (0.440)	-0.001 *** (0.004)
Legal status				
Private company	0.039 (0.419)	0.110 *** (0.000)	0.057 (0.359)	0.100 *** (0.000)
Public limited company	0.131 *** (0.001)	0.151 *** (0.000)	0.164 *** (0.001)	0.148 *** (0.000)
Other	0.010 (0.941)	-0.085 (0.217)	-0.030 (0.829)	-0.037 (0.611)
Experience on the national market				
1 or 2 subsidiaries	0.136 *** (0.001)	0.214 *** (0.000)	0.097 ** (0.048)	0.027 (0.261)
3 and more subsidiaries	0.070 (0.385)	0.103 *** (0.006)	-0.237 ** (0.024)	-0.112 *** (0.005)
Investment [x 10^4]	0.004 (0.300)	0.001 (0.476)	0.005 (0.212)	0.003 * (0.052)
Goods and services for resale	0.005 *** (0.000)	0.006 *** (0.000)	0.004 *** (0.000)	0.004 *** (0.000)
Constant	-2.858 *** (0.000)	-2.560 *** (0.000)	-2.506 *** (0.000)	-3.042 *** (0.000)
Year dummies	yes	yes	yes	yes
Business lines [Dummies]	yes	yes	yes	yes
Number of observations	27,498	96,426	27,498	96,426
Number of enterprises	12,110	41,771	12,110	41,771

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

Table 5.A7: Determinants of the export intensity of companies in the German business services sector considering unobserved time-constant characteristics in West and East Germany 2003-2005

	Pooled fractional probit regression of the export intensity (exports as percent of turnover) Balanced Panel 2003 to 2005			
	East Germany		West Germany	
	without time averages	with time averages	without time averages	with time averages
Size	0.001 (0.254)	0.001 (0.578)	0.002 *** (0.000)	0.001 (0.103)
Size squared [10^{-3}]	-0.002 (0.404)	-0.001 (0.730)	-0.003 *** (0.000)	-0.004 ** (0.017)
Productivity [10^{-5}]	-0.021 (0.618)	0.021 (0.426)	0.032 *** (0.000)	--0.002 (0.733)
Human capital [10^{-4}]	0.085 *** (0.000)	-0.005 (0.861)	0.054 *** (0.000)	-0.003 (0.651)
Part-time work	-0.001 (0.572)	-0.003 (0.180)	-0.001 *** (0.001)	0.001 (0.250)
Legal status				
Private company	0.013 (0.869)	yes	0.094 *** (0.009)	yes
Public limited company	0.109 * (0.077)	yes	0.153 *** (0.000)	yes
Other	-0.077 (0.636)	yes	-0.055 (0.511)	yes
Experience on the national market				
1 or 2 subsidiaries	0.093 (0.130)	yes	0.029 (0.308)	yes
3 and more subsidiaries	-0.227 ** (0.038)	yes	-0.107 ** (0.020)	yes
Investment [10^{-4}]	0.000 (0.989)	-0.008 (0.138)	-0.001 (0.730)	0.000 (0.909)
Goods and services for resale	0.002 * (0.079)	0.000 (0.690)	0.004 *** (0.000)	0.001 *** (0.002)
Constant	-3.435 *** (0.000)	-3.457 *** (0.000)	-3.009 *** (0.000)	-3.174 *** (0.000)
Year dummies	yes	yes	yes	yes
Time averages of all exogenous variables	no	yes	no	yes
Business Lines [Dummies]	yes	yes	yes	yes
Number of observations	19,143	19,143	68,856	68,856
Number of enterprises	6,381	6,381	22,952	22,952

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.

6 The impact of the 2004 EU-enlargement on enterprise performance and exports of service enterprises in the German eastern border region*

6.1 Motivation

In May 2004, 10 countries, almost completely from the former Communist countries of Eastern Europe, joined the European Union in its hitherto largest expansion. This paper considers the impact of this enlargement on service enterprises in Germany's eastern border region close to Poland and the Czech Republic. Specifically, we use panel data from German official statistics for 2003 to 2005 and treat the EU-enlargement as an exogenous shock for enterprises close to Germany's eastern border. Our results from regression-adjusted difference-in-differences-estimators on matched samples suggest a small negative impact on both the turnover and the export intensity of large enterprises situated in a Federal State with an eastern border relative to enterprises in other Federal States, while we find significant changes in the turnover and profitability for small enterprises.

There are a number of reasons why we might expect to find an effect of the enlargement on the performance of (service) enterprises. The main theoretical reasoning here follows standard textbook models on the elimination of tariffs and barriers to trade (see e.g. Gandolfo 1998, pp. 195-204): The integration of the eastern countries into the common market lowers previously existing trade barriers and consequently the costs for both enterprises in the old and new membership countries to engage in trade with the respective other country. This (possible) increase in international trade may influence enterprise performance and behavior through an increased competition on the respective domestic market as well as through the emergence of new economic possibilities in the new foreign market.

* This Chapter is joined work with Nils Braakmann (Leuphana University of Lüneburg). The first version of this paper was published in April 2009 as *University of Lüneburg Discussion Paper in Economics* No. 124. This is the final version forthcoming in the *Review of World Economics / Weltwirtschaftliches Archiv*. All computations were done in the research data centre of the Statistical Office in Berlin.

Note that the existence of trade barriers prior to the enlargement is a necessary condition for this effect to emerge as otherwise a decrease in trade costs is logically impossible. In this study, we focus on service enterprises as strong legislative barriers existed in this sector before the expansion, for instance through residence and work permits as well as through the approval of foreign degrees in occupations with minimum qualification requirements (see Scharr/ Untiedt 2001, p. 186).[1] The case would be different for manufacturing where free trade agreements with Poland and the Czech Republic had been established as early as 1992 (European Agreement 1993, 1994). While an increase in international trade could still emerge through less restrictive border controls and lower waiting times, the effects of the EU-enlargement on trade in goods is likely to be quite small (see Scharr/ Untiedt 2001, p. 185).

Additionally, note that the effects of the EU-enlargement should be stronger for enterprises close to Germany's eastern border as services often require a personal contact between buyer and seller which is obviously cheaper to establish for both importers and exporters that are geographically close to the border. In our empirical investigation, we exploit this fact and compare differences over time within enterprises that are situated in a Federal State with a border to the new member states with differences over time within enterprises that are situated in a Federal State without such a border.

This paper is – to the best of our knowledge – the first study that considers the impact of the 2004 EU-enlargement on enterprise performance. There is, however, a small empirical literature that considers the economic consequences of the opening of borders. Hanson (1996) finds that the increasing economic integration of Mexico and the United States and the resulting expansion in Mexican exports has increased US manufacturing employment in several border cities. Egger and Egger (2002) find a significant relationship between trade in intermediate and final goods and industry wages in Eastern and Central European countries. Moritz and Gröger (2007) consider the impact of the fall of the Iron Curtain on the wages of Bavarian workers close to the Czech border using a 2% sample from German social security and

[1] It is worthwhile to note that one cannot expect that all trade barriers between the old and new member states of the European Union have been removed by the enlargement. The European Commission has documented several barriers to trade in services even among the old member states (European Commission, 2002). The discussion following the publication of this report ultimately resulted in the passing of the EU services directive ("Directive 2006/123/EC of the European Parliament and of the Council of 12 December 2006 on services in the internal market"). However, for the purpose of this paper it is sufficient that some barriers have been removed by the enlargement.

unemployment benefit records and find relatively minor effects on wages and the skill distribution in the border region. However, none of these studies deal with the economic consequences of the EU-enlargement.

The remainder of this paper is organized as follows: Section 2 describes the data, while our empirical modeling strategy is outlined in section 3. Results are presented in section 4. Section 5 concludes.

6.2 Data and descriptive statistics

This study uses data from the German services statistics panel which has recently been released by the Federal Statistical Office and the statistical offices of the Federal States. The source surveys, the annual services statistics (*"Strukturerhebung im Dienstleistungsbereich"*), which were introduced through an initiative of the European Union (European Council, 1996), have been conducted since the year 2000 by the statistical offices of the Federal States and the German Federal Statistical Office. The data cover enterprises and professions (*"Freie Berufe"*) operating in 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. Data collection is based on a stratified random sampling design where the stratification uses the federal states (*"Bundesländer"*), 4-digit industries and 12 size ranges for turnover and employees. As enterprises that were sampled in 2003 were also surveyed in 2004 and 2005, it is possible to merge the cross-sectional datasets to a panel dataset that covers the years 2003 to 2005 (for more information see Vogel, 2009).

The data include information about the economic sector, the number of employed persons (not including temporary workers), total turnover, salaries and wages, and variations in stocks. However, small enterprises with an annual turnover lower than €250,000 receive a smaller questionnaire, so important information, in particular concerning export activities, is missing for these enterprises. Given this restriction, all analyses are conducted separately for small and large enterprises with exports being only analyzed for the latter.

The enterprises' export activities are measured by an export dummy (1 if exporting; 0 if not) and export intensity (percentage of exports in total turnover). Unfortunately, the dataset contains no information about the target countries for exports or other international activities such as partnerships, direct investments or imports. The number of employees is based on the number of employed persons and, be-

cause the information is not included in the dataset, not on full-time equivalents. This difference has to be considered while interpreting the labor productivity measurement value-added per head (computed in line with the definition by the European Commission, 1998) and the subsidies per head. The average wage of an enterprise is computed by the total amount of wages and salaries, divided by the number of wage and salary earners. The turnover profitability is generated as gross enterprise surplus, which is the surplus generated by operating activities after the labor factor input has been recompensed (see European Commission, 1998), divided by total turnover, minus the change in stocks of goods and services.

In this study we focus on enterprises in business activities (NACE division K), in particular the two-digit industries 72 “Computer and related activities”, 73 “Research and Development” and 74 “Other business activities”, which covers consulting and related activities, as these require a high level of personal or direct intervention between buyers and sellers and should consequently profit or suffer more from the EU enlargement than enterprises in the NACE division I (transport, storage and communication), which we ignore. Additionally, enterprises that are active in storage or transports may have already profited from the earlier trade agreements in a similar way as manufacturing enterprises which implies that one cannot expect a large effect of the enlargement on these enterprises. Finally, we drop enterprises without any wage and salary earner, enterprises in the 1st or 99th percentile of the sales or profitability distribution and enterprises without a pre-treatment observation.

This procedure yields an unbalanced panel of 58,273 enterprise-year-observations for 22,872 large enterprises and 28,292 enterprise-year-observations for 12,643 small enterprises. In a second step we create a balanced sample by restricting the sample to those enterprises that are observed in all three years. The resulting sample consists of 48,015 enterprise-year-observations for 16,005 large enterprises and 19,233 enterprise-year-observations for 6,411 small enterprises. Finally, we create a matched sample of enterprises from the balanced panel by matching (without replacement) each observation located in a federal state with an eastern border (henceforth *treatment group*) to a firm that is situated in any of the remaining federal states (henceforth *control group*) using nearest neighbor propensity score matching. The propensity score is calculated by a probit regression of the eastern border dummy on the number of employees and its squared value, value-added per head, average wage per head, total turnover, subsidies per head

and a set of 4-digit industry dummy variables (all measured in 2003).[2] This sample which maximizes similarities between treatment and control group in the year prior to the EU-enlargement consists of 25,044 enterprise-year-observations for 8,348 large enterprises and 11,454 enterprise-year-observations for 3,818 small enterprises.[3] Descriptive statistics for all samples can be found in table 6.1.

TABLE 6.1: DESCRIPTIVE STATISTICS - GERMANY

	Unbalanced panel		Balanced panel		Matched sample	
Variable	Mean	Std.Dev	Mean	Std.Dev	Mean	Std.Dev
"Large" enterprises with a turnover greater or equal than €250,000						
Total Turnover (in €1,000)	3,215.66	6,528.90	3,450.57	6,779.73	3,039.42	5,921.80
Turnover Profitability	0.1832	0.2317	0.1795	0.2261	0.1716	0.2215
Average wage (in €1,000)	31.85	27.95	31.97	27.38	30.64	26.53
Number of Employees	60.30	190.80	65.72	202.40	59.15	172.77
Value added per employee (in €1,000)	55.51	51.44	54.75	49.24	50.96	43.71
Subsidies per employee (in €1,000)	0.24	2.86	0.24	2.96	0.34	3.73
Export intensity	0.0294	0.1199	0.0294	0.1181	0.0292	0.1176
Export participation (Dummy)	0.1762	0.3810	0.1854	0.3886	0.1819	0.3858
Enterprise located in a federal state with a border to Poland or the Czech Republic (Dummy)	0.2741	0.4461	0.2608	0.4391	0.5000	0.5000
Number of observations	58,273		48,015		25,044	
Number of enterprises	22,872		16,005		8,348	
"Small" enterprises with a turnover lower than €250,000						
Total Turnover (in €1,000)	123.77	60.18	121.10	55.48	122.74	55.57
Turnover Profitability	0.3209	0.3309	0.3420	0.3037	0.3355	0.2977
Average wage (in €1,000)	16.39	15.61	15.83	14.37	15.60	13.37
Number of Employees	3.54	4.44	3.44	3.02	3.51	3.16
Value added per employee (in €1,000)	30.23	21.28	30.00	20.13	29.36	19.52
Subsidies per employee (in €1,000)	0.18	1.58	0.16	1.48	0.21	1.61
Enterprise located in a federal state with a border to Poland or the Czech Republic (Dummy)	0.3062	0.4609	0.2978	0.4573	0.5000	0.5000
Number of observations	28,292		19,233		11,454	
Number of enterprises	12,643		6,411		3,818	

Note: The unbalanced panel costs of all enterprises that are observed in all three years (2003, 2004 and 2005) or that are observed in the first two years (2003 and 2004). The latter are dropped for the balanced sample. Finally, the matched sample is created from the balanced panel by matching (without replacement) each observation from the treatment group to its nearest neighbor from the control group using propensity score matching. The calculation of the propensity score is described in the text (Section 6.2). Enterprises with no wage and salary earner and enterprises in the 1st or 99th percentile of the sales or profitability distribution are excluded from all computations.

[2] The results of the probit model are reported in the appendix (see table 6.A1).

[3] The balancing property, which requires an absence of statistically significant (and economically large) differences between the treatment group and the control group in the covariates after matching, is satisfied (see table 6.A2 in the appendix).

6.3 Empirical modelling

Our analysis treats the EU-enlargement in 2004 as a natural experiment that affects enterprises near Germany's eastern border where the decrease in trade costs should be particularly strong. Specifically, we treat enterprises located in one of the federal states with an eastern border - Bavaria, Berlin, Brandenburg, Mecklenburg-Western Pomerania and Saxony - as the treatment group and use enterprises situated in any of the remaining federal states as the control group. To avoid issues with enterprises selecting into or out of the treatment group all definitions are based on the location in the pre-treatment year 2003. We then model impact of the EU-enlargement on turnover, profitability and, for large enterprises, exports using (regression-adjusted) difference-in-differences. More formally, we consider the following estimating equation

$$y_{it} = \eta_i + \beta' X_{it} + \delta * T_{it} + \tau * (D_i * T_{it}) + \varepsilon_{it}, \qquad (1)$$

where y_{it} is the outcome of interest, X_{it} contains control variables described below, ε_{it} is a standard error term, η_i is a enterprise specific fixed-effect and T_{it} contains two time dummies for 2004 and 2005. τ measures the divergence in average outcomes between the treatment and the control group in these two years which equals our effect of interest. As control variables we include a second order polynomial in the number of employees, value-added per head as measure of productivity, the average wage per head as a proxy for human capital, and subsidies per head. The latter are included as some recent evidence, while being in parts contradictory to each other, suggests that production related subsidies may influence international firm activities, e.g., the exporting behavior of a firm (see Girma et al, 2007, for China; Görg et al., 2008, for Ireland and Girma et al., 2009, for Germany).

Note that τ can be interpreted as a causal effect if (a) enterprises cannot select into or out of the treatment group, (b) enterprises cannot select into or out of the treatment period and (c) both treatment and control group would have experienced the same trends in the absence of treatment. The first two concerns are more relevant for cross-sectional difference-in-differences and are alleviated through the panel design of this study, which enables us to base group definitions on pre-treatment-locations and to use both pre- and post-treatment-observations for each enterprise. Unfortunately, we cannot use pre-treatment trend comparisons or

pseudo-interventions to “test” the common-trend assumption as data coverage begins only one year prior to the real intervention. Note, however, that using a matched sample ensures that we compare only plants that were identical with respect to the number of employees, value-added per head, average wage per head, subsidies per head and total turnover in the year prior to the EU-enlargement. Additionally, the distributions of 4-digit industries are identical in the treatment and the control group. Finally, note that controlling for enterprise-specific fixed-effects and the control variables further alleviates concerns regarding the validity of the common-trend-assumption.

Additionally, we conduct a simple robustness check to allow for differences between enterprises in East and West Germany. Allowing for these differences seems sensible as subsisidies (see Wagner, 2009, and Girma et al., 2009), wages and productivity (see Czarnitzki, 2005, for recent evidence and Barrel and te Velde, 2000, Franz and Steiner, 2000, and Klodt, 2000, for earlier studies) differ between East and West German plants. In this version of equation (1), we additionally interact an East Germany dummy ($East_i$) and all control (X_{it}), time (T_{it}) and treatment effect (D_i*T_{it}) variables and estimate the equation

$$y_{it} = \eta_i + \beta' X_{it} + \delta * T_{it} + \tau * (D_i * T_{it}) + \gamma' X_{it} * East_i + \omega * (T_{it} * East_i) + \rho * (D_i * T_{it} * East_i) + \varepsilon_{it}, \quad (2)$$

In this specification ρ measures differences in the effect of the EU-enlargement between enterprises in East and West Germany, specifically Bavaria.

6.4 Results

Consider the results for the difference-in-differences-estimates based on the matched sample displayed in table 6.2. Results using unmatched samples for both the balanced and the unbalanced panel can be found in the appendix (see table 6.A3 and 6.A4). Note that the pattern of results regarding e.g. the signs of the coefficients is generally identical, while some differences are found for the size and the significance of the effects.

Before turning to the parameters of interest, note that the apparently large differences in the effects of enterprise size on log turnover and turnover profitability between small and large enterprises are directly related to the differences in enterprise size. Using simulations of the effects over realistic enterprise size ranges

in both groups reveals that the effects are economically sensible. In particular, while the estimates for the effect of enterprise size on the (log) turnover of small enterprises look unrealistically large at a first glance, the simulations suggest realistic changes in the outcome over the range of 1 to 50 employees. As almost all enterprises in the data set are larger than the maximum of the respective quadratic equation, the results should be interpreted as a positive relationship (with slightly degressive character) between size and turnover or turnover profitability respectively for both small and large enterprises. The coefficients of the remaining control variables are as expected.

Turn now to the parameters of interest. For large enterprises, we observe a lower profitability, a higher turnover, and both a higher export intensity and a higher share of exporters in 2004 and 2005 relative to 2003. The pattern is somewhat different for small enterprises where - compared to 2003 - turnover is lower in 2004 and 2005, while profitability remains unchanged over these years.

Similarly, differences between large and small enterprises are also found for the interaction terms that describe the effect of the EU-enlargement on enterprises close to Germany's eastern border. For large enterprises, we find decline in both turnover in 2005 and the export intensity in 2004, while the turnover profitability and the share of exporters remain unchanged by the economic integration of the eastern countries. Both effects are not particularly large but also non-negligible in economic terms as turnover declines by circa 1.4% while the export intensity is reduced by roughly 0.5 percentage points (compared to a mean export intensity of 2.9%).

The case is somewhat different for small enterprises. Here, we obtain a positive and significant effect that suggests an increase in turnover by 2.3% for the treatment group in 2004. At the same time profitability in this group drops by 1.5 percentage points in 2004 and by another 1.9 percentage points in 2005 which is not negligible compared to a mean profitability of circa 34 percent. Unfortunately, we cannot test whether these results are caused by an eastward expansion that increases turnover but at the same time reduces profitability through start-up costs as we do not have information on the exporting behavior of these enterprises.

Table 6.3 presents the results for the model where all variables were interacted with an East Germany dummy. Results for the control variables and the corresponding interaction terms are omitted to save space.

TABLE 6.2:
DIFFERENCE-IN-DIFFERENCES ESTIMATES, BASED ON WITHIN-ESTIMATOR (MATCHED SAMPLE/ BALANCED PANEL) - GERMANY

	Large enterprises (turnover *greater or equal than €250,000 per year)*				Small enterprises (turnover *lower than €250,000 per year)*	
	Log of turnover	Turnover Profitability	Export intensity	Export status	Log of turnover	Turnover Profitability
Year=2004	0.0163***	-0.0076***	0.0040**	0.0125**	-0.0244***	-0.0028
	(0.0040)	(0.0025)	(0.0018)	(0.0053)	(0.0062)	(0.0048)
Treatment=1 & Year=2004	-0.0075	-0.0015	-0.0041*	-0.0029	0.0230***	-0.0150**
	(0.0056)	(0.0036)	(0.0024)	(0.0074)	(0.0085)	(0.0068)
Year=2005	0.0169***	-0.0117***	0.0032*	0.0216***	-0.0390***	0.0025
	(0.0054)	(0.0027)	(0.0017)	(0.0057)	(0.0072)	(0.0052)
Treatment=1 & Year=2005	-0.0138*	-0.0006	0.0025	0.0014	0.0142	-0.0194***
	(0.0074)	(0.0038)	(0.0025)	(0.0079)	(0.0099)	(0.0073)
Size	0.0030***	0.0002***	-0.0000	0.0001*	0.0972***	0.0230***
	(0.0004)	(0.0001)	(0.0000)	(0.0001)	(0.0083)	(0.0032)
Size squared [in 1000]	-0.0006***	0.0000***	0.0000	0.0000	-1.0031***	-0.2585***
	(0.0002)	(0.0000)	(0.0000)	(0.0000)	(0.1314)	(0.0544)
Value added per worker [in €1,000]	0.0023***	0.0036***	0.0000	0.0000	0.0092***	0.0111***
	(0.0001)	(0.0001)	(0.0000)	(0.0001)	(0.0004)	(0.0003)
Average wage [in €1,000]	0.0001	-0.0014***	0.0000	0.0000	0.0025***	-0.0111***
	(0.0001)	(0.0004)	(0.0000)	(0.0001)	(0.0005)	(0.0006)
Subsidies per head [in €1,000]	-0.0032*	0.0013*	0.0004	0.0010	-0.0062**	0.0064**
	(0.0018)	(0.0008)	(0.0003)	(0.0012)	(0.0027)	(0.0029)
Number of observations	25,044	25,044	25,044	25,044	11,454	11,454
Number of enterprises	8,348	8,348	8,348	8,348	3,818	3,818

Note: Presented are the estimated coefficients, standard errors adjusted for clustering on the enterprise level in parenthesis and the level of significance (*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level). Results are based on a matched sample of enterprises created from the balanced panel by matching (without replacement) each observation from the treatment group to its nearest neighbor from the control group using propensity score matching. The propensity score is calculated by a probit regression of the eastern border dummy on the number of employees and its squared value, value-added per head, average wage per head, total turnover, subsidies per head, and a set of 4-digit industry dummy variables (all measured in 2003). Enterprises with no wage and salary earner and enterprises in the 1st or 99th percentile of the sales or profitability distribution are excluded from all computations.

TABLE 6.3:
DIFFERENCE-IN-DIFFERENCES ESTIMATES, BASED ON WITHIN-ESTIMATOR (MATCHED SAMPLE/ BALANCED PANEL) – ESTIMATION WITH EAST GERMANY INTERACTION TERMS

	Large enterprises (turnover *greater or equal than €250,000 per year)*				Small enterprises (turnover *lower than €250,000 per year)*	
	Log of turnover	Turnover Profitability	Export intensity	Export status	Log of turnover	Turnover Profitability
Year=2004	0.0158***	-0.0079***	0.0037**	0.0126**	-0.0267***	-0.0042
	(0.0042)	(0.0026)	(0.0019)	(0.0057)	(0.0070)	(0.0053)
Treatment=1 & Year=2004	-0.0116	0.0013	-0.0037	0.0010	0.0071	-0.0142
	(0.0074)	(0.0047)	(0.0035)	(0.0105)	(0.0140)	(0.0124)
Year=2005	0.0173***	-0.0109***	0.0036**	0.0220***	-0.0384***	0.0014
	(0.0057)	(0.0028)	(0.0018)	(0.0061)	(0.0081)	(0.0058)
Treatment=1 & Year=2005	-0.0172*	0.0016	0.0043	0.0187*	-0.0083	-0.0150
	(0.0094)	(0.0049)	(0.0037)	(0.0111)	(0.0152)	(0.0132)
Year=2004	0.0037	-0.0006	0.0040	-0.0013	0.0159	0.0078
(x East Germany dummy)	(0.0142)	(0.0094)	(0.0062)	(0.0139)	(0.0147)	(0.0117)
Treatment=1 & Year=2004	0.0044	-0.0048	-0.0040	-0.0061	0.0088	-0.0065
(x East Germany dummy)	(0.0163)	(0.0108)	(0.0071)	(0.0175)	(0.0202)	(0.0170)
Year=2005	-0.0057	-0.0116	-0.0059	-0.0052	-0.0028	0.0062
(x East Germany dummy)	(0.0178)	(0.0100)	(0.0064)	(0.0162)	(0.0177)	(0.0128)
Treatment=1 & Year=2005	0.0111	0.0057	0.0019	-0.0264	0.0336	-0.0084
(x East Germany dummy)	(0.0205)	(0.0113)	(0.0075)	(0.0198)	(0.0233)	(0.0182)
Number of observations	25,044	25,044	25,044	25,044	11,454	11,454
Number of enterprises	8,348	8,348	8,348	8,348	3,818	3,818

Note: Presented are the estimated coefficients, standard errors adjusted for clustering on the enterprise level in parenthesis and the level of significance (*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level). Not presented are the coefficients of the control variables (number of employees and its squared value, value-added per head, average wage per head, total turnover and subsidies per head) and their interactions with the East Germany dummy. Results are based on a matched sample of enterprises created from the balanced panel by matching (without replacement) each observation from the treatment group to its nearest neighbor from the control group using propensity score matching. The propensity score is calculated by a probit regression of the eastern border dummy on the number of employees and its squared value, value-added per head, average wage per head, total turnover, subsidies per head, and a set of 4-digit industry dummy variables (all measured in 2003). Enterprises with no wage and salary earner and enterprises in the 1st or 99th percentile of the sales or profitability distribution are excluded from all computations.

For both large and small firms, we do not find significant differences between the causal effect of the EU-enlargement in Bavaria and East Germany. For large firms, the size of the coefficients of the East Germany interactions suggests only small differences between East and West German enterprises. The only exception is an increase in the likelihood of an enterprise being an exporter found in West Germany. For East Germany, the point estimate for the interaction term suggests that this increase was close to zero, although the difference is not statistically significant on conventional levels. For small firms, the positive effects found for (log) turnover in the baseline estimates seem to be driven by the East German firms. Here, point estimates for West German firms are generally close to zero and insignificant while point estimates for East Germany are often large and positive – although the precision of the estimates does not allow the rejection of the Null hypothesis of no effect.

Taken together, these results imply that the EU-enlargement in 2004 had a non-negligible, though not particularly large negative impact on large enterprises close to the border with declines relative to firms farther away from the border being observed in both turnover and export intensity after the expansion. For small enterprises we observe an increase in turnover in 2004 and a drop in profitability in both years after the enlargement. This result is consistent with the idea that these enterprises have expanded into the eastern market which increases turnover but reduces (current) profitability through startup-costs. Looking at differences between East and West German enterprises suggests that these effects are driven by East German enterprises.

What factors can explain the somewhat counterintuitive results for small firms? Remember that our sample consists of *business* service enterprises, e.g., consulting firms, which require relatively high-qualified labor. It seems possible that these firms were able to focus on, e.g., consulting activities in the new member countries, for instance, related to market research or legal restrictions in the common market. Large business service firms might no be interested in specializing in this type of activities or might have already been active in the new member countries in the years prior to the expansion, e.g., through subsidiaries.

6.5 Conclusion

This paper considered the impact of the 2004 EU-enlargement on service enterprises close to Germany's eastern border. Relying on panel data for 2003 to 2005 from German official statistics, we use regression-adjusted difference-in-differences estimator. Our results suggest a negative impact of the EU-enlargement on the turnover and export intensity of large enterprises with an annual turnover of €250,000 and more. We also find no effect on the share of exporters and the turnover profitability of these enterprises. For small enterprises close to Germany's eastern border, however, we find an increase in average turnover by 2.3% in 2004 and a decrease in profitability by 1.5 percentage points in 2004 and by an additional 1.9 percentage points in 2005 relative to other small enterprises. The latter finding is consistent with the idea that small enterprises expand to the east thereby increasing turnover but facing a reduction in profitability due to start-up costs. Unfortunately, this idea cannot be tested with the available data.

Taken together, our results suggest mixed effects for the effect of the EU-enlargement on German service enterprises with small firms gaining in some aspect and larger firms loosing. The results also provide some support for the idea that in particular small enterprises were able to expand into the new eastern markets. On a political level, the results suggest that the somewhat skeptical perspectives of many Germans regarding globalization and its consequences[4] may not be warranted given the facts. The results also contradict the view that globalization is only beneficial for large enterprises. Finally, the results highlight the fact that globalization may create winners and losers which is often forgotten in political and public debates focusing on the negative sides of globalization and trade liberation.

[4] See for instance the 2004 to 2006 surveys "Perspectives on Trade and Poverty Reduction," by the German Marshall Fund where about 50% of German respondents in each year had a unfavorable view of globalization and about one third reported an unfavorable view of the common market. For an econometric analysis on the relationship between international outsourcing and job loss fears see Fritjers and Geishecker (2008).

6.6 References

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6.7 Appendix

TABLE 6.A1:
RESULTS OF THE PROBIT MODEL FOR THE PROPENSITY SCORE MATCHING – GERMANY

	Probit regression of the eastern border dummy	
	Large enterprises (turnover *greater or equal than €250,000 per year)*	Small enterprises (turnover *lower than €250,000 per year)*
Size	-0.0003**	-0.0132
	(0.0001)	(0.0115)
Size squared [in 1000]	0.0000	0.1590
	(0.0000)	(0.1893)
Value added per worker [in €1,000]	-0.0012***	-0.0030**
	(0.0003)	(0.0012)
Average wage [in €1,000]	-0.0010*	0.0002
	(0.0006)	(0.0014)
Total Turnover [in €1,000]	0.0000	0.0009**
	(0.0000)	(0.0004)
Subsidies per employee [in €1,000]	0.0129***	0.0523***
	(0.0036)	(0.0103)
4-digit Industry Dummies	yes	yes
Number of observations	16,005	6,411

Note: Presented are the estimated coefficients, standard errors in parenthesis and the level of significance (*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level). The here presented probit regression of the eastern border dummy was used to calculate the propensity score for the matching procedure. Enterprises with no wage and salary earner and enterprises in the 1st or 99th percentile of the sales or profitability distribution are excluded from all computations.

TABLE 6.A2:
BALANCING PROPERTY – GERMANY

Variable	Sample	Mean		p-value
		Treatment group	Control group	
"Large" enterprises with a turnover greater or equal than €250,000				
Number of Employees	unmatched	57.69	67.02	0.009
	matched	57.69	59.11	0.709
Number of Employees squared (in 1000)	unmatched	30.98	47.61	0.087
	matched	30.98	36.14	0.584
Average wage (in €1,000)	unmatched	30.70	32.70	0.000
	matched	30.70	30.80	0.844
Value added per employee (in €1,000)	unmatched	52.89	58.84	0.000
	matched	52.89	52.25	0.502
Subsidies per employee (in €1,000)	unmatched	0.47	0.24	0.000
	matched	0.47	0.36	0.151
Total Turnover (in €1,000,000)	unmatched	3.0	3.5	0.000
	matched	3.0	3.0	0.944
"Small" enterprises with a turnover lower than €250,000				
Number of Employees	unmatched	3.55	3.45	0.255
	matched	3.55	3.59	0.673
Number of Employees squared (in 1000)	unmatched	0.22	0.21	0.800
	matched	0.22	0.25	0.597
Average wage (in €1,000)	unmatched	15.92	16.25	0.410
	matched	15.92	15.98	0.899
Value added per employee (in €1,000)	unmatched	30.14	31.20	0.056
	matched	30.14	30.18	0.954
Subsidies per employee (in €1,000)	unmatched	0.39	0.18	0.000
	matched	0.39	0.28	0.060
Total Turnover (in €1,000,000)	unmatched	0.13	0.12	0.228
	matched	0.13	0.13	0.668

Note: Presented are the p-values of mean comparisons tests of the used covariates between the treatment group and the control group before and after matching. The matched sample is created from the balanced panel by matching (without replacement) each observation from the treatment group to its nearest neighbor from the control group using propensity score matching. The propensity score is calculated by a probit regression of the eastern border dummy on the number of employees and its squared value, value-added per head, average wage per head, total turnover, subsidies per head, and a set of 4-digit industry dummy variables (all measured in 2003). Enterprises with no wage and salary earner and enterprises in the 1st or 99th percentile of the sales or profitability distribution are excluded from all computations.

TABLE 6.A3:
DIFFERENCE-IN-DIFFERENCES ESTIMATES, BASED ON WITHIN-ESTIMATOR (UNBALANCED PANEL) – GERMANY

	Large enterprises (turnover *greater or equal than €250,000 per year)*				Small enterprises (turnover *lower than €250,000 per year)*	
	Log of turnover	Turnover Profitability	Export intensity	Export status	Log of turnover	Turnover Profitability
Year=2004	0.0027	-0.0076***	0.0032***	0.0109***	-0.0156***	-0.0072**
	(0.0024)	(0.0014)	(0.0010)	(0.0029)	(0.0039)	(0.0030)
Treatment=1 & Year=2004	-0.0005	-0.0039	-0.0036**	-0.0019	0.0171**	-0.0135**
	(0.0046)	(0.0028)	(0.0018)	(0.0056)	(0.0067)	(0.0054)
Year=2005	0.0103***	-0.0111***	0.0038***	0.0199***	-0.0375***	-0.0005
	(0.0031)	(0.0016)	(0.0010)	(0.0033)	(0.0045)	(0.0033)
Treatment=1 & Year=2005	-0.0076	-0.0037	0.0012	0.0023	0.0084	-0.0153***
	(0.0059)	(0.0030)	(0.0020)	(0.0062)	(0.0079)	(0.0058)
Size	0.0019***	0.0001***	-0.0000	0.0000	0.1046***	0.0239***
	(0.0002)	(0.0000)	(0.0000)	(0.0001)	(0.0062)	(0.0026)
Size squared [in 1000]	-0.0003***	0.0000***	0.0000	0.0000	-1.1875***	-0.3041***
	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.1600)	(0.0598)
Value added per worker [in €1,000]	0.0020***	0.0031***	-0.0000	-0.0001**	0.0096***	0.0110***
	(0.0001)	(0.0001)	(0.0000)	(0.0000)	(0.0002)	(0.0002)
Average wage [in €1,000]	0.0001	-0.0017***	0.0000	0.0000	0.0026***	-0.0112***
	(0.0001)	(0.0003)	(0.0000)	(0.0001)	(0.0004)	(0.0004)
Subsidies per head [in €1,000]	-0.0034**	0.0020**	0.0003	0.0006	-0.0070***	0.0062***
	(0.0016)	(0.0008)	(0.0003)	(0.0010)	(0.0024)	(0.0022)
Number of observations	58,273	58,273	58,273	58,273	28,292	28,292
Number of enterprises	22,872	22,872	22,872	22,872	12,643	12,643

Note: Presented are the estimated coefficients, standard errors adjusted for clustering on the enterprise level in parenthesis and the level of significance (*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level). Results are based on enterprises that are observed in all three years (2003, 2004 and 2005) or that are observed in the first two years (2003 and 2004). Enterprises with no wage and salary earner and enterprises in the 1st or 99th percentile of the sales or profitability distribution are excluded from all computations.

TABLE 6.A4:
DIFFERENCE-IN-DIFFERENCES ESTIMATES, BASED ON WITHIN-ESTIMATOR (BALANCED PANEL) – GERMANY

	Large enterprises (turnover *greater or equal than €250,000 per year)*				Small enterprises (turnover *lower than €250,000 per year)*	
	Log of turnover	Turnover Profitability	Export intensity	Export status	Log of turnover	Turnover Profitability
Year=2004	0.0109***	-0.0070***	0.0033***	0.0122***	-0.0148***	-0.0063*
	(0.0024)	(0.0015)	(0.0010)	(0.0032)	(0.0041)	(0.0033)
Treatment=1 & Year=2004	-0.0023	-0.0032	-0.0034*	-0.0029	0.0144**	-0.0116**
	(0.0047)	(0.0030)	(0.0019)	(0.0060)	(0.0071)	(0.0058)
Year=2005	0.0135***	-0.0102***	0.0040***	0.0206***	-0.0331***	0.0003
	(0.0032)	(0.0016)	(0.0010)	(0.0034)	(0.0048)	(0.0034)
Treatment=1 & Year=2005	-0.0098	-0.0038	0.0014	0.0020	0.0101	-0.0173***
	(0.0061)	(0.0031)	(0.0021)	(0.0065)	(0.0084)	(0.0061)
Size	0.0020***	0.0001***	-0.0000	0.0001	0.1052***	0.0244***
	(0.0002)	(0.0000)	(0.0000)	(0.0001)	(0.0073)	(0.0030)
Size squared [in 1000]	-0.0003***	0.0000***	0.0000	0.0000	-1.1832***	-0.3123***
	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.1956)	(0.0783)
Value added per worker [in €1,000]	0.0020***	0.0031***	-0.0000	-0.0001**	0.0096***	0.0111***
	(0.0001)	(0.0001)	(0.0000)	(0.0001)	(0.0003)	(0.0002)
Average wage [in €1,000]	0.0001	-0.0016***	0.0000	0.0000	0.0023***	-0.0111***
	(0.0001)	(0.0003)	(0.0000)	(0.0001)	(0.0004)	(0.0004)
Subsidies per head [in €1,000]	-0.0033**	0.0021**	0.0004	0.0008	-0.0056**	0.0059***
	(0.0016)	(0.0009)	(0.0003)	(0.0011)	(0.0025)	(0.0023)
Number of observations	48,015	48,015	48,015	48,015	19,233	19,233
Number of enterprises	16,005	16,005	16,005	16,005	6,411	6,411

Note: Presented are the estimated coefficients, standard errors adjusted for clustering on the enterprise level in parenthesis and the level of significance (*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level). Results are based on enterprises that are observed in all three years (2003, 2004 and 2005). Enterprises with no wage and salary earner and enterprises in the 1st or 99th percentile of the sales or profitability distribution are excluded from all computations.

7 Conclusion

The majority of empirical studies that center on exporter performance and the determinants of export performance have focused mainly on the manufacturing sector, largely because there are very few datasets that facilitate a detailed investigation into the service sector. In 2008, however, the German Federal Statistical Office and the statistical offices of the Federal States released the German business services statistics panel. Thus, for the first time, appropriate panel analyses of the export behaviour of German business services firms became possible. This thesis uses this panel dataset and contributes to the literature on the microeconometrics of international trade by providing evidence concerning the German business services sector. First, Chapters 3 and 4 document the differences between exporting and non-exporting German business services firms relative to their various performance dimensions. They also explore whether these differences result from self-selection into export markets (Chapter 3 and 4) or represent an effect of exporting on the performance of the enterprises (Chapter 4), respectively. Second, Chapter 5 analyses the determinants of the export performance in the German business services sector. Finally, Chapter 6 investigates the impact of the 2004 EU enlargement on the export behaviour and enterprise performance of business services firms in Germany's eastern border region.

Overall, the results noted for exporter performance in the German business services sector correspond with those from the manufacturing sector. Contributing to the substantial body of literature that focuses on the relationship between exports and productivity, Chapter 3 shows that, similar to the manufacturing sector, exporting business services firms are more productive than non-exporters, even when controlling for size and industry. Concerning the self-selection hypothesis, Chapter 3 presents for Germany's western region evidence that export starters are more productive (in terms of turnover per employed person) than non-exporters, even several years before they commence exporting.

With regard to further performance dimensions, Chapter 3 finds that, similar to the manufacturing sector, exporting German business services firms are clearly larger (in terms of turnover and number of employed persons) than non-exporting business services enterprises, and that business services enterprises that export pay

higher average wages (even when controlling for size and industry). Concerning the hypothesis that better performing enterprises self-select into export markets, the results indicate that in the business services sector as well as in the manufacturing sector, enterprises that begin to export are larger than non-exporters, even two years before they commence exporting operations. Regarding average wages, the results are statistically significant only for business services enterprises in Germany's western region.

When controlling for unobserved, time-invariant characteristics, the significant differences between exporters and non-exporters relative to productivity or average wages disappear, while significant export premia associated with the size variables continue to exist, but on a much smaller scale (see Chapter 3). Thus, the export variable may be correlated with these unobserved characteristics, which may provide some evidence that the more "able" enterprises (e.g., in terms of management ability or—following the ideas of the management literature—the firms' ability to accumulate knowledge) are more likely to export. This positive correlation between export status with the unobserved effect is also in line with the evidence from the manufacturing sector. Also, in the most studies about the manufacturing sector (see e.g., International Study Group on Exports and Productivity, 2008), the export premia are much smaller when controlling for fixed effects compared to the models that control only for size and industry.

Aside from these similarities with the manufacturing sector, Chapter 4 presents evidence which suggests that, contrary to firms in the manufacturing industries, German business services firms do not benefit from exporting in terms of higher rates of profit. Chapter 4 documents a negative profitability differential of services exporters compared to non-exporters, and finds that export-starters in the business services sector are less profitable than non-exporters, even two years before they begin to export. Furthermore, the estimated dose-response function, which is used to investigate the causal impact of exports on profits, 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 as well. However, even at the maximum, the average profitability of the exporters is not, or is only slightly, higher than the average rate of profit of the non-exporting firms. This might be interpreted as follows: If services firms that start to export do so

by exporting a small share of their total sales, they will face a decline in their rate of profit due to the extra costs incurred through export activities. If the share of exports in total sales increases over time, profits will rise to the level earned on the national market; otherwise, the firms will leave the export market. Unfortunately, however, it is not possible to test whether this interpretation holds with the short panel of business service firms available.

Chapter 5 investigates the question which factors determine the export performance of German business services firms by estimating a model of the firms' export intensity decision. Overall, the results support most of the explanations of export behaviour found in the literature for both service firms and manufacturing firms, such as the positive effects of size, human capital, and productivity. Yet when controlling for unobserved heterogeneity, the picture changes; notably, in the model with fixed effects, the significance of productivity and human capital disappears. This indicates that these variables are not positively related to the export performance per se, but are related instead to unobserved time-constant characteristics. This result corresponds with a similar estimation for the manufacturing sector (Wagner, 2008). Nevertheless, size continues to exert a positive and significant effect on exporting when controlling for unobserved heterogeneity.

Chapter 6 considers the impact of the 2004 EU enlargement on service enterprises close to Germany's eastern border by using regression-adjusted difference-in-differences estimators. The results suggest a small negative impact associated with the EU enlargement on export intensity and the turnover of large enterprises with an annual turnover of €250,000 or more, and no effect on the share of exporters and the turnover profitability of these enterprises. For small enterprises close to Germany's eastern border, an increase in turnover and a decrease in profitability relative to other small enterprises are noted. The latter finding is consistent with the idea that small enterprises expand to the east thereby increasing turnover, but they face a reduction in profitability due to start-up costs. Unfortunately, this idea cannot be tested using the data available. On a political level, the results suggest that the somewhat sceptical perspectives held by many Germans regarding globalization and its consequences may not be warranted in view of these facts.

Overall, the export premia and self-selection effects seen, as well as the investigation of the determinants of the export performance, indicate that in the business services sector, firms that go abroad are—as a general pre-requisite—

economically strong. However, the results of Chapter 5 suggest that export performance is not positive relative to the commonly observed characteristics per se, but that time-constant, unobserved characteristics, such as management talent, the uniqueness of the services offered, etc., indeed make a difference. On a political level, these results cast doubts on export promotion programs that are based on strengthening the firms' human capital or productivity. Because of the very short time period of the data, the policy relevant question, whether exporting fosters the performance of the enterprises and thus, whether an impetus towards expansion on the firm and macroeconomic levels can be expected by engaging in exporting remains open. Even for the manufacturing sector, only mixed evidence concerning this hypothesis is available (cf., e.g., Wagner, 2007); thus, further research based on longer panel data is needed in this area. At the beginning of 2010, when the German business statistics panel 2003-2007 will likely become available, it will be possible to investigate at least the short-term effects of exporting on enterprise performance.

Note that the business services sector analysed here is a part of the heterogeneous services sector, where exports in the form of personnel travelling to foreign markets, the provision of services to foreign costumers in the home market, and exports in the form of embodied and wired services play significant roles in the internationalisation process (see e.g., Roberts, 1999). Thus, this thesis focuses on an element of the tertiary sector, where exporting bears some similarity to the export of goods. The task for future research would be not only to test if the results presented here can be found in the business services sectors of other countries, but also to expand the investigation to address other parts of the service sector.

7.1 References

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