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**Exports and Productivity in the German Business
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by
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Exports and Productivity in the German Business Services Sector. First Evidence from the Turnover Tax Statistics Panel*

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A wide range of empirical studies has analysed the relationship between exports and productivity in the manufacturing sector. By contrast, a detailed investigation of the services sector has remained neglected. To close this gap, this paper provides first evidence about export and productivity in the German business services sector. The database used is the German turnover tax statistics panel, which allows for the first time a detailed longitudinal analyses of exporting business services enterprises. Similar to the manufacturing sector, these enterprises are more productive than non-exporters, and more productive business services enterprises self-select into export markets. However, no evidence is found concerning the hypotheses that exporting increases productivity.

Keywords: export; productivity; business services; panel data

* This study uses the IAB Establishment Panel (waves 2000 – 2005) and the German turnover tax statistics panel (waves 2001 – 2005). Data access was provided via remote data access at the Research Data Centre of the German Federal Employment Agency at the Institute for Employment Research and at the Research Data Centre of the German Federal Statistical Office. For more details about the data access, see Zühlke et al. (2004) and Kölling (2000). All calculations were performed using Stata 8.2. All do-files are available from the author on request. My thanks go to Joachim Wagner, Stefan Dittrich and the seminar participants of the 4th Danish International Economics Workshop for helpful comments and to Dana Müller and Maurice Brandt for running the do-files in the Research Data Centres.

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1 Motivation

A wide range of empirical studies has analysed the relationship between exports and productivity in the manufacturing sector. A detailed investigation of the service sector remains 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, which engages more than 70% of employed persons (cf. Federal Statistical Office 2007). Furthermore, services are no longer non-tradeable; according to the German balance of payments, the trade in services with non-residents is equivalent to 20% of the trade volume in goods with non-residents (cf. Deutsche Bundesbank 2008).

Despite their importance for the economy and the fact that services have become tradeable, very little is known about the determinants of international trade in services on the micro level. Empirical evidence about the link between exporting and productivity has been derived almost solely from the manufacturing sector. Previous research in this sector has shown that exporters are more productive than non-exporters and that the more productive firms self-select into export markets. However, only mixed evidence has been found that exporting improves productivity (see Wagner 2007a for a survey). It would be useful to know if these findings are transferable to the service sector, especially with regard to the economic effect of sectoral support programs, since evidence for this is still lacking.

To close this gap, this paper provides first evidence on the relationship between exports and productivity in the German business services sector.¹ Even if this sector covers a

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) and 74 (e.g., business, management and tax consultancy, advertising, legal activities, market research, and architectural and engineering activities). These two NACE divisions account for more than 10% of the gross value added in Germany (cf. Federal Statistical Office 2007).

wide range of activities, these activities have in common that they provide primarily intermediate inputs and that business services are traded more than most other services.²

To ensure the comparability of the results, empirical models used to analyse the manufacturing sector (cf. International Study Group on Exports and Productivity 2007) are transferred to the business services. The study uses a dataset from the newly available German turnover tax statistics panel, including all enterprises whose turnover currently exceeds €17,500 per year. Even if this data contains only exports of goods and not explicit exports of services, it allows for the first time detailed longitudinal analyses of active cross-border business services providers. For this purpose, cross-border activities are proxied by the export of goods. To check the robustness of the export premium estimation, the study adds a dataset from a representative survey, the IAB-Establishment Panel. This dataset contains exports of both goods and services, although for a much smaller sample of business services establishments.

In the remainder of the paper, Section 2 begins with an overview of the literature about exports and productivity in the manufacturing sector and a presentation of studies and considerations of the export activities in the service sector. Datasets and data preparations are described in Section 3, while Section 4 presents the empirical results, starting with a descriptive overview and followed by the econometric tests of the link between exports and productivity. The last part of the paper, Section 5, concludes.

² According to the German balance of payments, business services (defined as advertising, engineering, commercial and computer services) show by far the highest trade volume, behind travel and transport (cf. Deutsche Bundesbank 2008). In addition, Jensen and Kletzer (2005) classified nearly all business services as tradable based on the geographic concentration of service activities within the United States.

2 Exports and productivity

Empirical studies in the manufacturing sector show that exporting firms are more productive than non-exporting firms. (See Wagner 2007a for a survey.) To explain these findings, the literature provides two hypotheses concerning the link between export activities and productivity. The theoretical models of Melitz (2003) and Bernard et al. (2003) formally show a self-selection of more-productive firms into export markets because of additional costs related to exporting (e.g., transportation costs, but also market entry costs for market information or product adaptations). Only with higher productivity it is possible to absorb these costs; less productive firms cannot overcome this entry barrier. In addition, it is hypothesised in the literature (cf. e.g. Bernard and Jensen 1999) that exporters can learn through knowledge transfer from foreign customer and competitors and the more intensive competition in international markets. In the manufacturing sector, there is strong evidence that more-productive firms self-select into export markets, but only mixed evidence concerning whether productivity increases after export activities begin (cf. Wagner 2007a, International Study Group on Exports and Productivity 2007).

Before analysing the transferability of manufacturing results to the business services sector, it is necessary to clarify how international trade of services can take place (following WTO 1994 and Copeland & Mattoo 2007). In contrast to goods, services are usually immaterial and not storable, and they require direct contact between user and provider. In international trade, this required proximity between consumer and producer results in three possible modes of delivery: the foreign user consumes the service at the domestic location of the supplier, the service provider opens a foreign commercial presence (foreign direct investment), or the services are supplied by independent or employed natural persons in the foreign country. Because of the heterogeneity of the service sector, 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 had once been limited to a physical place. For services of this kind, trade seems to be similar to trade in goods.

A similar effect of additional costs on self-selection in the manufacturing and service sectors is expected if these are primarily information costs (cf. Love & Mansury 2007). Additional costs in the form of personal transport costs occur if the service is supplied by a natural person in a foreign country, so a similar effect as that in the manufacturing sector is expected; otherwise, transportation costs play a secondary role in the case of cross-border delivery (e.g., because of communication technology). This may lead to a lower cost barrier, allowing less productive firms to enter export markets. Thus, the self-selection effect may be weaker in the service sector than in the manufacturing sector. Additional costs arising from regulatory barriers could also influence the self-selection effect in the services sector (cf. Kox & Nordås 2007).

In contrast to those in the manufacturing sector, there are only a few empirical studies about the determinants of export activities in the service sector. Similar to the manufacturing sector, service sector innovativeness (e.g., measured by an innovator dummy or the intensity of innovation expenditures) is positively associated with the probability to export (cf. Chiru 2007, Ebling & Janz 1999, Gourlay et al. 2005, and Love & Mansury 2007). The effect of size on exporting for the service sector has only mixed evidence: Love and Mansury (2007) found a positive effect, Gourlay et al. (2005) showed a hump-shaped relationship, Chiru (2007) showed a u-shaped relationship, and Ebling and Janz (1999) found no significant effect.³

Empirical studies about the relationship between exports and productivity showed that a higher productivity in period t (cf. Love & Mansury 2007) or $t-1$ (cf. Harris & Li 2007) increased the likelihood of being an exporter in period t . Concerning the learning-by-

³ In addition to these economics-based explanations, management and marketing literature is available on export behaviour and the choice of market entry modes in the service sector. See, e.g., Blomstermo et al. (2006), Brouthers and Brouthers (2003) and Ekeledo and Sivakumar (1998).

exporting hypothesis, Love and Mansury showed indications that productivity is positively affected by exporting and by the extent of exporting. Harris and Li showed a positive productivity effect for firms new to exporting and a negative effect for those exiting exporting. However, the approaches of these studies differed from the methods used by the International Study Group on Exports and Productivity (2007) in analysing the manufacturing sector,⁴ which makes it difficult to compare the results directly.

3 The data

Only three regularly collected datasets that include information about the export activities in the service sector are available from German official sources:

- 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*), which contains nearly 2,000 business services establishments (NACE code K) per year, including their share of exports in total sales (cf. Alda et al. 2006 and Kölling 2000)
- the services statistics of the German Federal Statistical Office and the statistical offices of the Federal States, with approximately 20,000 business services enterprises (NACE code K) per year. This cross-sectional dataset contains information about the non-domestic turnover (cf. Pesch 2007).
- the turnover tax statistics panel of the German Federal Statistical Office and the statistical offices of the Federal States, with more than 800,000 business services enterprises (NACE code K) and information about the export of goods of services enterprises (cf. Dittrich 2007 and section 3.1).

⁴ Love and Mansury's study was limited by cross-sectional data, and Harris and Li used a different empirical approach.

Because of the relatively small group of export starters in the business services sector, the IAB-Establishment Panel contains not enough observations for detailed longitudinal analyses. The cross-sectional services statistics contains enough observations, but does not allow to examine changes on an enterprise level over time.

Only the turnover tax statistics panel allows detailed longitudinal analyses of cross-border active business services enterprises. For the current purposes, the cross-border activities of business services enterprises are proxied by the exports of goods. In addition to the main analyses based on the turnover tax statistics panel, the IAB-Establishment Panel is used to check the robustness of the export premia estimation.

3.1 The turnover tax statistics panel

The turnover tax statistics panel is a linked dataset of the turnover tax statistics from 2001 to 2005. The turnover tax statistics are secondary statistics based on the monthly and quarterly advance turnover tax returns, i.e., the turnover tax prepayments of the enterprises. Adjustments that occur in the subsequent annual turnover tax declaration are not considered. The statistics include all enterprises whose deliveries and other performances exceed the applicable turnover threshold according to the turnover tax law (cf. Dittrich 2007).⁵ To get a constant threshold over the whole period of 2001 to 2005, the limit for each year is fixed at €17,081 in 2001 prices for the purposes of this paper.⁶

Because the turnover tax statistics are secondary statistics, they include mainly variables that are important for the turnover tax system, including information about taxable and tax-free turnover, turnover tax before input tax deduction, and deductible input tax. In contrast to the majority of primary statistics, the definition of turnover in the turnover tax statistics includes not only turnover from operating activities, but also extraordinary income

⁵ According to the applicable article 19 (1) of the turnover tax law, the turnover threshold was €16,617 in 2001 and €16,620 in 2002, and it has been €17,500 since 2003 (at current prices).

⁶ That is, equal to the 2003 threshold.

(e.g., from sales of fixed assets), which must be considered while interpreting the results. In addition, the turnover tax law allows tax groups of independent legal persons if they are related in a financial, economic, and organisational way;⁷ in this case, the turnover is collected together. For a consistent consideration of the enterprise level, the tax groups are excluded from all computations.⁸

In addition to the variables from the turnover tax statistics, the panel includes the number of employees liable for paying social insurance from the German business register (*Unternehmensregister*). This variable is available for almost 35% of the enterprises in the business services sector. Most of the enterprises without information from the business register are sole proprietorships, where it is reasonable to expect no employees are liable for paying social insurance. The results of a probit estimation also show that new enterprises and enterprises with a foreign legal form are more likely to lack information about their employees.⁹ This is explained by the business register: new enterprises are covered with a time delay, and foreign enterprises are not covered. Thus, enterprises with a foreign legal form are excluded from the current analysis, and new enterprises, while included, are under-reported.

Only with this additional information from the business register is it possible to compute a simple measure of productivity. Thus, productivity is measured in the form of labour productivity, as turnover per employee liable for paying social insurance (in 2001 prices). Enterprises with no employees liable for paying social insurance are excluded from all analyses.

⁷ According to the definition in article 2 (2) of the turnover tax law.

⁸ Nevertheless, an enterprise can still consist of more than one establishment.

⁹ The following probit model is estimated for business services enterprises: The dependent variable is a dummy defined as 1 if the employee variable contains only a missing value and 0 if the number of employees is stated. The independent variables are the turnover, an export dummy, legal form dummies (reference category: corporations), a dummy for new enterprises and year dummies (reference: 2005). In addition, it is controlled for federal states and economic activity (2-digit). Only for proprietorships, new enterprises, enterprises with foreign legal forms and enterprises with miscellaneous legal forms (concerns only a few cases) is it more likely to have no information about the employees. (A p-value of less than 0.01 was considered significant.)

Exports are not directly recorded in the dataset. However, the data for ‘tax free turnover with input tax deduction’ contains mainly exports of goods.¹⁰ Unlike exports of goods, exports of services are not tax free and, therefore, are recorded under the data for ‘taxable turnover’.¹¹ Other than this principle rule, because of exceptions in the turnover tax law, most services exports are not taxable in Germany but are taxable abroad.¹² In both cases, the export of services is not separately identifiable. (For more details, see Vogel 2008.)

Thus, in this paper, the exporter status dummy and the export intensity are based on the data for ‘tax free turnover with input tax deduction’. In the case of business services enterprises, these data contain the exports of goods within service activities and within other activities (because the economic activity of an enterprise is defined by its main activity). The data could also contain exports of services because of incorrect declarations by the enterprises,¹³ yet the exporter status dummy indicates if an enterprise is at least cross-border active with exports of goods. This information is used as a proxy for internationally active business services enterprises.

3.2 The IAB-Establishment panel

The IAB-Establishment Panel, an annual representative survey of establishments, is used to check the robustness of the results. This dataset contains the exports of both goods and services, but only for a small sample of business services establishments; thus, it is possible to compare the results only of the export premia. A comparison of the tests that analyse the small group of export starters (self-selection and learning-by-exporting hypotheses) is not possible. In this paper, waves relating to 2000 to 2005 of the Establishment Panel are used; because the sales information and the export intensity are reported for only the previous year,

¹⁰ The data for ‘tax free turnover with input tax deduction’ is defined in articles 4 and 15 (3) of the turnover tax law. Besides the exports of goods, these data contains only unusual cases, like gold deliveries to central banks.

¹¹ According to article 3a (1) of the turnover tax law.

¹² According to article 3a (2, 3, 4) of the turnover tax law.

¹³ According to financial auditors and tax offices, it is possible that export of services is incorrectly declared as ‘tax free with input tax deduction’ because of the complexity of the turnover tax law.

the analyses cover the years 1999 to 2004. For a more detailed description of the IAB-Establishment Panel, see Kölling (2000).

4 Empirical analyses

This section investigates whether a relationship between exports and productivity (described in section 2) can be found in the German business services sector. A descriptive overview about the export intensity, the export participation, and the differences between exporting and non-exporting business services enterprises, is followed by more detailed analyses of the self-selection and the learning-by-exporting hypotheses. To ensure the comparability of the results, the analyses follow the approach of the International Study Group on Exports and Productivity (2007).

Some additional notes: In all analyses, labour productivity and turnover are stated in 2001 prices. To avoid bias by outliers, the 1st and 99th percentiles of the labour productivity distribution are excluded from all computations. Finally, the federal state of Berlin is included in the East Germany analysis.

4.1 Descriptive overview

Compared to the manufacturing sector, the business services sector in both East Germany and West Germany has a lower share of exporting enterprises (export participation) and a lower average share of exports in total turnover (export intensity). (See Table 1.)

TABLE 1
EXPORT PARTICIPATION OF ENTERPRISES IN WEST AND EAST GERMANY

	West Germany			East Germany		
	share of exporting enterprises (in %)	average export intensity (in %)		share of exporting enterprises (in %)	average export intensity (in %)	
		all enterprises	exporters only		all enterprises	exporters only
Business Services Sector						
2001	11.3	1.2	10.7	4.8	0.5	9.6
2003	11.5	1.3	11.3	5.3	0.5	9.9
2005	11.7	1.3	11.4	5.8	0.6	10.7
Manufacturing Sector						
2001	34.2	5.6	16.3	18.3	2.5	13.7
2003	35.6	6.2	17.3	20.2	3.0	15.1
2005	37.4	6.7	18.0	23.7	3.6	15.2

Note:

Only enterprises with one or more employees liable for paying social insurance and a turnover higher than €17,081 in 2001 prices are considered. Business services are defined as NACE divisions 72 and 74. Data source: German turnover tax statistics panel 2001-2005.

The fact that only exports of goods are considered leads to an underestimation of the export intensity and the export participation in the service sector. Descriptive studies of business services in Germany have shown an export participation of around 20% (cf. Ebling & Janz 1999, Redling 2007).¹⁴ The IAB-Establishment Panel indicates export intensities for exporters and for all establishments that are more than twice as high as the results from the turnover tax statistics.¹⁵ If even a part of these differences is caused by the different levels (establishments vs. enterprises), this indicates that the export intensity is also underestimated in the turnover tax statistics panel.¹⁶

Table 2 reports the results of the comparison of exporting and non-exporting business services enterprises. On average, exporting business services enterprises are more productive

¹⁴ Redling (2007) found an export participation of 21%. Business services enterprises are defined (in line with this paper) as enterprises in the NACE Divisions 72 and 74. The results are based on the pilot survey "Sales of Services (*Dienstleistungsumsätze nach Arten*) 2004"; Ebling and Janz (1999) reported an export participation of 21% based on the Mannheim Innovation Panel in the Service Sector 1997. Enterprises of business-oriented services (IT, consulting, advertising and cleaning) with 5 or more employees are considered.

¹⁵ The comparison is based on the years 2001 to 2004. The results of the IAB-Establishment Panel can be found in Table A1 in the appendix.

¹⁶ An enterprise with more than one establishment is defined as an exporter even if only one establishment exports. Thus, the export intensity of exporters should be higher in the IAB-Establishment Panel, and the overall export intensity should be almost the same. This is in line with the results for the manufacturing sector. Here, a higher export intensity for exporters and an equal overall export intensity is found, based on the IAB-Establishment Panel.

and larger (meaning they have higher turnover and more employees) than enterprises that serve only the domestic market. This holds true even if exports of goods and services are considered (by using the IAB-Establishment Panel).¹⁷ The results show that, even 15 years after the German reunification, East German enterprises are still at a lower level in turnover, productivity and employees.

TABLE 2
EXPORTERS VS. NON-EXPORTERS IN WEST AND EAST GERMANY 2005,
BUSINESS SERVICES ENTERPRISES

	Exporters		Non-exporters	
	mean (standard deviation)	number of enterprises	mean (standard deviation)	number of enterprises
West Germany				
Employees liable for paying social insurance	20.4 (149.0)	17,822	8.4 (64.9)	134,625
Labour productivity (in € 1,000)	175.4 (160.4)	17,822	109.5 (104.3)	134,625
Turnover (in € 1,000)	2,714 (29,800.0)	17,822	654 (4,889.0)	134,625
Growth 2002-2005:				
of labour productivity	13.8 (65.4)	6,635	14.1 (63.6)	79,980
of employees	12.2 (55.8)	6,613	6.1 (52.8)	79,880
East Germany				
Employees liable for paying social insurance	15.6 (43.3)	1,953	6.9 (31.2)	31,781
Labour productivity (in € 1,000)	120.6 (101.7)	1,953	84.6 (69.4)	31,781
Turnover (in € 1,000)	1,381 (3,859.0)	1,953	414 (1,581.0)	31,781
Growth 2002-2005:				
of labour productivity	19.7 (73.2)	526	17.8 (66.5)	20,730
of employees	15.5 (55.9)	528	5.7 (54.9)	20,674

Note:

T-tests show statistically significant ($\alpha=1\%$) differences for all mean comparisons (excluding the growth of labour productivity). Only enterprises with one or more employees liable for paying social insurance are considered. The 1st and the 99th percentiles of the labour productivity distribution are excluded from all computations. Labour productivity and turnover are in 2001 prices. For the comparison of the growth rates, only enterprises that export or do not export over the whole period are considered. Business services are defined as NACE divisions 72 and 74. Data source: German turnover tax statistics panel 2001-2005.

Comparing the rates of growth between 2002 and 2005 shows that exporters have, on average, higher growth in employment than non-exporters in both parts of Germany. The labour productivity growth rates in West Germany are almost equal between exporters and non-exporters and, in both parts of Germany, the differences in the labour productivity growth

¹⁷ The results of the IAB-Establishment Panel can be found in Table A2 in the appendix.

rates between exporters and non-exporters are not statistically significant. An estimation of the productivity growth differences is shown in section 4.4 but, even if it is controlled for other influences, there is no clear evidence of difference.

4.2 Export premium

Section 4.1 shows an unconditional productivity differential between exporters and non-exporters. In this section, the exporter productivity premium is investigated by computing the ceteris paribus percentage productivity difference between exporters and non-exporters. The premium is estimated by:

$$(1) \ln \text{productivity}_{it} = \beta_0 + \beta_1 \text{export}_{it} + \beta_2 \text{control}_{it} + u_{it},$$

where i is the enterprise index, t is the index of the years between 2001 and 2005, u is the error term, and *productivity* is the labour productivity in 2001 prices. The vector *control* contains the number of employees liable for paying social insurance and its squared value, as well as a full set of interaction terms of year and economic activity (4-digit) dummies.

Following Wagner (2007b), three variants are estimated in order to analyse exports: First, equation 1 is estimated with an export dummy indicating the export status of the enterprise (1 if exporting, 0 if not). The exporter productivity premium (computed as $100 * (\exp(\beta_1) - 1)$) shows the average percentage difference in productivity 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. Thus, $\beta_1 * 100$ shows the percentage increase in labour productivity if the export intensity increases (ceteris paribus) by one percentage point. To investigate a possible non-linear relationship, both the export intensity and its squared value are included in a third variant.

In addition to the pooled regression of equation 1, a fixed effects model is estimated to control for unobserved, time-invariant heterogeneity.¹⁸

Table 3 reports the results of the estimation for West Germany, and Table 4 reports the results for East Germany. Even for business services enterprises, there is a statistically and economically significant export premium in the form of a higher productivity. Based on the pooled regression, an average percentage labour productivity difference of 38.3% in West Germany and 31.5% in East Germany occurs in the years 2001 to 2005. After controlling for unobserved heterogeneity by including fixed enterprise effects, the analyses show that an economically relevant productivity difference of 7% in West-Germany and 5% in East-Germany is still present.

The much smaller export premium in the fixed effects model (compared to the pooled regression) suggests that the exporter status variable is positively correlated with the unobserved effect. This drop in the premium is consistent with the idea that enterprises that are more “able”¹⁹ are also more likely to be exporting enterprises. Thus, in the pooled regression, a large part of the export premium reflects the fact that exporting enterprises would be more productive even if they were not exporting.

¹⁸ The pooled regression is estimated with robust standard errors, relaxing the assumption of independence of the observations. Independence is assumed only between enterprises (cluster). Therefore, the cluster option of Stata 8.2 is used.

¹⁹ Captured by a higher unobserved effect.

TABLE 3
PRODUCTIVITY PREMIA OF INTERNATIONAL ACTIVE BUSINESS SERVICES ENTERPRISES IN
WEST GERMANY (2001-2005)

	Estimation of the logarithmised labour productivity in t					
	pooled regression			fixed effects model		
	1	2	3	1	2	3
Internationally active: export dummy _t	38.3**	-	-	7.0**	-	-
export intensity _t	-	0.008**	0.015**	-	0.006**	0.007**
export intensity squared _t	-	-	-0.000*	-	-	-0.000**
number of employees _t	-0.001**	-0.001**	-0.001**	-0.002**	-0.002**	-0.002**
number of employees squared _t	0.000**	0.000**	0.000**	0.000**	0.000**	0.000**
year x four-digit branch dummies	yes	yes	yes	yes	yes	yes
number of observations	726,840					

Note:

The estimated regression coefficients and the levels of significance (* indicates significance at the 5% and ** at the 1% level) are presented from three estimations of the logarithmised labour productivity at t. Model 1 contains an export dummy, model 2 contains the export intensity and model 3 adds the squared export intensity. To facilitate the interpretation, the estimated coefficient for the export dummy has been transformed by $100(\exp(\beta)-1)$. The transformation shows the average percentage difference in labour productivity (ceteris paribus) between exporters and non-exporters. The 1st and the 99th percentiles of the labour productivity distribution are excluded from all computations. Business services are defined as NACE divisions 72 and 74. Data source: German turnover tax statistics panel 2001-2005.

TABLE 4
PRODUCTIVITY PREMIA OF INTERNATIONAL ACTIVE BUSINESS SERVICES ENTERPRISES IN
EAST GERMANY (2001-2005)

	Estimation of the logarithmised labour productivity in t					
	pooled regression			fixed effects model		
	1	2	3	1	2	3
Internationally active: export dummy _t	31.5**	-	-	5.0**	-	-
export intensity _t	-	0.007**	0.014**	-	0.006**	0.003**
export intensity squared _t	-	-	-0.000**	-	-	-0.000**
number of employees _t	-0.004**	-0.004**	-0.003**	-0.01**	-0.01**	-0.01**
number of employees squared _t	0.000**	0.000**	0.000**	0.000**	0.000**	0.000**
year x four-digit branch dummies	yes	yes	yes	yes	yes	yes
number of observations	166,192					

Note:

The estimated regression coefficients and the levels of significance (* indicates significance at the 5% and ** at the 1% level) are presented from three estimations of the logarithmised labour productivity at t. Model 1 contains an export dummy, model 2 contains the export intensity and model 3 adds the squared export intensity. To facilitate the interpretation, the estimated coefficient for the export dummy has been transformed by $100(\exp(\beta)-1)$. The transformation shows the average percentage difference in labour productivity (ceteris paribus) between exporters and non-exporters. The 1st and the 99th percentiles of the labour productivity distribution are excluded from all computations. Business services are defined as NACE divisions 72 and 74. Data source: German turnover tax statistics panel 2001-2005.

The second and the third variants of the estimation show the relationship between labour productivity and export intensity. In both parts of Germany, labour productivity increases about 0.6% if the export intensity increases ceteris paribus about one percentage point (based

on the fixed effects model). These results are statistically highly significant. Allowing for a non-linear relationship by including the squared export intensity shows an increase with a slight depressive character.

To check the robustness of the results, the export premium is estimated with the IAB-Establishment Panel. Because of the much smaller sample, equation 1 is estimated for both parts of Germany together.²⁰ The findings for business services establishments in the time period 1999 to 2004 are in close agreement with the findings based on the turnover tax statistics panel. The pooled regression reveals an export premium in the form of a higher productivity of 33.6% and the fixed effects model reveals an export premium of 3.5%.²¹ Contrary to the results from the turnover tax statistics, only the export premium from the pooled regression is statistically significant. The coefficient in the fixed effects model is not statistically significant, which is attributable to the fact that, in the fixed effects model, the coefficient is identified only by the export status changing establishments, a group that is very small in the sample. However, these results indicate that, even if exports of goods and exports of services are considered, an export premium is present in the business services sector.

In summary, internationally active German business services enterprises are clearly more productive than business services enterprises that do not have international activities in the form of exported goods. This is in line with the evidence from the manufacturing sector.

4.3 Self-selection hypothesis

There are two hypotheses in the literature to explain the export premia shown in section 4.2: the hypothesis concerning self-selection of the more productive enterprises into export markets and the hypothesis that exporting makes enterprises more productive (learning-by-exporting). This section investigates the hypothesis that export starters are more productive

²⁰ In addition to the control variables, interactive terms of year and region (1=east) dummies are included in equation 1.

²¹ The results of all 3 estimated models based on the IAB-Establishment Panel can be found in Table A3 in the appendix.

than non-exporters, even several years before they begin to export, by estimating the average productivity differences in period $t-3$ between enterprises that start to export in period t and enterprises that do not export in any period. Only enterprises with no export activities between $t-3$ and $t-1$ are considered. The pre-entry productivity differences are estimated by:

$$(2) \ln \text{productivity}_{it-3} = \beta_0 + \beta_1 \text{export starter}_{it} + \beta_2 \text{control}_{it-3} + u_{it},$$

where i is the enterprise index, t represents the years 2004 and 2005, u is the error term and *productivity* is the labour productivity in 2001 prices. The vector *control* contains the number of employees liable for paying social insurance and its squared value, as well as dummies for economic activity (4-digit).²²

Export starter is a dummy variable that indicates the export status in t (1 if the enterprise starts to export, 0 if not). The average percentage difference in labour productivity at $t-3$ between export starters at t and enterprises that do not start to export is computed from the estimated coefficient β_1 by $100 * (\exp(\beta_1) - 1)$.

Table 5 presents the results for the East and West German export starters in 2004 and 2005. Estimations of positive productivity differences at $t-3$ between prospective exporters and enterprises that do not export in any period are found in all estimations, and all results are statistically significant.

²² Equation 2 is estimated by a regression model with robust standard errors, using the robust option of Stata 8.2.

TABLE 5
 SELF-SELECTION INTO EXPORT MARKETS OF BUSINESS SERVICES ENTERPRISES IN
 WEST AND EAST GERMANY

	OLS estimation of the logarithmised labour productivity in t-3			
	West Germany		East Germany	
	t=2004	t=2005	t=2004	T=2005
Internationally active: export dummy _t	14.40**	14.36**	12.41**	6.84*
number of employees _{t-3}	-0.002**	-0.002**	-0.006**	-0.008**
number of employees squared _{t-3}	0.000**	0.000**	0.000**	0.000**
four-digit branch dummies _{t-3}	yes	yes	yes	yes
number of export starters	2,676	2,653	417	467
number of non-exporters	91,892	94,622	24,032	24,748

Note:

The estimated regression coefficients and the levels of significance (* indicates significance at the 5% and ** at the 1% level) from the OLS estimation of the logarithmised labour productivity at t-3 are presented. To facilitate the interpretation, the estimated coefficient for the export dummy has been transformed by $100(\exp(\beta)-1)$. The transformation shows the average percentage difference in labour productivity at t-3 between export starters at t and enterprises that do not start to export. The 1st and the 99th percentiles of the labour productivity distribution are excluded from all computations. Business services are defined as NACE divisions 72 and 74. Data source: German turnover tax statistics panel 2001-2005.

Three years before starting export activities, West German prospective exporters of the starter cohort from 2004 and 2005 were, on average, 14% more productive than non-exporters. A pre-entry productivity difference of 12% for the starter cohort 2004 and a difference of 7% for the starter cohort 2005 are found in East Germany. This is in line with evidence from the literature about the manufacturing sector and indicates that more-productive enterprises in the business services sector also self-select into export markets. In direct comparison with the results of the manufacturing sector, the pre-entry productivity difference in the business services sector is slightly lower in East Germany and slightly higher in West Germany;²³ however, these findings are based only on the exports of goods of business services enterprises. Because the IAB-Establishment Panel includes only a very small number of export starters, it is not possible to check the robustness of the results; thus, it is not possible to test whether there is a weaker self-selection effect in the business services sector compared to the

²³ In East Germany, a pre-entry productivity difference of 13.1% occurs in the manufacturing sector for t=2004 and 9.7% for t=2005. In West Germany, a pre-entry productivity difference of 10.6% for t=2004 and 9.9% for t=2005 is observed. The complete results of the manufacturing sector can be found in Table A4 in the appendix.

manufacturing sector as a result of lower transportation costs in the case of cross-border service activities. (See section 2). Nonetheless, the consideration of internationally active business services enterprises proxied by the export of goods suggests that there is a self-selection effect in this sector as well.

4.4 Learning-by-exporting

The second step in explaining the export premium tests whether export activities improve productivity through learning effects. The average difference in labour productivity growth in the period $t+1$ to $t+2$ between enterprises that start to export in period t and those enterprises that do not export in any period ($t-2$ to $t+2$) is estimated. Export starters are defined as enterprises that do not export in period $t-2$ and $t-1$ but do start to export in t and continue exporting in periods $t+1$ to $t+2$. The productivity growth difference is estimated by:

$$(3) \ln \text{productivity}_{it+2} - \ln \text{productivity}_{it+1} = \beta_0 + \beta_1 \text{export starter}_{it} + \beta_2 \text{control}_{it-3} + u_{it},$$

where i is the enterprise index, t represents the year 2003, u is the error term and *productivity* is the labour productivity in prices of 2001. In line with equation 2, the *control* vector contains the number of employees liable for paying social insurance and its squared value, as well as dummies of the economic activity (4-digit).²⁴

Export starter is a dummy variable that indicates the export status at t (1 if the enterprise starts to export, 0 if not). The estimated coefficient β_1 shows the average percentage difference of the productivity growth in $t+1$ to $t+2$ between export starters and enterprises that continue to produce only for the domestic market transformed to $100 * (\exp(\beta_1) - 1)$. Because the turnover tax statistics panel contains only the years 2001 to 2005, equation 3 can be estimated only for $t=2003$.

²⁴ Equation 3 is estimated by a regression model with robust standard errors, using the robust option of Stata 8.2.

The results of the estimated productivity growth premia are reported in Table 6. In West Germany and East Germany, export activity has no statistically significant effect on productivity growth, which confirms the unclear evidence of the mean comparisons in section 4.1. However, statistically significant results are lacking in the manufacturing sector as well.²⁵ It is likely that the learning effect occurs in later periods but, because the turnover tax statistics contain only five periods, it is not possible to test this hypothesis.

TABLE 6
LEARNING-BY-EXPORTING OF BUSINESS SERVICES ENTERPRISES IN
WEST AND EAST GERMANY

	OLS estimation of the logarithmised labour productivity _{t+2} – the logarithmised labour productivity _{t+1}	
	West-Germany	East-Germany
	t=2003	
Internationally active: export dummy _t	-1.09	-0.21
number of employees _{t-3}	0.000**	0.000*
number of employees squared _{t-3}	-0.000**	-0.000
four-digit branch dummies _{t-3}	yes	yes
number of export starters	917	116
number of non-exporters	79,206	19,393

Note:

The estimated regression coefficients and the levels of significance (* indicates significance at the 5% and ** at the 1% level) from the OLS estimation of the logarithmised labour productivity at t+2 minus the logarithmised labour productivity at t+1 are presented. To facilitate the interpretation, the estimated coefficient for the export dummy has been transformed by $100(\exp(\beta)-1)$. The transformation shows the average labour productivity growth premium of export starters in 2003 compared to non-exporters two years after starting to export. The 1st and the 99th percentiles of the labour productivity distribution are excluded from all computations. Business services are defined as NACE divisions 72 and 74. Data source: German turnover tax statistics panel 2001-2005.

Like the findings of previous studies about the manufacturing sector in Germany (cf. Wagner 2007b) and other countries (cf. Wagner 2007a, International Study Group on Exports and Productivity 2007), this analysis offers no clear evidence concerning the learning-by-exporting hypothesis in the business services sector. Fryges and Wagner (2007) showed a positive effect for the manufacturing sector, at least for some intervals of export intensity.

²⁵ The results of the manufacturing sector can be found in Table A5 in the appendix.

5 Conclusion

A wide range of empirical studies has analysed the relationship between exports and productivity 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 the relationship between export and productivity in the German business services sector.

Similar to the manufacturing sector, exporting business services enterprises are more productive than non-exporters, and more-productive business services enterprises self-select into export markets. These results are in line with studies about the manufacturing sector in Germany (Wagner 2007b), the manufacturing sector in other countries (cf. Wagner 2007a, International Study Group on Exports and Productivity 2007), and previous studies of the service sector (Harris & Li 2007, Love & Mansury 2007). No evidence is found that exporting increases productivity, which also corresponds with the results from the German manufacturing sector (Wagner 2007b).

The investigation is limited by the fact that the turnover tax statistics contain only the exports of goods, so the exporting activities of business services enterprises are proxied by the export of goods. The IAB-Establishment Panel, a much smaller sample containing export of both goods and services, is used to check the robustness of the results. Even if exports of services are considered, similar productivity premia of exporting business services enterprises are found, so it can be assumed that the results are conclusive for internationally active business services enterprises. Nonetheless, testing hypotheses with a special focus on the exports of services (e.g., a weaker self-selection effect resulting from lower transportation costs) would require a dataset that contains information about the exports of goods and enough observations over time. As of this writing, no such dataset is available for Germany.

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Appendix

TABLE A1
EXPORT PARTICIPATION OF ENTERPRISES IN GERMANY
(IAB-ESTABLISHMENT PANEL)

	Germany		
	share of exporting enterprises (in %)	average export intensity (in %)	
		all enterprises	exporters only
Business Services Sector			
2001	9.9	2.6	25.9
2003	13.6	3.2	23.5
Manufacturing Sector			
2001	22.5	5.6	24.8
2003	22.6	6.2	27.6

Note:

Only enterprises with one or more employees liable for paying social insurance and a turnover higher than €17 081 in 2001 prices are considered. Cross-section weights are used. Business services are defined as NACE divisions 72 and 74. Data source: IAB-Establishment Panel 2002 and 2004.

TABLE A2
EXPORTERS VS. NON-EXPORTERS IN GERMANY 2004
BUSINESS SERVICES ENTERPRISES (IAB-ESTABLISHMENT PANEL)

	Exporters		Non-exporters	
	mean (standard deviation)	number of enterprises	mean (standard deviation)	number of enterprises
Germany				
Employees liable for paying social insurance	13.3 (51.0)	229	8.2 (39.9)	1,121
Labour productivity (in € 1,000)	139.1 (84.2)	207	121.1 (107.6)	958
Turnover (in € 1,000)	1,787 (6,843)	207	738.2 (5,665)	958
Growth 2001-2004:				
of labour productivity	7.4 (37.9)	23	5.1 (50.9)	241
of employees	9.3 (50.2)	24	7.3 (48.3)	275

Note:

t-tests show statistically significant ($\alpha=1\%$) differences in employees and turnover. The labour productivity difference is significant only on a level of $\alpha=10\%$ (but is significant on a level of $\alpha=5\%$ for the years 2001 to 2003, not presented here). The mean comparisons of the growth rates show no significant differences. Only enterprises with one or more employees liable for paying social insurance are considered. The 1st and the 99th percentiles of the labour productivity distribution are excluded from all computations. Labour productivity and turnover are in 2001 prices. Only enterprises that export or do not export over the whole period are considered for the comparison of growth rates. Cross-section weights and longitudinal section weights are used for the comparison of growth rates.. The numbers of cases are unweighted. Business services are defined as NACE divisions 72 and 74. Data source: IAB-Establishment Panel 2005.

TABLE A3
PRODUCTIVITY PREMIA OF INTERNATIONAL ACTIVE BUSINESS SERVICES ENTERPRISES IN
GERMANY 1999-2004 (IAB-ESTABLISHMENT PANEL)

	Estimation of the logarithmised labour productivity at t					
	pooled regression			fixed effects model		
	1	2	3	1	2	3
Internationally active: export dummy _t	33.6**	-	-	3.5	-	-
export intensity _t	-	0.007**	0.016**	-	0.000	0.000
export intensity squared _t	-	-	-0.000**	-	-	0.000
number of employees _t	-0.000*	-0.000	-0.000	-0.002**	-0.002**	-0.002**
number of employees squared _t	0.000	0.000	0.000	0.000**	0.000**	0.000**
year x four-digit branch dummies	yes	yes	yes	yes	yes	yes
year x region dummies	yes	yes	yes	yes	yes	yes
number of observations	6,532					

Note:

The estimated regression coefficients and the levels of significance (* indicates significance at the 5% and ** at the 1% level) from three estimations of the logarithmised labour productivity at t are presented. Model 1 contains an export dummy, model 2 contains the export intensity and model 3 adds the squared export intensity. To facilitate the interpretation, the estimated coefficient for the export dummy has been transformed by $100(\exp(\beta)-1)$. The transformation shows the average percentage difference in labour productivity (ceteris paribus) between exporters and non-exporters. The 1st and the 99th percentiles of the labour productivity distribution are excluded from all computations. Business services are defined as NACE divisions 72 and 74. Data source: IAB-Establishment Panel 2000-2005.

TABLE A4
SELF-SELECTION INTO EXPORT MARKETS OF MANUFACTURING ENTERPRISES IN
WEST AND EAST GERMANY (TURNOVER TAX STATISTICS PANEL)

	OLS estimation of the logarithmised labour productivity at t-3			
	West Germany		East Germany	
	t=2004	t=2005	t=2004	T=2005
Internationally active: export dummy _t	10.6**	9.9**	13.1**	9.7**
number of employees _{t-3}	-0.004**	-0.004**	-0.005**	-0.005**
number of employees squared _{t-3}	0.000**	0.000**	0.000**	0.000**
four-digit branch dummies _{t-3}	yes	yes	yes	yes
number of export starters	3,173	2,943	743	692
number of non-exporters	62,596	60,281	17,917	16,988

Note:

The estimated regression coefficients and the levels of significance (* indicates significance at the 5% and ** at the 1% level) from the OLS estimation of the logarithmised labour productivity at t-3 are presented. To facilitate the interpretation, the estimated coefficient for the export dummy has been transformed by $100(\exp(\beta)-1)$. The transformation shows the average percentage difference in labour productivity at t-3 between export starters at t and enterprises that do not start to export. The 1st and the 99th percentiles of the labour productivity distribution are excluded from all computations. Data source: German turnover tax statistics panel 2001-2005.

TABLE A5
LEARNING-BY-EXPORTING OF MANUFACTURING ENTERPRISES IN WEST- AND EAST-GERMANY
(TURNOVER TAX STATISTICS PANEL)

	OLS estimation of the logarithmised labour productivity _{t+2} – the logarithmised labour productivity _{t+1}	
	West Germany	East Germany
	t=2003	
Internationally active: export dummy _t	0.15	-1.39
number of employees _{t-3}	0.000**	0.000**
number of employees squared _{t-3}	-0.000*	-0.000
four-digit branch dummies _{t-3}	yes	yes
number of export starters	1,250	260
number of non-exporters	50,616	13,539

Note:

The estimated regression coefficients and the levels of significance (* indicates significance at the 5% and ** at the 1% level) from the OLS estimation of the logarithmised labour productivity at t+2 minus the logarithmised labour productivity at t+1 are presented. To facilitate the interpretation, the estimated coefficient for the export dummy has been transformed by $100(\exp(\beta)-1)$. The transformation shows the average labour productivity growth premium of export starters in 2003 compared to non-exporters two years after starting to export. The 1st and the 99th percentiles of the labour productivity distribution are excluded from all computations. Data source: German turnover tax statistics panel 2001-2005.

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