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by

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Robust estimates of exporter productivity premia in German business services enterprises*

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Abstract:

A large and growing number of micro-econometric studies show that exporting firms are more productive than firms that sell their products on the home market only. This so-called exporter productivity premium qualifies as a stylized fact. Only recently researchers started to look at the role of extreme observations, or outliers, in shaping these findings. These studies use micro-econometric methods that are robust against outliers to show that very small shares of firms with extreme values drive the result. The large exporter productivity premium found for samples of firms including outliers are dramatically smaller in samples without these extreme observations. Evidence on this, however, is limited so far to firms from manufacturing industries. This note adds comparable evidence for firms from the business services industries. We find that the estimated exporter productivity premium is statistically significant and relevant from an economic point of view when a standard fixed effects estimator is used to control for unobserved firm characteristics, but that it drops to zero when a robust estimator is applied.

Keywords: Exporter productivity premium, services firms, robust estimation, panel data,

JEL Classification: F14, C23, C81, C87

* All computations were done in the research data centre of the Statistical Office in Hannover. The data used are confidential but not exclusive; information how to access the data is provided in Zühlke et al. (2004) and Vogel (2009). To facilitate replication and extensions the Stata code is available from the first author on request.

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1. Motivation

A large and growing number of micro-econometric studies show that exporting firms are more productive than firms that sell their products on the home market only. This so-called exporter productivity premium qualifies as a stylized fact that is found for firm level data from almost every country – regardless of the productivity measure used and even after controlling for unobserved firm characteristics in fixed-effects models.[1] These empirical findings motivate a class of theoretical models of heterogeneous firms that are at the heart of the so-called *new new trade theory* showing that only the more productive firms export while the less productive serve the national market.[2]

Only recently researchers started to look systematically at the role of extreme observations, or outliers, in shaping these findings of statistically significant and economically large exporter productivity premia. Everybody who ever worked with firm level data will strongly agree that if one investigates a sample of heterogeneous firms often values of some variables for some observations are much larger or smaller than the values for the other observations in the sample. These extreme observations, or outliers, may have a large impact on the results of statistical analyses. Conclusions based on a sample with and without these units may differ drastically.

While applied researchers tend to be aware of this, the detection of outliers and their appropriate treatment is usually not considered as an important issue. Given that due to confidentiality of the firm level data used single observations as a rule cannot be inspected closely enough to detect and correct reporting errors or to

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1 See Wagner (2007) for a survey and International Study Group on Exports and Productivity (ISGEP) (2008) for an application covering 14 countries.

2 The canonical model that is motivated by empirical findings of an exporter productivity premium is Melitz (2003); for a survey of the theoretical literature see Redding (2010).

understand the idiosyncratic events that lead to extreme values a widely used procedure to keep these extreme observations from affecting the results is to drop the observations from the top and bottom one percent of the distribution of the variable under investigation. A case in point is the international comparison study on the exporter productivity premium by the International Study Group on Exports and Productivity (ISGEP) (2008, p. 610).

However, although this approach is rather popular in applied micro-econometric studies it is in some sense arbitrary. Why the top and bottom one percent? Why not choose a larger or smaller cut-off point? There are alternative approaches to deal with extreme observations (outliers) that are substantiated in statistics. In a pioneering study Verardi and Wagner (2011) applied a newly developed robust estimator for fixed effects models to estimate the productivity premium for exporters for firms from manufacturing industries in Germany. Contrary to findings from the earlier literature studies they show that a very small number of firms with extreme values (3 percent of the sample) drive the result. The large exporter productivity premium found for samples of firms including outliers of 13.5 percent is only one percent and, therefore, dramatically smaller in the sample without these extreme observations. Similar findings are reported in Verardi and Wagner (2010) in a study on the exporter productivity premium in German manufacturing firms by area of export destination that applies a highly robust MM-estimator in estimates based on cross-section data, too.[3]

Evidence on the role of outliers in shaping results for estimates of exporter productivity premia, however, is limited so far to firms from manufacturing industries. This paper contributes to the literature by looking for comparable evidence for firms

[3] See also Wagner (2011) for a comparison of estimated exporter productivity premia based on various variants of robust and conventional (OLS) estimators.

from the German business services industries. In doing so we follow Dan Hamermesh (2000, p. 376) who argues that “the credibility of a new finding that is based on carefully analyzing two data sets is far more than twice that of a result based only on one.” To anticipate our most important result we find that the estimated exporter productivity premium is statistically significant and relevant from an economic point of view when a standard fixed effects estimator is used to control for unobserved firm characteristics, but that it drops to zero when a robust estimator is applied.

The rest of the paper is organized as follows. Section 2 introduces the data used and shows that firms are extremely heterogeneous and that there are extreme observations at both ends of the productivity distribution in each year. Section 3 describes briefly the used alternative approaches to deal with outliers and presents the results from non-robust and from robust estimations. Section 4 concludes.

2. Data

The data used in this study come from 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). Because the sample of enterprises required to give information in 2003 was also used in 2004 to 2007, it is possible to merge the cross-sectional datasets to a panel dataset that covers the years 2003 to 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.[4] Small enterprises with an annual sum of turnover and other operating income lower than 250,000 € are given a shorter questionnaire, so important information, such as information about export activities, is missing for these enterprises. For more details about the dataset see Vogel (2009).

For the purpose of analysing the relationship between exporting firms and productivity, we use data for firms with an annual sum of turnover and other operating income equal or higher than 250,000 € operating in the business service sector based on the 4-digit NACE sector classification 72-74, covering the period 2003-2007.[5] Productivity is measured as labour productivity, defined as turnover per employee (in Euro). More appropriate measures of productivity like total factor productivity, cannot be computed because of a lack of information on the capital stock in the surveys. Controlling for the industry affiliation, however, can be expected

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4 Unfortunately, information on the target countries of exports is not included in the statistics and we cannot distinguish between service and goods exports as well as the different types of services exported by the firm. Also, no information is obtained about other forms of companies' activities abroad, such as cooperation, direct investments, exports via commercial presence, or imports.

5 The data used in this study are confidential but not exclusive; information on how to access the data via the research data centres of the Federal Statistical Office and the statistical offices of the federal states is provided in Zühlke et al. (2004) and Vogel (2009).

to absorb much of the differences in the degree of vertical integration and capital intensity.[6]

Table 1 gives information about the distribution of two variables used in the empirical model to estimate the exporter productivity premium, turnover per employee (labor productivity) and the number of employed persons (the measure of firm size). The data show a considerable degree of heterogeneity among firms. While most firms are small (the 75th percentile is around 40 employees in all years) some are very large and the value at the 99th percentile is about 1,000 times the value at the 1st percentile. Turnover per employee varies even more between the firms. The value of labor productivity is reported to be less than one Euro cent on average for the three firms at the bottom end of the productivity distribution and more than 30 million Euros for the three firms at the top.[7] Turnover per employee at the 99th

[6] Note that Bartelsman and Doms (2000, p. 575) point to the fact that heterogeneity in labor productivity has been found to be accompanied by similar heterogeneity in total factor productivity in the reviewed research where both concepts are measured. In a recent comprehensive survey Chad Syverson (2010: 9) argues: “Simply put, high-productivity producers will tend to look efficient regardless of the specific way that their productivity is measured.” See International Study Group on Exportrs and Productivity (ISGEP) (2008) for a comparison of results for productivity differentials between exporting and non-exporting firms based on sales per employee, value added per employee and total factor productivity. Results proved remarkably robust. Furthermore, Foster, Haltiwanger and Syverson (2008) show that productivity measures that use sales (i.e. quantities multiplied by prices) and measures that use quantities only are highly positively correlated.

[7] Note that the smallest and the largest values are confidential (because they are figures for a single firm); therefore, only the average of the three smallest and largest firms can be reported. Due to confidentiality it is not possible to explore the extreme large and small labor productivity values at the firm level. Extreme small values could for example exist in firms with high other operating income but small turnover. Extreme large values could occur in firms where for example the actual activity is spun off to a separate entity. However, the aim of the article is to analyze the effect of alternative approaches to deal with outliers. Therefore, we decide to use the original data without trimming these extreme observations in advance.

percentile is 234 times the value at the 1st percentile in 2003, and the respective values for the other years are similar.

[Table 1 near here]

This illustrates the point made in section 1 above. In a sample of heterogeneous firms often the values of some variables for some observations are much larger or smaller than the values for the other observations in the sample. Due to confidentiality of the firm level data used here single observations cannot be inspected closely enough to detect and correct any reporting errors or to understand the idiosyncratic events that lead to extreme values. Given that these extreme observations, or outliers, may have a large impact on the results of empirical studies and that conclusions based on a sample with and without these units may differ drastically the presence of such outliers in the sample should be taken care of in micro-econometric analyses.

Before turning to that exercise we will look at one other dimension of the data used in this study. We have data for five years from 2003 to 2007 from an (unbalanced) panel of firms.[8] In the econometric investigation we will use these panel data to estimate the exporter productivity premium in two types of empirical models – a model using pooled data without fixed firm effects and a model that includes fixed firm effects to control for unobserved time invariant firm characteristics. The exporter productivity premium is estimated as the coefficient of a dummy variable indicating

[8] In addition to the sample of firms 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. Thus, we find an increase from 23,064 business services firms in 2003 up to 27,751 business services firms in 2007 in our panel dataset. This is in line with the still observable growth of the business services sector in Germany.

whether a firm is an exporter or not in an empirical model that regresses the labor productivity of a firm in a year on the exporter status in this year and a set of control variables (detailed below). While in the estimation of the model with pooled data all information on all firms and all variables over the years is used the regression coefficient of the exporter dummy variable in the model with fixed firm effects is identified only from information on firms that change their exporter status (at least once) between two consecutive years[9] and only the variation in the variables over time inside each of these firms is used in the estimation of the regression coefficients of the control variables, too.

To apply a fixed effects model, therefore, it is necessary to have variation of labor productivity, exporter status and control variables inside the firms over the years in the sample that is large enough to identify the coefficients of both the exporter dummy and the control variables. Table 2 shows that in the panel data set used here the variation in the firms over time is smaller than the variation between the firms (as usual) but that the within variation is quite large compared to the between variation so that an application of a fixed effects model seems to be appropriate.[10]

[Table 2 near here]

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9 In our sample the share of firms that start or stop to export at least once is rather large. Thus, 6,516 of the 38,266 firms in the dataset (17 percent) change their export status at least once during the time they occur in the dataset; 28,091 firms did not export and 3,659 firms export in all periods they occur in the dataset.

10 Given that firms that are in the sample for one year only – so-called singletons – do by construction not add to the identification of the coefficients in a fixed-effects model these observations were used in the pooled model but not in the fixed-effect model. 8,517 of the 38,266 firms in the dataset are singletons.

3. The exporter productivity premium in German business services firms – Results from non-robust and from robust estimations

The exporter productivity premium is defined as the percentage differential in productivity between exporting and non-exporting firms from the same industry and of the same size. It is estimated from an empirical model with the log of productivity as the endogenous variable and a dummy variable that takes on the value of one when a firm is an exporter and zero otherwise as an exogenous variable; the number of employees (and its squared value) and dummy variables for the industries and years are included to control for firm size, industry affiliation and time trend. The estimated coefficient ß of the exporter dummy variable (transformed by computing 100*exp(ß-1)) shows the average percentage difference of productivity between exporters and non-exporters after controlling for firm size and industry affiliation – the exporter productivity premium.[11]

In a first step, the exporter productivity premium in German business services firms is estimated using pooled data for the years 2003 – 2007 from the business services statistics (described in section 2) for the complete sample of 126,157 observations for 38,266 firms.[12] Results reported in the first column of row one table 3 show that the estimated premium is positive, statistically highly significant and very large from an economic point of view – exporters are ceteris paribus 54.7 percent more productive than non-exporting firms. These results are in line with previous findings concerning the export productivity premia of business services firms. Vogel (2011) and Temouri et al. (2010) find statistically and economically significant large

[11] See Wagner (2007) for a discussion of the standard approach used in the literature on the micro-econometrics of international firm activities to estimate the exporter productivity premium.

[12] All models for pooled data without fixed effects include a full set of interaction terms of year and industry (2-digit level) dummy variables plus the number of employees and its squared value; standard errors are computed using the firm as a cluster.

export productivity premia for the business service sectors in France, the United Kingdom as well as in East and West Germany.

[Table 3 near here]

Productivity differences between firms is related to variables besides firm size and industry affiliation that are not included in the empirical model to estimate the exporter productivity premium either because information is missing or because they are unobservable to a researcher. A case in point is management quality (see Syverson (2010, p. 14) and the recent study by Bloom and Van Reenen (2010)). In the data set used here (and in all other data sets used to empirically investigate international firm activities that we are aware of) variables that measure management quality are missing. This would not pose a big problem if management quality would be uncorrelated with the other variables included in the empirical model (e.g., the exporter status) – of course it would not be possible to investigate the role of management quality for productivity differences between firms empirically, but the estimated coefficient for the exporter dummy variable would be an unbiased estimate of the exporter productivity premium (given all other assumptions for the applicability of OLS are fulfilled). However, one would not expect that management quality is uncorrelated with either the exporter status or other variables like firm size. Not controlling for management quality then leads to biased estimates for the exporter premium.

A standard solution for this problem that is widely used in the literature on the micro-econometrics of international firm activities is the estimation of fixed effects models for panel data (see e.g. ISGEP (2008)). Using pooled cross-section time-series data for firms and including fixed firm effects in the empirical model allows to control for time invariant unobserved firm heterogeneity, and to estimate the coefficients for the time variant variables that are included in the models without any bias caused by the non-inclusion of the unobserved variables that are correlated with these included variables.

In a second step, the exporter productivity premium in German business services firms is estimated using pooled data for the years 2003 – 2007 adding fixed firm effects to the model used in step 1.[13] The result reported in the third column of row one in table 3 shows that the estimated premium is positive, statistically highly significant but considerably smaller than the estimated premium from the pooled model without fixed firm effects; the productivity differential of 3.4 percent, however, can still be considered to be relevant from an economic point of view.[14] These results are again in line with previous findings concerning the export productivity premia of business services firms. After controlling for fixed effects Vogel (2011) and Temouri et al. (2010) find much smaller export productivity premia compared to the pooled regression. Still significant productivity differences are found in France and Germany.

Results from step 1 and step 2 where the standard approach based on pooled data with and without fixed firm effects is used point to the existence of a significant

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[13] All models with fixed effects include a full set of year dummy variables plus the number of employees and its squared value; standard errors are computed using the firm as a cluster. Note that observations from firms that are in the sample for one year only (the singletons) are not used in the estimation because they do not contribute to the identification of the regression coefficients. Therefore, the number of observations used here is smaller than the number used to estimate the pooled model. Information on the industry affiliation is not included in the fixed effects models because this is a time-invariant variable in our sample.

[14] A drop in the size of the estimated exporter productivity premium when fixed firm effects are added to a an empirical model is found in many studies from the micro-econometrics of international firm activities; a case in point is the study using data from 14 countries by ISGEP (2008).

and relevant positive exporter productivity premium in German business services firms. In the remaining steps we will look at the role of extreme observations, or outliers, in shaping these results.

If one investigates a sample of heterogeneous firms it often happens that some variables for some firms are far away from the other observations in the sample. For example, in the sample of exporting and non-exporting firms that is analyzed here according to table 1 there are a few firms with labour productivity values that are extremely low or extremely high compared to the mean values. These extreme values might be the result of reporting errors (and, therefore, wrong), or due to idiosyncratic events (like in the case of a shipyard that produces a ship over a long time and that reports the sales in the year when the ship is completed and delivered), or due to firm behavior that is vastly different from the behavior of the majority of firms in the sample. Observations of this kind are termed outliers. Whatever the reason may be, extreme values of labour productivity may have a large influence on the mean value of labour productivity computed for the exporters and non-exporters in the sample, on the tails of the distribution of labour productivity, and on the estimates of the exporter premium. Conclusions with regard to the productivity differences between exporters and non-exporters, therefore, might be influenced by a small number of firms with extremely high or low values of productivity.

Researchers from the field of micro-economics of international firm activities usually are aware of all of this. Given that due to confidentiality of the firm level data single observations as a rule cannot be inspected closely enough to detect and correct reporting errors, or to understand the idiosyncratic events that lead to extreme values, a widely used procedure to keep these extreme observations from shaping the results is to drop the observations from the top and bottom one percent of the distribution of the variable under investigation. A case in point is the international comparison study on the exporter productivity premium by the International Study Group on Exports and Productivity (ISGEP) (2008, p. 610).

To illustrate the effects of trimming the sample this way in a third step the empirical model for pooled data is estimated without and with fixed firm effects for a sample without the observations from the top and bottom one percent of the productivity distribution.[15] Results are reported in row two of table 3. While the estimates for the exporter productivity premia are still positive and highly statistically significant they are smaller in both models. The estimated premium in the fixed effects model is only 1.4 percent and might no longer be viewed as relevant from an economic point of view. This clearly demonstrates that a small share of observations from both ends of the productivity distribution with very low or high values of labor productivity do have a large impact on the estimated values for the exporter premium at least in the model including fixed effects.

Dropping the firms from the top and the bottom one percent of the productivity distribution and comparing the results of empirical investigations with and without these firms with extremely high or extremely low values of labour productivity might be considered as a first and useful step to check the sensitivity of results. However, although this approach seems to be rather popular it is in some sense arbitrary. Why the top and bottom one percent? Why not choose a larger or smaller cut-off point? There are alternative approaches to deal with extreme observations (outliers) that are substantiated in statistics, and we will turn to these methods now.

In a fourth step we will look at robust estimation of the exporter productivity premium based on the model for pooled data that does not include fixed firm effects.

[15] More precisely, we compute in a first step the 1st and 99th percentile of the productivity distribution using the pooled dataset. In a second step we drop all firms (and not only the respective observation) that belong to the 1st or 99th percentile of the productivity distribution in at least one of the considered years 2003 to 2007.

Following Rousseeuw and Leroy (1987) we distinguish three types of outliers that influence the OLS estimator: vertical outliers, bad leverage points, and good leverage points. Verardi and Croux (2009, p. 440) illustrate this terminology in a simple linear regression framework (the generalization to higher dimensions is straightforward) as follows: “Vertical outliers are those observations that have outlying values for the corresponding error term (the *y* dimension) but are not outlying in the space of explanatory variables (the *x* dimension). Their presence affects the OLS estimation and, in particular, the estimated intercept. Good leverage points are observations that are outlying in the space of explanatory variables but that are located close to the regression line. Their presence does not affect the OLS estimation, but it affects statistical inference because they do deflate the estimated standard errors. Finally, bad leverage points are observations that are both outlying in the space of explanatory variables and located far from the true regression line. Their presence significantly affects the OLS estimation of both the intercept and the slope.”

Full robustness in a regression based on pooled cross-section data can be achieved by using the so-called MM-estimator that can resist contamination of the data set of up to 50% of outliers (i.e., that has a breakdown point of 50 % compared to zero percent for OLS).[16]

[16] The breakdown point of an estimator is the highest fraction of outliers that an estimator can withstand, and it is a popular measure of robustness. Using the terminology of Rousseeuw and Leroy one can state that the median regression estimator (also known as Least Absolute Deviations, or LAD) protects against vertical outliers but not against bad leverage points (Verardi and Croux 2009, p. 441). Another quite popular robust estimator is the M-estimator proposed by Huber that generalizes median regression to a wider class of estimators. However, as pointed out by Verardi and Croux (2009, p. 442), this estimator can only identify isolated outliers and is inappropriate when clusters of outliers exist where one outlier can mask the presence of another, and the initial values for the algorithm is not robust to bad leverage points.

A discussion of the details of this estimator is beyond the scope of this paper (see Verardi and Croux (2009) and the Appendix to Verardi and Wagner (2011)). The result is reported in column one of row three in table 3. The estimated exporter productivity premium is again statistically highly significant and very large from an economic point of view. The point estimate is only slightly smaller than the point estimate reported for the application of the non-robust standard approach using OLS for the complete sample and only slightly larger than OLS applied to the trimmed sample.

Therefore, neither trimming the sample nor using a highly robust estimator and the full sample does make a large difference when fixed firm effects are not included in the empirical model. In the last step of our empirical study we will investigate whether this is also the case when a model with fixed firm effects is estimated. Note that when working with panel data a fourth category of outliers (besides vertical outliers, bad leverage points, and good leverage points) should be considered, namely block concentrated outliers that correspond to a situation in which most of the outlying observations are concentrated in a limited number of time series (see Bramati and Croux, 2007). To deal with the presence of any of these types of outliers we apply a robust estimator for the linear fixed effects model suggested in Verardi and Wagner (2011). Again, a discussion of the details of this estimator is beyond the scope of this paper. Suffice it to say here that we first center all variables by removing the median (and not the mean as in the non-robust standard approach) to remove individual fixed effects and then run a robust estimator to identify the outliers. Outlying individuals are then awarded a weight zero and a standard fixed effect model is fitted to the remaining observations. The robust estimator we use for the outlier identification step is an S-estimator which is known to be particularly robust to outliers. The logic behind this estimator is that, instead of minimizing the variance of the residuals as in OLS, another measure of dispersion of the residuals, less sensitive to outliers, is minimized. The measure of spread minimized here is an M-estimator of scale (see Verardi and Croux (2009) for further details).

The results are reported in last two columns of row three in table 3. Note first that 25,946 (or 22 percent)[17] of all observations are identified as outliers and dropped from the estimation sample. This is a large fraction of outliers, and this may come as a surprise. Remember, however, that a huge number of firms in the complete sample report tiny or extremely large values of turnover per employee (see table 1).

Using the sample without outliers the estimated exporter productivity premium is no longer statistically different from zero at any conventional error level, and the point estimate is close to zero. Controlling for observed firm size (and time invariant industry affiliation) and unobserved time invariant firm characteristics there is no such thing as an exporter premium!

This result (that is in line with findings from two other studies that estimate exporter productivity premia in models with fixed effects for firms from manufacturing industries reported by Verardi and Wagner (2010, 2011)) demonstrates that it is extremely important to identify outliers and document their role in shaping the results from estimation of linear fixed effects models. Furthermore, it illustrates that trimming the sample by dropping the smallest and largest one percent observations from the productivity distribution is no valid solution.[18]

[17] To be more precise, 24,881 of all observations are identified as outliers and 1,080 are additional singletons resulting from dropping out the identified outliers.

[18] For a demonstration that trimming leads to biased coefficient estimates in the presence of outliers see the Monte Carlo study in Verardi and Wagner (2011).

4. Concluding remarks

Researchers active in applied micro-econometrics are often aware of the fact that extreme observations, or outliers, can have a large impact on the results of statistical analyses, and that conclusions based on a sample with and without these units may differ drastically. To our experience, however, the detection of outliers and their appropriate treatment is often dealt with in a rather sloppy manner. We demonstrate that outliers drive the results of the estimate of the exporter productivity premium, a figure that plays a prominent role in the *Micro-econometrics of International Firm Activities* (and in the *New New Trade Theory* as well).

Evidence for a vanishing exporter productivity premium in models with fixed firm effects that are estimated using data from "cleaned" samples without outliers, however, is (to the best of our knowledge) as of today limited to results from studies using data for German firms from manufacturing and business services. An important next step in research in this area consists in similar empirical investigations that are based on data from other countries. Given that we cannot access these data for confidentiality reasons we suggest that researchers from other countries replicate our study – and inform us about any results.

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Tables

TABLE 1
Distribution of the used variables – Original data

	Number of observation	Mean	Standard Deviation	Minimum*	Maximum*	p1	p25	p50	p75	p99
	Reporting year: 2003									
Turnover per employee	23064	165665	1068793	0.0020	69100000	6291	44763	74965	132004	1472567
Number of employed persons	23064	71.69	348.80	1	15370	1	7	14	40	1008
	Reporting year: 2004									
Turnover per employee	24082	162442	764374	0.0018	47100000	6498	45352	75854	134473	1510551
Number of employed persons	24082	72.44	355.94	1	15608	1	7	14	39	1037
	Reporting year: 2005									
Turnover per employee	24782	161527	620638	0.0018	30800000	6396	46504	77457	138047	1521151
Number of employed persons	24782	72.10	404.50	1	21815	1	7	14	38	999
	Reporting year: 2006									
Turnover per employee	26478	166731	656182	0.0018	36500000	6808	47397	79175	139680	1566667
Number of employed persons	26478	74.87	468.52	1	26696	1	7	14	39	1050
	Reporting year: 2007									
Turnover per employee	27751	172288	739045	0.0026	39800000	7010	47536	79946	141871	1574772
Number of employed persons	27751	78.02	545.95	1	34034	1	7	14	39	1097

Source: Research Data Centres of the Federal Statistical Office and the statistical offices of the Länder, The German Business Services Statistics Panel 2003-2007, Author’s own calculations.
Note: (*) For confidentiality reasons the minimum is proxied by the mean of the three smallest firms and the maximum is proxied by the mean of the three largest firms.

TABLE 2
Within and Between standard deviation of the used variables (2003-2007) – Original Data

	Standard Deviation		
	Overall	**Between**	**Within**
Export status (dummy)	0.3893	0.3299	0.2106
Turnover per employee (log)	1.2899	1.2473	0.5458
Number of employed persons	436.13	369.01	133.90

Source: Research Data Centres of the Federal Statistical Office and the statistical offices of the Länder, The German Business Services Statistics Panel 2003-2007, Author's own calculations.
Note: Computations are based on 126,157 observations for 38,266 firms, 8,517 of which are singletons. The overall, between and within standard deviation are computed by the xtsum command of STATA 10.

TABLE 3

Exporter productivity premia of business services enterprises (2003-2007)

	Estimation of the turnover per employee on export status and controls in t			
	pooled regression		fixed effects model	
	coefficient (p-value)	number of observations	coefficient (p-value)	number of observations
Non robust standard approach – Original Data (no control for outliers)				
Turnover per employee (log)	54.7** (0.000)	126,157	3.4** (0.000)	117,640
Non-robust standard approach – Trimmed Data (excluding outliers by excluding the 1st and 99th percentile of the distribution)				
Turnover per employee (log)	45.7** (0.000)	121,683	1.4** (0.004)	113,449
Robust estimation – Original Data (using mmregress and xtregrob to control for outliers)				
Turnover per employee (log)	51.2** (0.000)	126,157	0.1 (0.410)	91,694

Source: Research Data Centres of the Federal Statistical Office and the statistical offices of the Länder, The German Business Services Statistics Panel 2003-2007, Author's own calculations.

Note:

The estimated regression coefficients and the levels of significance (** indicates significance at the 1% level, based on cluster robust standard errors) are presented for estimations of the logarithmic turnover per employed persons on the export status at t. In the pooled regression model it is controlled for a full set of interaction terms of year and economic activity (2-digit) dummies, the number of employed persons and its squared value. In the fixed effects model it is controlled for fixed enterprise effects, year dummies, the number of employed persons and its squared value. To facilitate the interpretation, the estimated coefficient for the export dummy has been transformed by 100(exp(ß)-1). The transformation shows the average percentage difference in labour productivity (ceteris paribus) between exporters and non-exporters. The number of observations of the fixed effects model is presented without singletons.

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