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Do outliers and unobserved heterogeneity explain the exporter productivity premium? Evidence from France, Germany and the United Kingdom*

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Abstract:

A stylized fact from the literature on the *Micro-econometrics of International Trade* and a central implication of the heterogeneous firm models from the *New New Trade Theory* is that exporters are more productive than non-exporters. It is argued that this exporter productivity premium is due to extra costs of exporting that can be covered only by more productive firms. However, in recent papers that control for extreme observations and unobserved firm heterogeneity by applying a highly robust fixed-effects estimator, no such exporter productivity premium is found for firms from manufacturing and services industries in Germany. This paper uses enterprise level panel data for France, Germany and the United Kingdom from 2003 to 2008 to systematically investigate the role of outliers and unobserved firm heterogeneity for estimates of the exporter productivity premium. We report that outliers do have an influence on the estimated exporter productivity premium. We argue that the vanishing exporter premium in robust fixed effects estimations that is reported for all three countries is caused by characteristics of firms that start or stop to export over the period under investigation, and that are not representative for the bulk of firms that either export or not.

Keywords: Export, productivity premium, outlier, unobserved heterogeneity, robust estimation
JEL Classification: F14

* All computations with German data were performed at the Research Data Centre of the Statistical Office of Berlin-Brandenburg in Berlin. The German firm-level data used are strictly confidential but not exclusive; see http://www.forschungsdatenzentrum.de/datenzugang.asp for information on how to access the data. To facilitate replication the Stata do-files are available from the authors on request.

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1. Motivation

Ever since Bernard and Jensen (1995) pioneered the literature on what is now labelled the *Micro-econometrics of International Trade*, empirical studies that compare exporting and non-exporting firms report that exporters are more productive than non-exporters of the same size and from the same industry. This positive exporter productivity premium has been found in hundreds of studies for countries from all over the world, and is now considered a stylized fact (see the surveys by Greenaway and Kneller (2007), Bernard et al. (2012) and Wagner (2007, 2012)).

The empirical finding of a positive exporter productivity premium motivated Melitz (2003) to develop a dynamic industry model with heterogeneous firms in which exporters exhibit a level of productivity that lies beyond some threshold, while firms with lower productivity do not export and only serve the home market (and the least productive firms exit the market). The reason for this productivity threshold, which divides exporters from non-exporters, is that exporters have to cover extra-costs to serve a foreign market (including cost for finding foreign customers, transportation costs, distribution or marketing costs, costs for personnel with skill to manage foreign networks, or costs to modify products for foreign customers), and only the more productive firms can cover these export-related costs while still remaining profitable.

The Melitz (2003) model has become the workhorse model of a large and growing theoretical literature labeled the *New New Trade Theory* (reviewed in Helpman (2006, 2011), Redding (2011) and Melitz and Redding (2012)). Recently, the core ideas made its way into undergraduate classes on International Economics (see Krugman, Obstfeld and Melitz (2012), ch. 8). A graph showing productivity thresholds that divide firms into three groups – exits, non-exporters and exporters – like figure 5.1 in Helpman (2011, p. 103) or figure 2 in Melitz and Redding (2012, p. 20) will soon be as familiar to

students of international trade all over the world as a graph showing the consequences of a tariff on production and consumption in a small open economy.

However, recent econometric studies report empirical evidence that does not fit well into the picture sketched so far. The starting point of these studies is the fact that heterogeneous firms are at the heart of both the *New New International Trade Theory* and the *Micro-econometrics of International Firm Activities.* This heterogeneity may lead to severe problems in empirical investigations based on data for these firms for two reasons.

First, if one investigates a sample of heterogeneous firms it often happens that the values of some variables for some firms are far away from the other observations in the sample. For example, labor productivity values might be extremely low or extremely high compared to the mean values for some firms. 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 labor productivity may have a large influence on the mean value of labor productivity computed for exporters and non-exporters in the sample, on the tails of the distribution of labor productivity, and on the estimates of the productivity difference between exporters and non-exporters (i.e. exporter productivity premium). Conclusions with regard to the exporter productivity premium, therefore, might be heavily 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 are well aware of this. Given that due to confidentiality of the firm level data single

observations cannot, as a rule, be inspected closely enough to detect and correct reporting errors, or to understand the idiosyncratic events that lead to extreme values. Thus, a widely used procedure to keep these extreme observations from shaping the results is to drop the observations from the top and bottom percentile of the distribution of the variable under investigation. A case in point is the international comparison study on the exporter productivity premium by the ISGEP - International Study Group on Exports and Productivity (ISGEP) (2008, p. 610). For a discussion of the advantages and disadvantages of this and other methods to deal with outliers see Wagner (2011) and the examples and references given therein.

Second, firm heterogeneity might be caused by factors that are either observed by the researcher or that are unobservable to a researcher. A case in point with regard to the exporter productivity premium is management quality. Variables that measure management quality are often missing in data sets used to empirically investigate international firm activities. 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). In this case, 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 Ordinary least squares (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. 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. In other words, one can 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. A case in point is the paper by ISGEP – International Study Group on Exports and Productivity (2008), were in table 4, exporter productivity premia are reported based on empirical models with and without fixed effects. If fixed firm effects are added to control for time invariant unobserved heterogeneity, the point estimates of the exporter productivity premium are much smaller compared to the results based on pooled data only.

An empirical estimation of the exporter productivity premium, therefore, should control for both types of firm heterogeneity and the potentially important problems caused by (1) observed heterogeneity in firm characteristics that might lead to outliers that have a large impact on the estimated coefficients (sign, size and statistical significance) and (2) unobserved heterogeneity that might lead to biased estimates of coefficients (due to correlation between observed and unobserved firm characteristics). Recent econometric studies that use firm-level longitudinal data from German manufacturing and services industries by Verardi and Wagner (2011, 2012) and Vogel and Wagner (2011) do so for the first time. They apply a new highly robust estimator for fixed effects models (discussed below) and find that the exporter productivity premium that is reported in studies that use standard econometric methods (OLS without and with fixed firm effects) vanishes when outliers are dealt with explicitly.

This paper makes three contributions to the literature. First, it uses identically specified empirical models to investigate in a comparable way the role of outliers in

estimates of the exporter productivity premium based on data for an unbalanced panel of enterprises from manufacturing industries in France, Germany and the United Kingdom for the years 2003 to 2008. Second, it documents that the striking finding for Germany of no exporter productivity premium is also found for France and the United Kingdom in models that control for outliers and for unobserved heterogeneity by including fixed firm effects. This replication exercise is performed because we subscribe to the credo of Hamermesh (2000, p. 376) 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". Third, it puts the new empirical results into perspective against the background of the findings from the broad literature on the stylized fact of a positive exporter productivity premium.

The rest of the paper is organized as follows. Section 2 reports estimates for the exporter productivity premium in France, Germany and the UK using simple OLS, a highly robust estimation method that takes care of outliers, a standard fixed-effects estimator to take care of unobserved heterogeneity and the new highly robust fixed-effects estimator. Section 3 discusses the results of this exercise and puts them into perspective.

2. The role of outliers and unobserved heterogeneity for the estimate of the exporter productivity premium

In the empirical investigation of the exporter productivity premium – the percentage difference in productivity between exporting and non-exporting enterprises of the same size and from the same industry – we use an unbalanced panel data for manufacturing

enterprises from France, West Germany[1] and the United Kingdom for the years 2003 to 2008. Data for Germany are taken from regular surveys performed by the Statistical Offices and described in detail in Malchin and Voshage (2009). Data for France are taken from the ORBIS data base provided by Bureau van Dijk (see www.bvdep.com), and data for the United Kingdom are from the FAME data base that is based on ORBIS.[2]

In a first step, the exporter productivity premium is estimated from a regression model in which log labour productivity is regressed on the current exporter status dummy and a set of control variables:

$$\text{Ln } LP_{it} = a + ß\ Export_{it} + c\ Control_{it} + e_{it} \qquad (1)$$

where i is the index of the firm; t is the index of the year; Ln LP is the log of labor productivity (computed as total sales per employee); Export is a dummy variable indicating whether or not an enterprise is an exporter; Control is a vector of control variables including the number of employees (also included in squares) to control for firm size plus 2-digit industry dummy variables and year dummy variables; and e is an error term. The exporter premium, computed from the estimated coefficient ß as 100(exp(ß)-1), shows the average percentage difference in labor productivity between exporters and non-exporters, controlling for the characteristics included in the vector

[1] The West German economy and the economy of the (former communist) East Germany differ considerably especially with regard to exporting and productivity even many years after the unification of both parts of Germany back in 1990 (see Wagner (2008a) for an in-depth discussion). Therefore, and due to the small number of exporting enterprises in East Germany we look at enterprises from West Germany only in this study.

[2] Because the German data cover only enterprises with a minimum of 20 employees, firms with less than 20 employees were dropped from the data sets for France and the United Kingdom. Details regarding the data for France and the United Kingdom (Germany) are available from the first (second) author on request.

control.[3] Results from the empirical model with pooled data estimated by OLS that are reported in panel 1 of Table 1 show a large and statistically highly significant exporter productivity premium that amounts to 31 percent in France, 62 percent in West Germany and 10 percent in the United Kingdom.

[Table 1 near here]

In the second step the empirical model specified in (1) is estimated using a highly robust method that takes care of extreme observations, or outliers. 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

[3] Note that the regression equation specified in (1) is not meant to be an empirical model to explain labor productivity at the plant level; the data set at hand here is not rich enough for such an exercise. Equation (1) is just a vehicle to test for, and estimate the size of, exporter premia controlling for industry affiliation. Furthermore, note that productivity differences at the firm level are notoriously difficult to explain empirically. "At the micro level, productivity remains very much a measure of our ignorance." (Bartelsman and Doms 2000, p. 586)

from the true regression line. Their presence significantly affects the OLS estimation of both the intercept and the slope."

Using this terminology one can state that the often used median regression estimator (also known as the Least Absolute Deviation estimator, or the quantile regression estimator at the median) 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 (1964) 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.

Full robustness 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[4] of 50 % compared to zero percent for OLS). A discussion of the details of this estimator is beyond the scope of this paper (see Verardi and Croux (2009)). Results for this MM-estimator[5] applied for model (1) using the pooled data are reported in panel 2 of Table 1. While the order of magnitude of the estimated exporter productivity premium is the same for OLS and MM-regression in the UK, the premium estimate from the MM-regression is much smaller compared to the OLS estimate in both France and Germany. This illustrates that outliers can indeed have a high influence on the

[4] 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.

[5] Computations were done using the ado-files provided by Verardi and Croux (2009) with the efficiency parameter set at 0.7 as suggested there based on a simulation study; details are available on request.

estimated premium.[6] Therefore, a highly robust estimator should be used routinely as a robustness check. Note that the estimated exporter productivity premium is highly statistically significant and large from an economic point of view according to the results from the MM-regression in all three countries.

To control for unobserved firm heterogeneity due to time-invariant firm characteristics which might be correlated with the variables included in the empirical model and which might lead to a biased estimate of the exporter premium, (1) is augmented by adding fixed enterprise effects in a third step.[7] As reported in panel 3 of Table 1 this changes the results considerably. While the estimated productivity premium is still statistically significant, compared to the results from OLS estimates reported in panel 1 the point estimate declines dramatically to 2 percent in France, 8 percent in West Germany and 4 percent in the UK.[8]

The robust MM-regression takes care of outliers but ignores the problems related to unobserved firm heterogeneity, while the fixed-effects estimator controls for unobserved time-invariant firm characteristics but does not take care of outliers. To deal with both problems simultaneously, an appropriate highly robust estimator for panel data with fixed effects has been proposed recently by Bramati and Croux (2007) that

[6] The share of outliers in all observations identified in the MM-regression is 4.96 percent in France, 5.03 percent in West Germany, and 5.12 percent in the UK. These outliers tend to be concentrated at the lower and the upper end of the productivity distribution, but are found all over the firm size distribution and the distribution of the export/sales ratio, and are not concentrated in some industries. Detailed tables are available on request.

[7] Note that the fixed-effects models do not include the industry dummy variables because there are (nearly) no industry switchers in the samples.

[8] This result – a considerably lower estimated exporter premium in empirical models including fixed effects – is standard in micro-econometric studies of firm performance and international activities; see ISGEP - International Study Group on Exports and Productivity (2008) for evidence from several countries.

has been used by Verardi and Wagner (2011, 2012) and Vogel and Wagner (2011) to estimate the exporter productivity premium.[9] A discussion of the details of this estimator is beyond the scope of this paper (see Verardi and Wagner (2012), section 4). It suffices to say that the estimator proceeds in four steps. In a first step all variables are centered by removing the median (and not, as usual when applying a non-robust version of a fixed-effects estimator, the mean that is highly sensitive against outliers). In a second step, an S-estimator is applied which is known to be particularly robust against outliers of the centered dependent variable on the centered explanatory variables (discussed in detail in Verardi and McCathie (2012)). Having obtained the residuals and the estimated measure of dispersion from the second step, the third step identifies outliers by flagging observations with robust standardized residuals (i.e. residuals obtained by the S-estimator divided by the estimated measure of dispersion) that are larger than 2.[10] The fourth and final step is then to drop all outliers and to apply a standard fixed-effects estimator to the clean sample.

If the empirical model with fixed firm effects is estimated with the robust method that controls for outliers, a completely different picture emerges that is reported in panel 4 of Table 1. After dropping the observations identified to be outliers, the estimated exporter productivity premium is no longer statistically significant at the usual error level of five percent in all three countries and the point estimates drop to almost zero.[11] This

[9] All computations were done with Stata 12.1. Stata code for the robust fixed effects estimator is available from http://repec.wirtschaft.uni-giessen.de/~repec/RePEc/jns/Datenarchiv/v231y2011i4/-y231y2011i4p546_557/

[10] Obviously, this cut-off value is in a sense arbitrary. Note that if a higher cut-off value would be chosen, efficiency increases but resistance with respect to outliers is reduced. If we set it to a lower value robustness increases but efficiency decreases.

[11] The share of observations identified as outliers is 15 percent in Germany and some 53 percent in France and the UK. Outliers are neither concentrated among exporters or non-exporters, nor at the tails

is the same pattern of results that has been reported with German firm level data from manufacturing and services industries before by Verardi and Wagner (2011, 2012) and Vogel and Wagner (2011).

3. Discussion

The results reported in this paper can be summarized as follows.

(1) Using pooled data and OLS we find a large and statistically highly significant exporter productivity premium that amounts to 31 percent in France, 62 percent in West Germany and 10 percent in the United Kingdom.

(2) While the order of magnitude of the estimated exporter productivity premium is the same for OLS and the highly robust MM-regression that controls for outliers in the UK, the premium estimate from the MM-regression is much smaller compared to the OLS estimate (but still statically highly significant and large from an economic point of view) in both France and Germany. This illustrates that outliers can indeed have a high influence on the estimated premium.

(3) Including fixed firm effects in the empirical model to control for unobserved firm heterogeneity (but ignoring the potentially important role of outliers) changes the results considerably. While the estimated productivity premium is still statistically significant compared to the results from OLS estimates the point estimate declines dramatically to 2 percent in France, 8 percent in West Germany and 4 percent in the UK. The estimated premia are statistically highly significant and they can be considered as relevant from an economic point of view, at least for Germany and the UK.

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of the distributions of productivity, firm size or the export / sales ratio, nor in some of the manufacturing industries. There is no such thing as a typical outlier. Details are available on request.

(4) If the empirical model with fixed firm effects is estimated with the robust method that controls for outliers, the estimated exporter productivity premium is no longer statistically significant at the usual error level of five percent in all three countries and the point estimates drop to almost zero. This is the same pattern of results that has been reported with German firm level data from manufacturing and services industries before.

In our view, these findings suggest the following recommendations for empirical investigations of the exporter productivity premium.

First, given that the presence of outliers can be expected to be the rule in data sets for heterogeneous firms and that outliers might have a large influence on the estimated regression coefficients, a highly robust estimator should be used routinely in a robustness check of results computed by estimators with a low breakdown point (like OLS).

Second, unobserved firm heterogeneity does matter, and adding fixed firm effects to the empirical model changes the order of magnitude of the estimated exporter productivity premium. However, before ignoring the estimates based on pooled data without fixed effects one should remember that by construction the estimated coefficients of the exporter status variable from the empirical models with fixed firm effects are identified only by observations that change their exporter status (at least once) during the period under investigation. However, this exporter status of a firm tends to be highly persistent over adjacent years, which can be shown by our sample of firms. If we compare the exporter status of a firm in two adjacent years (t and t+1) in France we find a switch from no exports in year t to exports in year t+1 in 5.42 percent of all observations and a switch from exports in year t to no exports in year t+1in 5.45

percent of all observations. In the United Kingdom the respective figures are 2.47 percent and 2.21 percent, and in West Germany 2.32 percent and 1.60 percent.

Furthermore, we know that firms that enter or exit the export market are different from firms that persistently stay in or out of it. Using a panel of German manufacturing establishments Wagner (2008b) finds that firms that stop exporting in year t were in t-1 less productive than firms that continue to export in t, and that firms that start to export in year t are less productive than firms that export both in year t-1 and in year t. Furthermore, there is evidence from studies using data for a large number of countries that more productive firms self-select into exports, and that export starters were more productive that firms that continue to serve the home only in years before starting to export (see the surveys by Wagner (2007, 2012)). This means that the coefficient of the exporter status variable that gives us the estimate for the exporter productivity premium is in a sense estimated for quite different samples when models with and without firm fixed effects are used. Our second recommendation, therefore, is not to emphasize results from models with fixed effects too much.

This recommendation seems to be even more appropriate when it comes to the results from the robust version of the fixed effects estimator. Use of this estimator to estimate the exporter productivity premium leads to results that seem weird given all the empirical evidence for a positive exporter productivity premium from numerous studies using various descriptive and econometric approaches and data for firms from all over the world.[12] Controlling for outliers and unobserved heterogeneity via fixed firm effects simultaneously seems to remain a problem in search of a convincing solution.

[12] Furthermore, the share of observations classified as outliers by this estimator is more than weird for France and the United Kingdom. This, however, might be caused by problems with the quality of the firm data for these countries; see Gal et al. (2013), p. 13.

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Table 1: Estimated exporter productivity premium in enterprises from manufacturing industries in France, West Germany and the United Kingdom, 2003 - 2008

Estimation method		France	West Germany	United Kingdom
Pooled OLS	Premium (%)	31.34	62.59	10.04
	Prob-value	0.000	0.000	0.000
	Number of firms	20,653	41,461	8,422
	Number of observations	74,593	191,863	39,493
Robust MM-regression	Premium (%)	18.75	36.89	9.72
	Prob-value	0.000	0.000	0.000
	Number of firms	20,653	41,461	8,422
	Number of observations	74,593	191,863	39,493
Fixed effects (standard)	Premium(%)	2.16	8.36	3.77
	Prob-value	0.000	0.000	0.010
	Number of firms	16,743	36,835	7,785
	Number of observations	70,683	187,237	38,756
Fixed effects (robust)	Premium(%)	0.23	-0.26	0.76
	Prob-value	0.287	0.170	0.083
	Number of firms	10,066	35,570	4,940
	Number of observations	30,914	158,092	17,372

Note: The exporter productivity premium is based on the estimated coefficient ß of a dummy variable that takes on the value of one if an enterprise in an exporter in the respective year (and zero else) by calculating (exp(ß) – 1) * 100. It shows the average percentage difference in labor productivity (measured as total sales per employee) between an exporting and a non-exporting enterprise. The prob-value is based on estimated standard errors adjusted for clusters at the enterprise level. All empirical models include the number of employees (also included in squares) and year dummy variables; the models estimated by OLS by MM-regression with pooled data also includes two-digit industry dummy variables.

Table 2: Share of outliers in all observations in the deciles of the productivity distribution in manufacturing enterprises in France, West Germany and the United Kingdom, 2003 – 2008
Results for robust MM-regression for pooled data

	France		West Germany		United Kingdom	
Decile	Exporters	Non-Exporters	Exporters	Non-exporters	Exporters	Non-exporters
1	8.71	29.57	10.20	37.34	10.85	17.17
2	0.67	7.67	0.30	3.26	0.19	0.55
3	0.23	1.85	0.18	0.20	0.16	0.14
4	0.19	0.27	0.41	0.20	0.09	0.27
5	0.13	0.18	0.71	0.25	0.28	0.27
6	0.23	0.23	1.00	0.46	0.09	0.41
7	0.63	0.77	1.60	0.88	0.62	0.14
8	0.86	1.40	1.92	1.48	0.56	1.23
9	2.61	3.25	3.31	2.41	2.11	3.00
10	25.95	26.65	22.61	21.89	34.26	36.83
Average	4.02	7.18	4.22	6.84	4.92	6.00

Note: Productivity is total sales / employees, measured as a percentage of the average value of the 4-digit level industry in the year of observation. The entries in the table are the percentage shares of observations classified as outliers (see text for details) among exporters or non- exporters in the deciles of the productivity distribution of exporters or non-exporters, respectively.

Table 3: Share of outliers in all observations in the deciles of the firm size distribution in manufacturing enterprises in France, West Germany and the United Kingdom, 2003 – 2008
Results for robust MM-regression for pooled data

	France		West Germany		United Kingdom	
Decile	Exporters	Non-Exporters	Exporters	Non-exporters	Exporters	Non-exporters
1	4.32	7.76	5.58	11.25	8.90	8.18
2	4.19	6.20	3.91	5.88	7.90	11.14
3	3.87	6.33	3.51	4.54	5.65	7.83
4	4.52	6.10	3.72	4.85	4.14	4.81
5	5.04	6.59	4.07	5.05	3.03	3.90
6	3.65	7.44	3.82	5.21	3.58	2.19
7	3.15	5.64	3.72	6.14	3.32	2.46
8	3.85	6.06	3.91	6.30	3.67	2.16
9	4.21	7.81	3.89	7.68	2.80	6.48
10	3.41	11.43	6.11	11.36	5.98	10.79
Average	4.02	7.18	4.22	6.84	4.92	6.00

Note: Firm size is measured by the number of employees. The entries in the table are the percentage shares of observations classified as outliers (see text for details) among exporters or non-exporters in the deciles of the firm size distribution of exporters or non-exporters, respectively.

Table 4: Share of outliers in all observations in the deciles of the export / sales distribution in manufacturing enterprises in France, West Germany and the United Kingdom, 2003 – 2008
Results for robust MM-regression for pooled data

Decile	France	West Germany	United Kingdom
1	3.61	4.26	4.14
2	3.31	3.97	5.41
3	3.50	3.77	5.08
4	3.00	3.71	3.44
5	3.04	3.98	4.09
6	3.04	3.83	2.35
7	3.31	3.72	2.87
8	3.86	4.54	4.09
9	5.25	4.19	4.05
10	7.93	6.26	5.79
Average	4.02	4.22	4.92

Note: The entries in the table are the percentage shares of observations classified as outliers (see text for details) among exporters in the deciles of the distribution of the share of exports in total sales.

Table 5: Share of outliers in all observations from 2-digit manufacturing industries in France, West Germany and the United Kingdom, 2003 – 2008
Results for robust MM-regression for pooled data

	France		West Germany		United Kingdom	
Industry	Exporters	Non-exporters	Exporters	Non-exporters	Exporters	Non-exporters
15	8.07	14.14	18.56	8.63	8.62	9.68
16	46.15	100.0	21.43	0.00	33.33	50.00
17	7.10	8.67	3.70	14.68	1.10	12.07
18	16.03	51.63	11.84	46.44	12.11	4.69
19	4.06	4.30	11.90	##.##	1.22	0.00
20	1.17	1.64	2.79	3.53	1.46	0.32
21	1.93	2.86	2.28	7.87	2.44	1.33
22	1.90	1.48	3.36	6.80	4.75	1.81
23	9.47	16.92	22.82	34.38	20.49	47.83
24	6.05	8.87	5.95	13.60	6.42	15.66
25	2.01	3.82	1.86	8.51	2.09	3.90
26	3.26	10.83	3.32	8.19	2.80	4.15
27	12.20	9.69	9.38	11.84	14.18	14.44
28	1.89	2.06	2.34	3.75	3.38	2.34
29	2.48	3.76	2.29	4.52	3.40	6.44
30	8.77	10.34	4.29	##.##	4.42	5.56
31	2.99	2.70	3.15	5.88	4.60	9.21
32	4.08	10.73	5.26	8.62	8.92	12.87
33	1.96	1.73	2.19	2.09	2.09	0.85
34	3.24	13.63	6.34	11.31	3.57	7.08
35	5.26	7.06	6.28	12.23	3.14	0.00
36	1.72	3.81	2.83	4.47	4.90	5.25
Average	4.01	7.18	4.22	6.84	4.92	6.00

Note: For a definition of the industries see Appendix. The entries in the table are the percentage shares of observations classified as outliers (see text for details) among exporters and non-exporters in an industry. ##.## indicates that one of the two entries is confidential according to the rules used by the Statistical Office, and the other value entry has to be eliminated to preserve this confidentiality.

Table 6: Share of outliers in all observations in the deciles of the productivity distribution in manufacturing enterprises in France, West Germany and the United Kingdom, 2003 – 2008
Results for robust FE-regression

	France		West Germany		United Kingdom	
Decile	Exporters	Non-Exporters	Exporters	Non-exporters	Exporters	Non-exporters
1	55.82	47.15	29.22	32.73	60.07	59.53
2	50.89	39.54	16.62	17.11	53.91	51.11
3	51.91	33.45	15.57	13.99	53.48	47.15
4	53.24	35.10	15.61	11.73	52.77	50.07
5	53.76	38.08	15.43	11.68	54.04	44.01
6	56.14	40.71	15.93	12.23	58.36	49.79
7	58.78	42.13	15.85	13.12	57.02	50.56
8	59.85	46.12	15.18	13.71	54.54	54.18
9	61.16	49.68	15.07	17.79	53.45	50.14
10	63.92	56.15	12.87	23.59	52.96	45.96
Average	56.55	42.81	15.04	16.77	55.06	50.25

Note: Productivity is total sales / employees, measured as a percentage of the average value of the 4-digit level industry in the year of observation. The entries in the table are the percentage shares of observations classified as outliers (see text for details) among exporters or non- exporters in the deciles of the productivity distribution of exporters or non-exporters, respectively.

Table 7: Share of outliers in all observations in the deciles of the firm size distribution in manufacturing enterprises in France, West Germany and the United Kingdom, 2003 – 2008
Results for robust FE-regression

	France		West Germany		United Kingdom	
Decile	Exporters	Non-Exporters	Exporters	Non-exporters	Exporters	Non-exporters
1	24.51	22.97	18.90	29.22	24.67	23.35
2	22.31	18.49	16.21	16.62	26.57	23.16
3	26.20	21.17	15.92	15.57	24.08	19.54
4	33.81	23.20	15.73	15.61	25.97	20.47
5	44.66	26.43	15.43	15.43	38.50	30.11
6	68.41	32.73	14.87	15.93	60.80	49.65
7	80.33	42.64	13.82	15.85	76.54	69.41
8	87.97	68.92	13.06	15.18	86.81	83.40
9	88.89	83.00	13.18	15.07	92.80	89.08
10	91.05	91.18	13.18	12.87	94.89	95.13
Average	56.55	42.81	15.04	16.77	55.06	50.25

Note: Firm size is measured by the number of employees. The entries in the table are the percentage shares of observations classified as outliers (see text for details) among exporters or non-exporters in the deciles of the firm size distribution of exporters or non-exporters, respectively.

Table 8: Share of outliers in all observations in the deciles of the export / sales distribution in manufacturing enterprises in France, West Germany and the United Kingdom, 2003 – 2008
Results for robust FE-regression

Decile	France	West Germany	United Kingdom
1	46.17	14.31	52.43
2	46.49	14.47	54.70
3	47.90	14.21	52.86
4	51.82	14.33	53.79
5	55.50	14.13	55.20
6	57.95	13.92	53.84
7	59.98	14.82	56.54
8	63.08	14.32	59.11
9	65.60	15.93	59.92
10	70.06	20.00	58.52
Average	56.55	15.04	55.06

Note: The entries in the table are the percentage shares of observations classified as outliers (see text for details) among exporters in the deciles of the distribution of the share of exports in total sales.

Table 9: Share of outliers in all observations from 2-digit manufacturing industries in France, West Germany and the United Kingdom, 2003 – 2008
Results for robust FE-regression

	France		West Germany		United Kingdom	
Industry	Exporters	Non-exporters	Exporters	Non-exporters	Exporters	Non-exporters
15	52.72	38.55	12.81	16.79	64.02	65.17
16	61.54	37.50	##.##	##.##	83.33	100.0
17	52.89	44.12	12.72	20.41	58.71	50.88
18	58.47	46.72	17.42	23.79	48.51	50.00
19	60.18	63.88	##.##	##.##	46.30	100.0
20	44.10	33.49	15.03	15.92	59.15	40.98
21	55.69	41.47	7.90	6.63	54.86	40.00
22	44.85	34.43	11.50	12.77	45.84	43.04
23	55.43	65.00	23.50	15.87	48.33	78.26
24	65.51	58.94	12.03	18.50	57.56	45.29
25	59.45	48.46	10.82	15.31	55.75	42.95
26	57.30	43.82	12.79	18.45	54.99	48.23
27	69.09	65.41	21.17	20.37	61.79	47.13
28	49.89	38.64	13.97	18.00	51.97	41.93
29	58.44	50.51	19.18	18.48	53.90	42.88
30	42.99	65.22	22.76	28.28	54.33	59.26
31	63.50	53.86	16.09	15.88	55.07	43.89
32	68.16	54.72	19.83	22.14	60.03	38.38
33	57.35	41.19	13.81	13.72	49.04	51.72
34	65.24	64.72	18.21	24.57	70.27	77.62
35	71.75	69.53	25.21	30.27	62.52	47.86
36	53.04	36.38	14.29	16.77	48.01	48.29
Average	56.55	42.81	15.04	16.77	55.06	50.25

Note: For a definition of the industries see Appendix. The entries in the table are the percentage shares of observations classified as outliers (see text for details) among exporters and non-exporters in an industry. ##.## indicates that one of the two entries is confidential according to the rules used by the Statistical Office, and the other value entry has to be eliminated to preserve this confidentiality.

Appendix

List of manufacturing industries

15	Manufacture of food products and beverages
16	Manufacture of tobacco products
17	Manufacture of textiles
18	Manufacture of wearing apparel; dressing and dyeing of fur
19	Tanning and dressing of leather; manufacture of leather goods
20	Manufacture of wood and products of wood except furniture
21	Manufacture of pulp, paper and paper products
22	Publishing, printing and reproduction of recorded media
23	Manufacture of coke, refined petroleum products and nuclear fuel
24	Manufacture of chemicals and chemical products
25	Manufacture of rubber and plastic products
26	Manufacture of other non-metallic mineral products
27	Manufacture of basic metals
28	Manufacture of fabricated metal products, except machinery and equipment
29	Manufacture of machinery and equipment n. e. c.
30	Manufacture of office machinery and computers
31	Manufacture of electrical machinery and apparatus n. e. c.
32	Manufacture of radio, television and communication equipm. and apparatus
33	Manufacture of medical, precision and optical instruments, watches, clocks
34	Manufacture of motor vehicles, trailers and semi-trailers
35	Manufacture of other transport equipment
36	Manufacture of furniture, manufacturing n. e. c.

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