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First evidence for manufacturing enterprises

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Exports, imports and profitability:

First evidence for manufacturing enterprises*

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Abstract:

This paper documents for the first time the relationship between profitability and three types of international trade activities – exports, imports and two-way trade. It uses unique new representative data for manufacturing enterprises from Germany, one of the leading actors on the world market for goods, that merge information from surveys performed by the Statistical Offices and administrative data collected by the Tax Authorities. Descriptive statistics and regression analysis (with and without controlling for unobserved firm heterogeneity and the role of outliers) point to the absence of any statistically significant and economically large effects of trade activities on profits. This demonstrates that any productivity advantages of trading firms are eaten up by extra costs related to selling and buying on foreign markets.

JEL classification: F14

Keywords: Exports, imports, profitability

*All computations for this study were done inside the research data center of the Statistical Office of Berlin-Brandenburg. Many thanks to Julia Höninger for her help with the data, for running my Stata do-files and for checking the output for violation of privacy. The firm level data used are confidential but not exclusive; see Zühlke et al. (2004) for a description of how to access the data. To facilitate replication the Stata do-files are available from the author on request.

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1. Motivation

A huge literature demonstrates that firms engaged in international trade as exporters or importers are more productive than otherwise identical firms that sell or buy on the national market only. For exporting firms this stylized fact has been found in a large number of empirical studies based on establishment or enterprise level data from countries all over the world that were published since the pioneering paper by Bernard and Jensen (1995).[1] While the positive correlation of engagement in exports and productivity is uncontroversial, the direction of causality is not. In a nutshell the results from empirical investigations can be sketched as follows. Many studies report evidence in favour of the so-called self-selection hypothesis. Future export starters tend to be more productive than future non-exporters years before they enter the export market, and often have higher ex-ante growth rates of productivity. The good firms go abroad. Evidence regarding the so-called learning-by-exporting hypothesis is somewhat more mixed. Results for post-entry differences in performance between export starters and non-exporters point to faster productivity growth for the former group in some studies only. Exporting does not necessarily improve firms.

While the causes and consequences of export and its mutual relationships with productivity are prominent topics in the recent literature on internationally active firms, imports are seldom dealt with. With new datasets that include information on imports at the firm level becoming available for more and more countries a new literature is emerging that has a focus on the links between productivity and imports. A number of recently published empirical studies (surveyed in Wagner (2011)) based on data from a wide range of countries document the shares of firms that are

[1] See Greenaway and Kneller (2007) and Wagner (2007, 2011) for surveys.

exporters, importers, and two-way traders (that both export and import), or that sell or buy on the national market only, and they look at differences between these four types of firms. Differences in productivity and their relationship with different degrees of involvement in international trade are at the centre of these studies. Details aside, the big picture that emerges from this literature can be sketched as follows. There is a positive link between importing and productivity at the firm level, documented by a significant productivity differential between firms that import and firms that do not trade internationally; the same holds for exporting. Two-way traders are more productive than firms that either only import, or only export, or do not trade at all. Often, two-way traders are the most productive group of firms, followed by importers and then exporters, while firms selling or buying on the national market come last. We have evidence for self-selection of more productive firms into exporting from most of the studies that look at this issue; the evidence on learning-by-importing, however, is still rare and inconclusive.

That said, from the micro-econometric literature on trade and productivity two conclusions emerge than can be regarded as uncontroversial:

- Exporters and importers are more productive than firms that do not trade internationally.

- Firms engaged in international trade have to bear extra costs. Exporting firms have to pay for, among others, market research in foreign countries, adaptation of products to local regulations there, or transport costs. Furthermore, exporting firms tend to pay higher wages than non-exporting firms (see Schank, Schnabel and Wagner (2007, 2010)). Importing is associated with fixed costs that are sunk costs, because the import agreement is preceded by a search process for potential foreign suppliers, inspection of goods, negotiation, contract formulation etc. Furthermore,

there are sunk costs of importing due to the learning and acquisition of customs procedures. These extra costs are the reason for self-selection of more productive firms on international markets – only firms with a productivity that is high enough can be profitable when extra costs have to be covered.

A question that has been investigated in the literature on the micro-econometrics of international trade only recently is whether the productivity advantage of exporting and importing firms does lead to a profitability advantage of firms that engage in international trade compared to otherwise identical non-trading firms even when exporters and importers are facing extra costs. This apparent gap in the literature on the micro-econometrics of international trade comes as a surprise because maximization of profits (and not of productivity) is usually considered as a central goal for firms. Furthermore, looking at profitability instead of productivity is more appropriate from a theoretical point of view, too. Even if productivity and profitability are positively correlated (which tends to be the case) productivity is, as was recently pointed out by Foster, Haltiwanger and Syverson (2008, p. 395), only one of several possible idiosyncratic factors that determine profits. Success of firms in general, and especially survival, depends on profitability. Often profitability is viewed both in theoretical models of market selection and in empirical studies on firm entry and exit as a positive monotonic function of productivity, and selection on profits then is equivalent to selection on productivity. In empirical studies the use of productivity instead of profitability is usually due to the fact that productivity is easily observed in the data sets at hand while profitability is not. Fortunately, there are data sets that are rich enough to allow to measure profitability. Table 1 summarizes the findings from recent studies on trade and profits.

[Table 1 near here]

The number of studies on trade and profits is still small and the number of countries covered (all of which are member states of the EU) is even smaller. Results differ widely across the studies – from positive to no to negative profitability differences between exporters and non-exporters; from evidence for self-selection of more or less profitable firms into exporting to no evidence for self-selection at all; from no positive effects of exports on profits to positive effects. Remarkably, none of the studies listed in table 1 looks at imports and profitability.

This paper contributes to the literature by documenting for the first time the relationship between profitability and three types of international trade activities – exports, imports and two-way trade – for manufacturing enterprises. It uses a unique new representative data set from Germany, one of the leading actors on the world market for goods. The data were constructed by merging information from surveys performed by the Statistical Offices and administrative data collected by the Tax Authorities. To anticipate the most important results descriptive statistics and regression analysis (with and without controlling for unobserved firm heterogeneity and the role of outliers) point to the absence of any statistically significant and economically large effects of trade activities on profits. This demonstrates that the productivity advantages of trading firms are eaten up by extra costs related to selling and buying on foreign markets.

The rest of the paper is organized as follows. Section 2 describes the new data set. Section 3 presents descriptive results. Section 4 reports OLS estimates for trader productivity premia based on pooled data and models with and without fixed

enterprise effects. Section 5 controls for outliers in robust estimations with and without fixed effects. Section 6 concludes.

2. Data

The scarcity of comprehensive micro-econometric studies on the links between profitability and trade activities is due to the fact that information on profits, exports and imports (plus other firm characteristics that are needed as control variables like firm size and industry) are only rarely found in a single data set. Germany is a case in point. While readily available enterprise level data allow empirical investigations of the relation between exports and profitability (see Fryges and Wagner (2010), Vogel and Wagner (2010b)) and of the links between exports, imports and productivity (see Vogel and Wagner (2010a)) none of these data sets contains information on both types of trade (exports and imports) and on profitability.

For this study a tailor-made enterprise level data set was built that uses information from surveys performed by the Statistical Offices and from data collected by the Tax Authorities. The first source of data is the monthly report for establishments in manufacturing industries described in Konold (2007). This survey covers all establishments from manufacturing industries that employ at least twenty persons in the local production unit or in the company that owns the unit. Participation of firms in the survey is mandated in official statistics law. This survey is the source for information on the location of the firm in West Germany or East Germany, the industry affiliation, the export activity and the number of employees (used to measure firm size). In this data set, export refers to the amount of sales to a customer in a foreign country plus sales to a German export trading company; indirect exports (for example, tires produced in a plant in Germany that are delivered

to a German manufacturer of cars who exports some of his products) are not covered by this definition. For this project the information collected at the establishment level has been aggregated at the enterprise level to match the unit of observation from the second and third source of data used here.

The second source of data is the cost structure survey for enterprises in the manufacturing sector. This survey is carried out annually as a representative random sample survey stratified according to the number of employees and the industries (see Fritsch et al. 2004). This survey is the source for information on profitability. While firms with 500 and more employees are covered by the cost structure survey in each year, the sample of smaller firms is part of the survey for four years in a row only.

The third source of data is the German Turnover Tax Statistics Panel (described in detail in Vogel and Dittrich 2008). This data set is based on the yearly turnover tax; all enterprises with a turnover that exceeds a rather low threshold (17,500€ since 2003) are covered in the data. This data set is the source of information about import activities of firms. Note, however, that imports are not directly recorded therein completely. Imports from EU member states are reported under the item of ‘intra-Community acquisitions’. The amount of imports from states beyond the EU is not included in the turnover tax statistics. In this case an import turnover tax is charged by the customs authorities. Nonetheless, this import turnover tax is deductible as input tax and therefore reported in the dataset. With this information a dummy variable which shows whether the enterprise imports from non-EU states or not can be generated (taking the value 1 if the import turnover tax is greater than zero, and 0 if no import turnover tax is deducted as input tax).

The data from the three sources were linked by using the enterprise register system (*Unternehmensregistersystem*) that includes, among others, information on the unique enterprise identifier used in surveys conducted by the Statistical Offices and the unique turnover tax identifier used by the Tax Authorities. Data from the turnover tax statistics that are used to identify enterprises with imports are available for the years 2001 to 2007 (as of June 2011). Data from the cost structure survey that are used to compute turnover profitability are available for one sample of enterprises from 1999 to 2002 and for a different sample for 2003 to 2006. Data based on the monthly report of manufacturing establishments that are used to identify enterprises with exports (and for information on firm size and industry affiliation) are available for 1995 to 2008 (as of June 2011). The sample of enterprises used in the empirical investigation performed here consists of all enterprises for which information from all three surveys for the years 2003 to 2006 could be linked via the enterprise register system. Enterprises that do not have complete information for each year were dropped from the computations.[2]

3. Descriptive results

Based on the combined data from the three sources described in section 2 it is possible to distinguish between four types of enterprises, namely enterprises without

[2] The merging of the data sets was done inside the research data center of the Statistical Office in Berlin-Brandenburg by Julia Höninger. Firms with incomplete information for any variable in at least one year were dropped from all computations because there are, on the one hand, by construction no entries due to the fact that the firms taking part in the cost structure survey were sampled before the start of the survey in 2003. On the other hand, exits cannot be identified because firms with information in, say, 2003 but not in 2004 might have closed down – they might have, however, relocated out of manufacturing (or out of Germany) or they might have shrunk below the cut-off point relevant for the monthly report or the cost-structure survey.

trade, enterprises that only export, enterprises that only import and enterprises that both export and import. Table 2 reports the shares of these four types of enterprises in the samples for each year between 2003 and 2006 for West Germany and East Germany.[3] In West Germany more than three in four enterprises are two-way traders while the share of firms not engaged in trade at all is small and declines from 8.6 percent in 2003 to 7.2 percent in 2006. The share of firms that only export is about 4 percent and the share of firms that only import is about 12 percent. In East Germany the share of two-way traders is smaller than in West Germany (around 60 percent). The share of firms that only import is about twice as high in East Germany as in West Germany while the share of firms that only export is about the same. Note that the share of firms without any trade is much larger in East compared to West Germany.

The high share of internationally active firms in both parts of Germany may come as a surprise. Note, however, that the average number of employees in a firm tends to increases from no traders to only exporters to only importers to two-way traders (which is, however, not the case in East Germany when non-trading firms are compared to firms that only export) and that by construction the largest firms are oversampled in the data set used here because the cost structure survey includes all enterprises with at least 500 employees but only a stratified random sample of smaller firms.[4]

[Table 2 near here]

[3] The West German and the East German economy still differ largely even many years after the unification in 1990, and this is especially true for international trade (see Wagner (2008a) for an analysis). Therefore, all empirical investigations are carried out separately for both parts of Germany here.

[4] For a comprehensive documentation of participation in trade in manufacturing firms from West and East Germany between 2001 and 2006 by size class see Vogel et al. (2009).

The rate of profit of a firm is computed as a rate of return, defined as gross firm surplus (computed in line with the definition of the European Commission (1998) as gross value added at factor costs minus gross wages and salaries minus costs for social insurance paid by the firm) divided by total sales (net of VAT) minus net change of inventories:[5]

$$(1) \qquad rate\,of\,profit = \frac{gross\,value\,added - gross\,wages - costs\,for\,social\,insurance}{total\,sales - net\,change\,of\,inventories}$$

This profit measure is a measure for the price-cost margin which, under competitive conditions, should on average equal the required rental on assets employed per money unit of sales (see Schmalensee 1989, p. 960f.). Differences in profitability between firms, therefore, can follow from productivity differences, but also from different mark-ups of prices over costs and from differences in the capital intensity.[6] That said, a first look at the mean and the median values of the rate of profit for the different categories of firms in West Germany does not reveal a pattern that is consistent over the years. If anything, two-way traders tend to have the smallest values for the rate of profit. For East Germany, the pattern is even less obvious.

Results for a t-test for statistical significance of the difference in means between pairs of groups of firms are reported in table 3. At a usual error level of five

[5] Note that the data set does not have any information on the capital stock, or the sum of assets or equity, of the firm, so that it is not possible to construct profit indicators based thereon like return on assets or return on equity.

[6] Given that the data set does not have information on the capital stock employed by the firms in the econometric investigations in the following sections differences in the capital intensity are controlled for by including industry dummy variables or enterprise fixed effects.

percent the null-hypothesis of no difference cannot be rejected in all years for any pair of firms in West or East Germany; p-values of 0.050 or smaller are only found for four out of 24 tests in West Germany and for two out of 24 test in East Germany. This indicates that the average rate of profit tends to be rather similar between the four groups of firms with different forms of international activities.

[Table 3 near here]

A test for differences in the mean values, however, can only be a first step in a comparison of these groups of firms. As Moshe Buchinsky (1994, p. 453) put it: "'On the average' has never been a satisfactory statement with which to conclude a study on heterogeneous populations." An empirical study of heterogeneous firms should look at differences in the whole distribution of the variables under investigation between groups of firms, not only at differences at the mean. The hypothesis that the distribution of profits for one group of firms stochastically dominates the respective distribution of the comparison group can be tested by the Kolmogorov-Smirnov test. This non-parametric test for first order stochastic dominance of one distribution over another was introduced into the literature on the micro-econometrics of international firm activities by Delgado, Farinas and Ruano (2002). Let F and G denote the cumulative distribution functions of a variable for two groups of firms, firms that do not trade and firms that only export. First order stochastic dominance of F relative to G is given if $F(z) - G(z)$ is less or equal zero for all z with strict inequality for some z. Given two independent random samples of firms from each group, the hypothesis that F is to the right of G can be tested by the Kolmogorov-Smirnov test based on the

empirical distribution functions for F and G in the samples (for details, see Conover 1999, p. 456ff.).

The results for the Kolmogorov-Smirnov test are reported in table 3. Using an error level of five percent the test indicates that in East Germany the distributions of profit rates do not differ between the four types of firms with the exception of firms that only import compared to firms that export and import in one year, 2004 (where the results points to a difference in distributions that is in favour of the firms that only import). The big picture in West Germany is only slightly different. The Kolmogorov-Smirnov tests points to differences in the distributions of the profit rate at an error level of 5 percent or lower in 8 out of 24 cases. However, only when firms that do not trade at all are compared to two-way traders results are the same for all four years – and always in favour of the firms that do not trade at all. However, even if these differences are significant statistically they are rather small from an economic point of view (on average, the difference is less than one percentage point over the years).

The bottom line from the descriptive evidence presented in this section, then, is that the rate of profit does not vary systematically with the way a firm is engaged in international trade. This picture is very much different from the results reported by Vogel and Wagner (2010a) for a comparison of productivity (and not profitability) between groups of firms with different degrees of involvement in international trade. They find that compared to firms that do not trade at all two-way traders do have the highest productivity premium, followed by firms that only export, while firms that only import have the smallest premium. However, up to now only raw profitability differentials have been looked at without controlling for industry specific shocks or macroeconomic shocks that differ between years. Furthermore, neither effects due to

differences in firm size nor other influences that might be important for profitability besides international trade have been controlled for. This is done in the econometric analyses in the next two sections.

4. Trader profitability premia

After a first look at descriptive statistics and tests for the statistical significance of differences in the rate of profit and its distribution between firms with different forms of engagement in international trade the next step of the empirical investigation of the links between profitability and trade is the estimation of so-called trader profitability premia. These premia are the difference in profitability between firms that do not trade and firms from each of the three types of traders (only exporters, only importers and two-way traders) after controlling for other firm characteristics and factors that might influence profitability. While the data at hand are not rich enough to estimate an empirical model for profitability the approach used here follows the standard approach in the micro-econometrics of international firm activities (described in detail in Wagner (2007)) and estimates the premia with a regression that controls for firm size (measured by the number of employees and its squared value to take care of a nonlinear relation) and industry affiliation (to control for industry specific shocks on the demand or supply side and to proxy differences in the unobserved capital intensity between industries). The empirical model is estimated using pooled data for the years 2003 to 2006, and year dummy variables are included to control for macroeconomic shocks and business cycle conditions.

In a first step this model is estimated by OLS. Results are reported in column one and three of table 4 for West Germany and East Germany, respectively. For West Germany the point estimates of the trader profitability premia are tiny (below

one percentage point) and never statistically significant at a conventional error level of five percent. For East Germany only the estimated premium for the two-way traders is statistically significantly different from zero at an error level of five percent. This premium is negative, pointing to a profitability disadvantage of two-way traders compared to firms that do not trade, and having a value of -1.5 percentage points it is relevant from an economic point of view.[7]

[Table 4 near here]

These results for the trader premia computed by OLS, however, are only conditional on observed firm characteristics included in the empirical model. They cannot deal with the role of unobserved (and sometimes unobservable) characteristics – like a unique product, or superior quality of the management of a firm - that might be correlated with the observed characteristics. Here, one might expect that selling and buying on international markets is related to the quality of the products of a firm, the international orientation of the management and other firm specific characteristics that are not included in the empirical model. If this is the case, the estimated values for the trader premia are biased. The workhorse in empirical studies faced with this problem is an empirical model that includes fixed effects to control for time invariant unobserved firm characteristics that might be correlated with the variables in that empirical model.

[7] As a robustness check the same models were estimated with industry dummies at the 4digit-level instead of the 2digit-level. The conclusions remain unchanged; details are available from the author on request.

In a second step, therefore, the empirical model is estimated with fixed enterprise effects. Results are reported in columns two and four of table 4. Compared to the results from the OLS estimates without fixed firm effects the big picture is the same for West Germany. For East Germany, controlling for unobserved firm heterogeneity leads to an estimated two-way trader premium that is no longer statistically significantly different from zero (and a point estimate that is much smaller). The bottom line so far, then, is that results point to the absence of any statistically significant and economically large effects of trade activities on profits.

One crucial problem in any application of the fixed effects strategy is that in the estimation of the coefficients only the within variation of variables over time is used. Therefore, in the empirical model for the estimation of trader premia with fixed firm effects the coefficients for the premia are only identified by information from firms that changed their trader status at least once between 2003 and 2006. In our sample this is the case for 821 (or 12.8 percent of all firms) in West Germany and 275 (or 23.7 percent of all firms) in East Germany.[8] These status switchers that start or stop to export or import do differ from firms that continue (not) to export or import.[9] This means that in the empirical model with fixed firm effects the trader premia are estimated using a sample of firms that is different from the population of firms (or a representative random sample of this population). Given that here the conclusions from the empirical model with and without firm fixed effects with regard to significance, sign and size of the trader premia do not differ much, however, this is not a cause for concern.

[8] In West Germany, 331 firms did not trade in all four years, 108 exported only, 494 imported only and 4642 firms exported and imported in each year. The respective numbers of firms in East Germany are 91, 19, 160 and 617, respectively.

[9] See Wagner (2008b) for evidence on this for export starters and export stoppers in Germany.

5. Robust estimates of trader profitability premia

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 firms that is analyzed here the value of the rate of profit is -17.8 percent at the 1st percentile, 8.5 percent at the median and 33.9 percent at the 99th percentile for the firms not trading internationally in West Germany in 2003. The corresponding values for the other groups of firms in the other years are similar. The smallest and largest values of the rate of profit are even further away from the values of the bulk of enterprises – due to confidentiality of the firm level data, however, these extreme values cannot be reported. These extreme values might be the result of reporting errors (and, therefore, wrong), or due to idiosyncratic events (think of the bankruptcy of a customers that causes a large loss in one year), 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 profitability may have a large influence on the mean value of profitability computed for the different groups of firms in the sample, on the tails of the distribution of the rate of profit, and on the estimates of the trader premia. Conclusions with regard to the differences in profits between non-traders and the various groups of trading firms, therefore, might be influenced by a small number of firms with extremely high or low values of profits.

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).

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. 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 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[10] 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) for this estimator and for Stata commands to compute it). Suffice it to say here that this estimator combines a breakdown point of 50 percent with a high efficiency (the degree of which can be chosen by the researcher). Explicit formulas for the estimator are not available; it is computed by numerical optimization.

Table 5 reports results for the trader premia computed using the MM-estimator (via `mmregress`) and pooled data without fixed firm effects in column 1 and column 3.[11] Results differ compared to the results reported in table 4 for the same empirical model estimated by conventional OLS and disregarding the potential influence of outliers. For West Germany the negative profitability premia of firms that only import and of two-way traders are now statistically significantly different from zero at an error level of much less than five percent (although still small and less than one percentage point). For East Germany all the estimated premia are not statistically significant at any conventional level – the point estimate for the premium for two-way trades now is positive (although tiny). These results illustrate that outliers do have a large impact on the estimation results here.

[10] 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.

[11] 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.

[Table 5 near here]

The models in columns 1 and 3 of table 5 do not control for unobserved heterogeneity by including firm fixed effects. A highly robust MM-estimator for panel data with fixed effects has been proposed recently by Bramati and Croux (2007). While a discussion of details of this estimator is beyond the scope of this paper the underlying idea is to center the series of observations for a firm in a similar way to what is generally done when applying the within transformation that is used to estimate a fixed effects model. The difference here is that the series are centered by removing the median instead of demeaning because the mean is largely distorted by outliers. Having centered the series, a robust estimator can be applied to deal with atypical individuals. The outcoming results will be comparable to those of a fixed effects estimator but will not be distorted by the presence of atypical individuals.

Verardi and Wagner (2011) apply this newly developed method to the estimation of exporter productivity premia for firms from manufacturing industries in West Germany. Using the `xtregrob`-command for Stata developed for this paper the empirical models for the trader premia were estimated with firm fixed effects. Results are reported in columns 2 and 4 of table 5. It turns out that in the data for West Germany 3,568 observations (or 13.9 percent) were identified to be outliers; the respective number of outliers in the data for East Germany is 679 (or 14.6 percent). Dropping these outliers and estimating the empirical model with fixed effects using the reduced samples leads to estimated values for the trader premia that are never statistically significantly different from zero at any conventional error level in West or East Germany.

The bottom line, then, is the same as the one based on results that do not take the presence of outliers into account. The results point to the absence of any statistically significant and economically large effects of trade activities on profits.[12] This demonstrates that any productivity advantages of trading firms are eaten up by extra costs related to selling and buying on foreign markets.

6. Concluding remarks

This paper documents for the first time the relationship between profitability and three types of international trade activities – exports, imports and two-way trade. Using unique new representative data for manufacturing enterprises from Germany, one of the leading actors on the world market for goods, the findings reported on the absence of any statistically significant and economically large effects of trade activities on profits hopefully add to the big picture on the relation between international firm activities and firm performance.

However, several caveats should be pointed out that might help to put the results reported here into perspective. First of all, the data used do not contain any information on the amount of imports from beyond the European Union. Therefore, the role of the difference in the exports to sales ratio and the imports to sales ratio between trading firms cannot be investigated; especially, it is not possible to investigate the causal effects of trading on profits with a dose-response approach (see Fryges and Wagner (2010)). Furthermore, due to other limitations in the data

[12] Given this absence of any evidence for a positive profitability premium of trade activities it makes no sense to investigate the direction of causality between trade and profitability (i.e. to test for self-selection of more profitable firms into trade and for positive effects of trade on profits). It should be noted that both tests are not possible with the data at hand anyway due to the very small number of trade starters in a year and the short time span of four years.

open questions include the role played by different export destinations and by the characteristics of these export-markets, and the importance of the number and the quality of products exported, for the relationship between exports and profitability.

Given these (data driven) limitations of the study the results cannot be considered as pointing to stylized facts – they should be taken as a first step and as stimulation for replication and extensions with (richer) data from other countries.

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Table 1: Micro-econometric studies on international trade and profits

Country Author(s) (year of publication)	Period covered	Topics investigated	Methods used	Important findings
France Temouri, Vogel and Wagner (2011)	2003 – 2007	Exports and profitability in business services enterprises	Descriptive analysis; regression analysis; propensity score matching	Services exporters are more profitable than non-exporters. No evidence for self-selection of more profitable firms into exporting. No evidence for positive effects of exports on profitability.
Germany Fryges and Wagner (2010)	1999 – 2004	Exports and profitability in manufacturing enterprises	Descriptive analysis; regression analysis; generalized propensity score methodology	Exporters are more profitable than non-exporters, but difference is small; rate of profit tends to increase with export-sales ratio. No evidence for self-selection of more profitable firms into exports. Positive causal effect of exporting on profitability almost over the whole domain of the export -sales ratio.
Germany Vogel and Wagner (2010b)	2003 – 2005	Exports and profitability in business services enterprises	Descriptive analysis; regression analysis; generalized propensity score methodology	Services exporters are less profitable compared to non-exporters, though difference is small. Evidence for self-selection of less profitable services firms into exports. No positive causal effect of exports on profits.
Germany Temouri, Vogel and Wagner (2011)	2003 – 2007	Exports and profitability in business services enterprises	Descriptive analysis; regression analysis; propensity score matching	Services exporters less profitable than non-exporters. Self-selection of less profitable firms into exports. No evidence for positive effects of exporting on profits.

Italy Amendolagine, Capolupo and Petragallo (2008)	1995 – 2003	Exports and performance in manufacturing firms	Regression analysis; propensity score matching	Profitability difference between exporters and non-exporters not reported. No evidence for self-selection of more profitable firms into exporting. Evidence for positive effects of exports on profits.
Italy Grazzi (2009)	1989 – 2004	Trade and profitability	Descriptive analysis; non-parametric comparison of distributions; regression analysis	No evidence for profitability differential between exporters and non-exporters over all; positive relation for some sectors, negative for others.
Netherlands Kox and Rojas-Romagosa (2010)	1997 – 2005	Exports and performance of manufacturing and services firms	Descriptive analysis; OLS and probit regression	Profitability higher in exporting firms. Evidence for self-selection of more profitable firms into exporting. No positive effects of exporting on profitability.
United Kingdom Temouri, Vogel and Wagner (2011)	2003 – 2007	Exports and profitability in business services enterprises	Descriptive analysis; regression analysis; propensity score matching	Services exporters do not differ in profitability compared to non-exporters. No evidence for self-selection of more profitable firms into exports. No evidence for positive effects of exporting on profits.

Table 2: Profitability and participation in internatinal trade – Descriptive evidence for German manufacturing enterprises

		No trade		Only exports		Only imports		Exports and imports	
West Germany									
2003	Number of firms (percentage share)	548	(8.6%)	271	(4.2%)	728	(11.4%)	4,859	(75.9%)
	Average number of employees	70.9		80.0		152.6		396.0	
	Rate of profit (percentage): mean	8.64		8.78		8.94		7.74	
	Rate of profit (percentage): median	8.52		8.44		7.94		7.35	
	Rate of profit: standard deviation	10.92		10.00		8.37		9.03	
2004	Number of firms (percentage share)	522	(8.1%)	242	(3.8%)	740	(11.6%)	4,902	(76.5%)
	Average number of employees	68.1		72.2		139.1		391.6	
	Rate of profit (percentage): mean	9.54		9.21		8.77		8.35	
	Rate of profit (percentage): median	9.35		9.15		7.92		7.73	
	Rate of profit: standard deviation	9.42		10.60		9.11		8.93	
2005	Number of firms (percentage share)	491	(7.7%)	240	(3.7%)	756	(11.8%)	4,919	(76.8%)
	Average number of employees	60.8		77.3		143.0		385.9	
	Rate of profit (percentage): mean	8.98		9.02		8.90		8.14	
	Rate of profit (percentage): median	8.86		8.45		8.35		7.60	
	Rate of profit: standard deviation	9.82		10.10		9.89		9.21	
2006	Number of firms (percentage share)	466	(7.2%)	231	(3.6%)	744	(11.6%)	4,965	(77.5%)
	Average number of employees	63.8		74.8		136.6		383.4	
	Rate of profit (percentage): mean	9.53		10.04		8.87		8.73	
	Rate of profit (percentage): median	9.53		9.77		8.12		8.20	
	Rate of profit: standard deviation	10.28		10.42		9.74		8.73	

East Germany

2003	Number of firms (percentage share)	155	(13.3%)	60	(5.2%)	264	(22.7%)	683	(58.8%)
	Average number of employees	65.0		56.9		125.2		179.2	
	Rate of profit (percentage): mean	10.70		8.05		10.51		9.04	
	Rate of profit (percentage): median	10.03		8.88		8.98		8.78	
	Rate of profit: standard deviation	10.20		9.37		9.55		12.03	
2004	Number of firms (percentage share)	142	(12.2%)	57	(4.9%)	272	(23.4%)	691	(59.5%)
	Average number of employees	59.2		56.6		126.1		178.7	
	Rate of profit (percentage): mean	10.41		9.73		10.62		8.78	
	Rate of profit (percentage): median	9.36		9.53		9.42		8.80	
	Rate of profit: standard deviation	9.87		13.66		10.69		11.83	
2005	Number of firms (percentage share)	149	(12.8%)	55	(4.7%)	250	(21.5%)	708	(60.9%)
	Average number of employees	59.9		57.8		125.7		174.5	
	Rate of profit (percentage): mean	10.59		8.86		9.98		9.21	
	Rate of profit (percentage): median	9.23		9.32		8.41		8.93	
	Rate of profit: standard deviation	10.35		12.39		9.62		10.57	
2006	Number of firms (percentage share)	147	(12.7%)	48	(4.1%)	246	(22.7%)	721	(62.0%)
	Average number of employees	61.2		61.3		115.6		176.2	
	Rate of profit (percentage): mean	10.41		10.23		9.75		9.51	
	Rate of profit (percentage): median	9.55		7.24		8.28		9.06	
	Rate of profit: standard deviation	8.71		8.90		9.26		9.29	

Table 3: Profitability difference between German manufacturing enterprises with different forms of participation in international trade

		No trade vs. only exports	No trade vs. only imports	No trade vs. exports and imports	Only exports vs. only imports	Only exports vs. exports and imports	Only imports vs. exports and imports
West Germany							
2003	t-Test (p-value) [1]	0.852	0.598	0.064	0.823	0.095	0.000
	K-S-Test (p-values)[2]	0.252	0.218	0.001	0.900	0.165	0.012
		0.625	0.109	0.761	0.537	0.990	0.996
		0.135	0.222	0.001	0.726	0.083	0.006
2004	t-Test (p-value) [1]	0.679	0.150	0.006	0.567	0.220	0.245
	K-S-Test (p-values)[2]	0.859	0.019	0.000	0.136	0.027	0.694
		0.531	0.397	0.805	0.245	0.361	0.986
		0.501	0.009	0.000	0.073	0.014	0.365
2005	t-Test (p-value) [1]	0.951	0.890	0.072	0.864	0.186	0.049
	K-S-Test (p-values)[2]	0.636	0.534	0.010	0.816	0.152	0.095
		0.792	0.370	0.767	0.464	0.786	0.960
		0.346	0.272	0.005	0.490	0.076	0.047
2006	t-Test (p-value) [1]	0.540	0.271	0.056	0.132	0.038	0.452
	K-S-Test (p-values)[2]	0.844	0.088	0.004	0.148	0.031	0.119
		0.489	0.831	0.756	0.874	0.775	0.662
		0.680	0.044	0.002	0.080	0.016	0.060

East Germany

2003	t-Test (p-value) [1]	0.073	0.849	0.079	0.071	0.446	0.050
	K-S-Test (p-values)[2]	0.302	0.192	0.201	0.320	0.801	0.405
		0.591	0.105	0.108	0.179	0.462	0.989
		0.170	0.402	0.136	0.930	0.800	0.215
2004	t-Test (p-value) [1]	0.735	0.839	0.086	0.645	0.612	0.020
	K-S-Test (p-values)[2]	0.955	0.893	0.108	0.654	0.389	0.016
		0.626	0.547	0.618	0.367	0.643	0.895
		0.753	0.539	0.059	0.703	0.213	0.009
2005	t-Test (p-value) [1]	0.359	0.562	0.142	0.531	0.840	0.289
	K-S-Test (p-values)[2]	0.498	0.886	0.221	0.851	0.531	0.421
		0.909	0.889	0.880	0.506	0.292	0.313
		0.280	0.532	0.119	0.630	0.772	0.224
2006	t-Test (p-value) [1]	0.903	0.475	0.261	0.733	0.592	0.733
	K-S-Test (p-values)[2]	0.350	0.508	0.526	0.837	0.424	0.588
		0.721	0.814	0.843	0.496	0.234	0.316
		0.200	0.277	0.283	0.541	0.500	0.446

[1] The t-Test is a test for difference in mean values of profitability (no equal variances for both groups of firms is assumed); a p-value of 0.050 (or smaller) indicates that the null-hypothesis that the difference is zero can be rejected at an error level of 5 percent (or smaller).

[2] The K-S-Test is the Kolmogorov-Smirnov test for equality of distributions of profitability. The first p-value reported is for a test of the null-hypothesis that the two distributions are equal; a p-value of 0.050 (or smaller) indicates that the null-hypothesis that the two distributions are equal can be rejected at an error level of 5 percent (or smaller). The second and the third p-value are for tests of first-order stochastic dominance of one profitability distribution over the other. If the second p-value is (smaller than) 0.050 there is evidence (at an error level of 5 percent or less) for dominance of the profitability distribution of the second group of firms over the first, and vice versa in case of the third p-value.

Table 4: Estimation results for trader profitability premia

		West Germany		East Germany	
Variable		Pooled OLS	Fixed effects	Pooled OLS	Fixed effects
Only exports	ß	0.300	-1.166	-1.736	-0.807
(Dummy; 1 = yes)	p	0.608	0.068	0.163	0.591
Only imports	ß	-0.167	-0.064	-0.057	-0.788
(Dummy; 1 = yes)	p	0.688	0.133	0.940	0.280
Exports and imports	ß	-0.700	-0.962	-1.471	-0.302
(Dummy; 1 = yes)	p	0.074	0.081	0.047	0.775
Number of employees	ß	-0.00030	-0.00048	0.0028	0.0042
	p	0.000	0.412	0.063	0.206
Number of employees	ß	2.11e-9	1.88e-9	-4.10e-7	-4.82e-7
(squared)	p	0.003	0.453	0.057	0.144
Year dummy variables		included	included	included	included
2digit industry dummies		included	not included	included	not included
Number of observations		25,624	25,624	4,648	4,648

Note: Standard errors for the pooled model are estimated using the firm as a cluster; standard errors for the fixed effects model are robust against heteroskedasticity and within-panel serial correlation in the idiosyncratic error term.

Table 5: Robust estimation results for trader profitability premia

		West Germany		East Germany	
Variable		Pooled OLS	Fixed effects	Pooled OLS	Fixed effects
Only exports	ß	-0.338	0.298	-0.989	-0.072
(Dummy; 1 = yes)	p	0.384	0.288	0.182	0.890
Only imports	ß	-0.650	0.072	0.020	0.201
(Dummy; 1 = yes)	p	0.022	0.699	0.970	0.560
Exports and imports	ß	-0.977	0.083	0.015	-0.533
(Dummy; 1 = yes)	p	0.000	0.736	0.976	0.224
Number of employees	ß	-0.00062	-0.00059	-0.00071	0.0050
	p	0.000	0.096	0.229	0.008
Number of employees	ß	1.53e-08	2.38e-9	4.97e-8	-5.16e-7
(squared)	p	0.000	0.151	0.562	0.031
Year dummy variables		included	included	included	included
2digit industry dummies		included	not included	included	not included
Number of observations		25,624	22,056	4,648	3,969

Note: See text for the robust methods used to estimate the empirical models.

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