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# Exports, Imports and Firm Survival: First evidence for manufacturing enterprises in Germany

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# Exports, Imports and Firm Survival: First evidence for manufacturing enterprises in Germany*

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Abstract:

This paper documents the relationship between firm survival 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. It contributes to the literature by providing the first evidence on the role of imports and two-way trading for firm survival in a highly developed country. Descriptive statistics and regression analysis (with and without explicitly taking the rare events nature of firm exit into account) point to a strong positive link between firm survival on the one hand and imports and two-way trading on the other hand, while exporting alone does not play a role for exiting the market or not.

JEL classification: F14

Keywords: Exports, imports, firm survival

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## 1. Motivation

Since the publication of the Brookings Paper by Bernard and Jensen (1995) a large and still growing empirical literature emerged that discusses the mutual links between international trade and firm performance.[1] The most prominent topic in this literature is the relationship between productivity and exports,[2] not least due to the central role played by productivity in the Melitz (2003) model of an exporting firm and the many variants of this model that are at the core of what is labelled the *new new international trade theory*. More recently, empirical investigations started looking beyond exports and considered the links between imports and productivity (Vogel and Wagner 2010). Stakeholders in firms, however, care for other dimensions of firm performance, too – workers for working conditions in general and especially for wages, shareholders for stock prices, dividends and profits, and all of them for the longer-run development of the firm including survival as an ultimate goal. The links between international trade and firm survival are the topic of this paper.[3]

Why should we expect that international trade activities and firm survival are linked, and in which direction should we expect these links to work? To start with, exporting can be considered as a form of risk diversification through spread of sales over different markets with different business cycle conditions or in a different phase of the product cycle (see Hirsch and Lev 1971). Therefore, exports might provide a chance to substitute sales at home by sales abroad when a negative demand shock hits the home market and would force a firm to close down otherwise. Furthermore, Baldwin and Yan (2011, p. 135) argue that non-exporters are in general less efficient

[1] See Wagner (2011a) for a survey of recent empirical studies.

[2] For surveys see Greenaway and Kneller (2007) and Wagner (2007, 2011a).

[3] For surveys of the empirical evidence on the links between international trade and wages see Schank, Schnabel and Wagner (2007, 2010), for trade and profitability see Wagner (2011b).

than exporters (younger, smaller and less productive) and that, as a result, one expects that non-exporters are more likely to fail than exporters.

As regards imports, imported intermediate inputs or capital goods might be cheaper and / or technically more advanced than inputs bought on the national market. Gibson and Graciano (2011) argue that the benefit of using imported inputs lies in a combination of the relative price and the technology embodied in the inputs. Imports, therefore, lead to an increase in price competitiveness and non-price competitiveness of importers compared to firms that do not import. Furthermore, there is empirical evidence for a positive link of imports and productivity (discussed in Vogel and Wagner 2010), documented by a significant productivity differential between firms that import and firms that do not trade internationally. Therefore, the probability to survive can be expected to be higher for importers than for non-importers, ceteris paribus.

Firms that both export and import can be expected to benefit from the positive effects of both forms of international trade on firm survival. Furthermore, two-way traders tend to be more productive than firms that either only import, or only export, or do not trade at all (see Vogel and Wagner 2010). Therefore, we expect the probability of firm exit to be smaller for two-way traders than for firms that only export or only import.

A small number of recent empirical studies look at the role of international trade activities in shaping the chances for survival of firms; Table 1 summarizes this literature.[4] As a rule the estimated chance of survival is higher for exporters, and this

[4] This literature looks at the survival of exporting and non-exporting firms on the home market; studies that investigate the determinants of surviving as an exporter on the export market include Ilmakunnas and Nurmi (2010) and Wagner (2008a, 2010).

holds after controlling for firm characteristics that are positively associated with both exports and survival (like size, age, productivity). This might point to a direct positive effect of exporting on survival. To the best of my knowledge López (2006), Gibson and Graciano (2011) and Namini et al. (2011) are the only empirical studies on imports and survival. All three studies use data for Chile. These studies find that importers are less likely to exit than non-importers. However, López (2006) reports that exporters are more likely to survive only if they import intermediate inputs – exporting per se, therefore, does not seem to decrease the probability of plant failure. In the light of the empirical evidence for a positive link of imports and productivity the positive link between imports and firm survival does not come as a surprise. The same holds for the positive link between two-way trading (i.e. importing and exporting) and survival. However, in light of the evidence for a positive link between exporting and survival found in the other studies summarized in table 1 (that do not deal with the role of imports) the finding that in Chile exporting per se does not seem to decrease the probability of plant failure is a puzzle.

[Table 1 near here]

This paper contributes to the literature by providing the first evidence on the role of exports, imports and two-way trade for firm survival in a highly developed country, Germany, one of the leading actors on the world market for goods. It uses unique new representative data for manufacturing enterprises that merge information from surveys performed by the Statistical Offices and administrative data collected by the Tax Authorities. To anticipate the most important result, descriptive statistics and regression analysis (with and without explicitly taking the rare events nature of firm

exit into account) point to a strong positive link between firm survival on the one hand and imports and two-way trading on the other hand, while exporting alone does not play a role for exiting the market or not.

The rest of the paper is organized as follows. Section 2 describes the new data set. Section 3 presents descriptive results. Section 4 reports probit estimates for trader survival premia for four cohorts of exits of enterprises. Section 5 explicitly takes the rare events nature of market exits into account and estimates the survival premia using rare events logit.[5] Section 6 concludes.

## 2. Data

This study uses a tailor-made enterprise level data set that contains 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, information on whether a firm exports or not, labour productivity (measured as sales per employee) and the number of employees (used to measure firm size). Furthermore, given that the data start with the year 1995 this survey is

[5] Given the data used in this study (described in section 2) and the definition of exits and survivors (discussed in section 3) applied here the time span of the study covers only four years (2001 to 2004). Therefore, it is not appropriate to apply methods from survival analysis (see Esteve-Pérez et al. (2008) for a study of the role of exports in determining the survival of small firms using discrete time proportional hazard models that account for unobserved individual heterogeneity).

used to distinguish between old firms (that were already covered by the survey in 1995) and new firms (that entered the survey in 1996 or later). Note that 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 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 whether a firm imports or not. 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. From this information we know whether the enterprise imports from non-EU states or not. Furthermore, this data set is used to identify firms that exit and firms that survive.

The third source of data is the survey of products (*Produktionsstatistik*). This survey is used to distinguish between firms that produce only one product and multi-product firms.

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 are available for the years 2001 to 2007 (as of June 2011). Data based on the monthly report of manufacturing establishments and on the survey of products 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 2001 to 2007 could be linked via the enterprise register system.[6]

## 3. Descriptive results

A firm is identified as an exit in year *t* if it has reported to the turnover tax statistics in year *t* but not in the three years after year *t* – i.e. if it was active in a part of year *t* but no longer than December 31 of year *t*. This definition of an exit prevents firms that fell below the threshold of the turnover tax statistic for some time only from being counted as exits. A surviving firm reported to the turnover tax statistics in each year between *t* and *t+3*. This means that a firm that exited soon after the end of year t is not included in the comparison group of surviving firms – survivors stay in the market for (at least) the next three years.

The numbers of exits from the cohorts of the years 2001 to 2004 and the percent share of exits in all firms (exits plus survivors) in these years are reported in

[6] The merging of the data sets was done inside the research data center of the Statistical Office in Berlin-Brandenburg by Julia Höninger.

table 2 for West Germany and table 3 for and East Germany.[7] This share of exits is declining from 7.55 percent in 2001 to 4.25 percent in 2004 in West Germany. In East Germany the exits rates were higher than in West Germany in each year and there was no decline in exits over time.

[Table 2 and table 3 near here]

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 trade, enterprises that only export, enterprises that only import and enterprises that both export and import. While participation in international trade is lower among East German than among West German firms, firms that both export and import are the largest group of firms in both parts of Germany in all four years, followed by firms that do not trade at all and firms that only import; firms that only export are the smallest group with a share of some six percents in all firms in both parts of Germany (for details see Appendix I).

In West Germany two-way traders had the smallest share of exits of all four groups of firms, followed by firms that only imported. However, participation in international trade did not go hand in hand with a smaller exit rate compared to non-trading firms for firms that only exported. This pattern is the same as the one reported by López (2006) for Chile in the pioneering study of exports, imports and firm survival mentioned above.

[7] 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 (2008b) for an analysis). Therefore, all empirical investigations are carried out separately for both parts of Germany here.

Exactly the same pattern is reported for the exit cohort of year 2001 in East Germany. Results for the three other exit cohorts in East Germany, however, show different results and no consistent pattern. Two-way traders had a share of exits that is about the same as the one of firms that only imported in 2002 and 2003; participation in international trade in each of the three ways looked at here goes hand in hand with a much lower risk of exit in the cohorts 2003 and 2004. This illustrates that a study of exits should not look at data for one cohort only but should consider three or more cohorts to see whether there is some kind of regularity or not in the data.

As a first result, therefore, it turns out that the risk of exit is not negatively related to each form of participation in international trade activities in each year in both parts of Germany. Firms that exported but did not import had a higher risk of failure than firms that did not trade at all for six out of eight cohorts. Given that a huge literature (mentioned in the introductory section) reports that exporters are on average "better" than firms which sell their products on the home market only and taking account of the results of the studies on export and firm survival listed in table 1 this comes as a surprise. However, it should be kept in mind that participation in international trade is related to firm characteristics that are linked to firm exit and survival and that should be controlled for when investigating the links between trade activities and survival. While this issue is tackled in the following two sections of the paper, the rest of this section will give some information on the share of exits in firms by size class, firm age, number of products and productivity.[8]

[8] Unfortunately, other firm characteristics that might be important for both firm survival and international trade like innovation activities (see Esteve-Pérez et al. 2008) and financial variables (see Görg and Spaliara 2010) cannot be included here due to lack of information in the data.

*Firm size:* David Audretsch (1995, p. 149) mentions as a stylized fact from many empirical studies on exits that the likelihood of firm exit apparently declines with firm size (usually measured by the number of employees in a firm). This is theoretically linked to the hypothesis of "liability of smallness" from organizational ecology. A small size can be interpreted as a proxy variable for a number of unobserved firm characteristics, including disadvantages of scale, higher restrictions on the capital market leading to a higher risk of insolvency and illiquidity, disadvantages of small firms in the competition for highly qualified employees, and lower talent of management (Strotmann 2007). Results reported in table 2 and table 3, however, do not show a pattern of the rate of exit over firm size class (measured by the number of employees) that is in line with this hypothesis.[9]

*Firm age:* David Audretsch (1995, p. 149) mentions as another stylized fact from many empirical studies on exits that the likelihood of firm exit apparently declines with firm age, too. This positive link between firm age and probability of survival is labelled "liability of newness" and it is related to the fact that older firms are "better" because they spent a longer time in the market during which they learned how to solve the range of problems facing them in day-to-day business. Table 2 and table 3 indicate that, in line with this hypothesis, the rate of exit is smaller in older firms (founded before 1996) than in younger firms that started in 1996 or later.[10]

*Product diversification*: On a theoretical level, the existence of multi-product enterprises has been explained by pointing to the reduction of risk and uncertainty

[9] The share of firms from the four size classes in West Germany and East Germany in each cohort is reported in Appendix I. Note that large firms are much more often found in West Germany than in East Germany.

[10] Not surprisingly, the share of old firms is much larger in West Germany than in East Germany; see Appendix I.

that can be reached by diversification across product markets (Jovanovic and Gilbert, 1993, pp. 199f.; Lipczynski and Wilson, 2001, pp. 324f.). Demand shocks or new competitors may have a negative impact on sales and profits in a product market in an unpredictable manner. A single-product firm, therefore, is highly vulnerable to adverse shocks that hit their market. A multi-product firm can substantially reduce this vulnerability, at least if the risks on the various product markets are randomly distributed or negatively correlated. Consequently, we would expect that, other things equal, higher levels of product diversification are positively related to a higher probability of survival. To the best of my knowledge, however, this hypothesis has not been tested empirically for Germany before.[11]

As is shown in table 2 and table 3 the rate of exits is about the same among single-product firms and firms that produce two or more products in West Germany in all years. The same holds for East Germany in the first three cohorts, while 2004 is an outlier where the exit rate is much higher among firms with two or more products. This descriptive evidence is not in line with the theory sketched above.

[11] Using data from the U.S. Bernard and Jensen (2007) report that the probability of failure is lower for multiproduct plants than for single-product plants after controlling for other plant characteristics including size, age and exporter status. Braakmann and Wagner (2011a) use German firm level longitudinal data to investigate the relationship between product diversification and the stability of sales and employment. They find that contrary to portfolio theoretic considerations more diversified firms exhibit a higher variability of sales and employment. However, the effects are negligibly small from an economic point of view. Furthermore, Braakmann and Wagner (2011b) find that an increase in the degree of product diversification has a negative impact on profitability when observed and unobserved firm characteristics are controlled for. This helps to understand the fact that about 40 percent of all firms are single-product firms according to a detailed classification of products (see Appendix I for the cohorts of firms investigated here), and that multi-product enterprises with a large number of goods are a rare species.

*Productivity:* In theoretical models for the dynamics of industries with heterogeneous firms, including Jovanovic (1982), Hopenhayn (1992), and Ericson and Pakes (1995), productivity differentials play a central role for entry, growth, and exit of firms. In equilibrium growing and shrinking, exiting and entering firms that have different productivities are found in an industry. These models lead to hypotheses that can be tested empirically. Hopenhayn (1992) considers a long-run equilibrium in an industry with many price-taking firms producing a homogeneous good. Output is a function of inputs and a random variable that models a firm specific productivity shock. These shocks are independent between firms, and are the reason for the heterogeneity of firms. There are sunk costs to be paid at entry, and entrants do not know their specific shock in advance. Incumbents can choose between exiting or staying in the market. When firms realized their productivity shock they decide about the profit maximizing volume of production. The model assumes that a higher shock in t+1 has a higher probability the higher the shock is in t. In equilibrium firms will exit if for given prices of output and inputs the productivity shock is smaller than a critical value, and production is no longer profitable.

Farinas und Ruano (2005, p. 507f.) argue that this model leads to the following testable hypothesis: Firms that exit in year t were in t-1 less productive than firms that continue to produce in t. They test this hypothesis using panel data for Spanish firms. The hypothesis is supported by the data. Wagner (2009) replicates the study by Farinas and Ruano with panel data for West and East German firms from manufacturing industries. For the cohorts of exit from 1997 to 2002 the results are in line with the results for Spain.

As is shown in table 2 and table 3 the rate of exit is much higher among firms from the lower third of the productivity distribution than among the more productive

firms.[12] While this is in line with the theory sketched above it should be noted that exits can be found among the most productive firms, too.

## 4. Trader survival premia: Results from Probit estimates

The second step in the empirical investigation of the links between firm survival and participation in international trade consists in the estimation of trader survival premia that are defined as the difference of the probability to exit between firms that did not trade at all and firms from one of the three groups of traders (firms that only export, firms that only import and two-way traders). To document these premia two empirical models were estimated by Probit for firms from each cohort of exits and from the respective control group of surviving firms. The first model includes a dummy variable taking the value 1 for exits and the value 0 for survivors as the endogenous variable; three dummy variables for firms that only export, firms that only import and two-way traders plus a full set of 2digit-level industry dummy variables and a constant are included as exogenous variables. The second model augments the first model by adding a number of control variables: dummy variables for three firm size classes (using firms from the smallest size class as the reference category), for old firms and for multi-product firms plus labour productivity (measured as sales per employee).[13]

[12] As is reported in Appendix II the average productivity is lower among exits than among surviving firms, too.

[13] Note that these empirical models are not to be considered as models that explain the exit decision of the firms. The data at hand are not rich enough for that kind of empirical investigation. The empirical models are only used to indicate the ceteris paribus difference in the exit probability of firms with different forms of international trade activities, following a standard approach used in empirical studies from the micro-econometrics of international firm activities (see the studies summarized in table 1).

Results are reported in table 4 for West Germany and in table 5 for East Germany.[14] The estimated coefficients from a Probit model cannot easily be used for statements about the size of the ceteris paribus effect of a change of the value of an exogenous variable (e. g. being a two-way trader or not) on the value of the endogenous variable (the probability of exit), because the size of this effect depends on both the value of the exogenous variable under consideration and on the values of all other variables in the model (see Long and Freese (2001), p. 87ff.). To put it differently, the estimated size of the change in the probability of exit due to a change in the value of one exogenous variable depends on where we start. In the tables, therefore, the estimated marginal effects are reported. For a continuous variable the marginal effect is the estimated change in the probability of exit due to a one unit change in the value of that variable when the values of all variables in the model are at the mean of the sample used for the estimation of the model. For a dummy variable the marginal effect is the change in the probability of exit when this dummy variable takes on the value 1 instead of the value 0 (and when the values of all other exogenous variables in the model are fixed at the sample mean).

[Table 4 and table 5 near here]

From the results of the Probit estimates we have strong evidence for a negative link between two-way trading and the probability of exit both in West Germany and in East Germany. The estimated coefficients in model 1 are statistically significantly different from zero at an error level of five percent or less for all cohorts in West Germany and for three out of four cohorts in East Germany. The evidence of

[14] Descriptive statistics for variables included in the empirical models are reported in Appendix II.

a negative link is somewhat weaker for importing only (where the estimated coefficients are not statistically significant in 2001 and only significant at an error level of ten percent in West Germany in 2004). The size of the marginal effects is quite large. For example, for West Germany and the cohort 2001 the estimated probability of exit is 2.3 percent lower for a firm that exports and imports than for a firm that does not trade internationally. Given that the share of exits in all firms is 7.55 percent (see table 2) this reduction can be considered to be relevant from an economic point of view, and the same holds for the other years (where the reduction in the probability of exit is often much larger relative to the overall share of exits) and for both parts of Germany.

Exporting per se is not negatively related to the probability of exit. In West Germany the estimated marginal effects for firms that only export are positive (but less than one percentage point) though never statistically significantly different from zero at a conventional error level. For East Germany, only the results for the cohort 2004 point to a lower probability of exit among firms that only export compared to firms that do not trade at all. This different result is due to the exceptionally high share of exits in the group of non-trading firms in this year (see table 3).

Note that the addition of the control variables in model 2 does not change this big picture. Furthermore, the point estimates for the marginal effects of the trade variables are more or less the same in the two models estimated with and without the control variables.

The results for model 2 show that the control variables are only rarely linked to the probability of exit. In West Germany, the only exception[15] is the effect of being an

[15] The marginal effect of labour productivity is statistically significant in 2002, too. However, this effect is tiny – if productivity at the mean increases by 10,000 (Euro per employee) the estimated reduction

old firm (founded before 1996) compared to being a firm founded since 1996. The probability of exit is smaller for older firms, ceteris paribus. This effect, however, is small (around one percentage point in 2001 and 2002, and half this size in 2004). In East Germany all the estimated marginal effects are insignificant at the usual error level of five percent in 2001 to 2003; exceptions can only be found for 2004, a special case with an exceptionally high share of exits in the group of non-trading firms.

The big picture from the probit estimates can be summarized as follows:

- We have strong evidence for a positive survivor premium of two-way trading and of importing firms, while exporting alone (a strategy chosen by about six percent of firms only) does not play a role for exiting the market or not. This is in line with the descriptive evidence (discussed in section 3) and with the results from Chile (discussed in section 1), the only other country we have empirical evidence for on exit and survival of exports, importers and two-way traders.

- Controlling for international trade activities firm size, product diversification and productivity do not matter for the probability of exit, and the same holds for firm age in East Germany (but not in West Germany). These findings are not in line with the results from many empirical studies on firm exit; however, in these studies the role of exporting and importing is not controlled for.

## 5. Trader survival premia: Results from Rare Events Logit estimates

Firm exit from the market is a rare event – between 2001 and 2004 only from 4.25 percent to 7.55 percent of firms were exits in West Germany, and the respective percentage values for East Germany were between 6.55 and 8.78 (see table 2 and

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of the probability of exit is 0.05 percentage points (note that the mean value of productivity in West Germany in 2002 was 118,200 Euro for the exits and 133,800 Euro for the survivors; see Appendix II).

table 3). In the application of the standard Probit model to estimate the marginal effects of trade activities and other firm characteristics on the probability of exit in section 4 this rare events nature of exits is ignored. King and Zeng (2001a, 2001b) developed a version of the Logit model to compute unbiased estimates in a situation like this. This method – that is called Rare Events Logistic Regression or ReLogit – estimates the same logit model as the standard logit procedure, but it uses an estimator that gives lower mean square error in the presence of rare events data for coefficients, probabilities, and other quantities of interest.

As the next step in the empirical investigation of the links between firm survival and international trade activities ReLogit is used to estimate the models 1 and 2 (described in section 4).[16] Results are reported in table 6 and table 7 for West Germany and East Germany, respectively.

[Table 6 and table 7 near here]

The big picture from the rare events logit estimates is exactly the same as the one based on the probit estimates reported in section 4 above. There is strong evidence for a positive survivor premium of two-way trading and of importing firms, while exporting alone does not play a role for exiting the market or not. Controlling for international trade activities firm size, product diversification and productivity do not matter for the probability of exit, and the same holds for firm age in East Germany (but not in West Germany).

[16] All estimations were done using the Stata ado-file `relogit.ado` available from Gary King's website (see http://gking.harvard.edu/software/).

As in the case of the results from the standard Probit procedure the estimated coefficients from a rare events logit model cannot easily be used for statements about the size of the ceteris paribus effect of a change of the value of an exogenous variable on the probability of firm exit, because the size of this effect depends on both the value of the exogenous variable under consideration and on the values of all other variables in the empirical model. A way to interpret the estimation results is to compute the estimated value of the endogenous variable (here: the probability of exit of an enterprise) for an enterprise with certain characteristics and to show how a change in the value of one firm characteristic at a time changes the estimated probability. The estimated probability of exit is computed as $\exp(x_j ß) / (1+\exp(x_j ß))$ where $x_j$ is a vector of firm characteristics and ß is a vector of estimated coefficients.

To demonstrate the role of participation in international trade by a firm for the probability of exit of this firm a couple of simulations of the type sketched above were run. These simulations are based on the rare events logit results for model 1 (reported in table 6 and table 7 for West Germany and East Germany, respectively).[17] For each cohort and each part of Germany the probability of exit was estimated for four hypothetical firms. Firm 1 does not trade at all; firm 2 only exports; firm 3 only imports; firm 4 exports and imports. For the computations it is assumed

[17] Model 1 is used because the control variables added in model 2 turned out to be insignificant in the estimation of the probability of exit. Furthermore, while it would be easy to specify the characteristic of a hypothetical firm (200 employees, old firm, etc.) and to compute the estimated exit probability for this firm assuming different degrees of international trade activities this procedure would only lead to an estimate for the exit probability that is higher or lower by a constant amount for firms with all types of trade activity. The difference in exit probability between firms with different degrees of involvement in international trade would not change.

that the firm is from the reference industry (manufacture of food products and beverages) so all dummy variables for industries are set to zero.[18]

Results from these simulations are reported in table 8. (Results in brackets indicate that the estimated coefficient is not statistically significant at an error level of 0.05.) It is evident that the estimated reduction in the probability of exit is large from an economic point of view for both firms that only import and for firms that export and import.

[Table 8 near here]

## 6. Discussion

This paper provides the first evidence on the role of exports, imports and two-way trade for firm survival in a highly developed country. Descriptive statistics and regression analysis (with and without explicitly taking the rare events nature of firm exit into account) point to a strong positive link between firm survival on the one hand and imports and two-way trading on the other hand, while exporting alone does not play a role for exiting the market or not.

At first sight these empirical results for Germany seem to contradict both theoretical reasoning and the findings from other empirical studies. As stated in section 1, exporting can be considered as a form of risk diversification through spread of sales over different markets with different business cycle conditions or in a different phase of the product cycle. Therefore, exports might provide a chance to

[18] Assuming another industry would only lead to an estimate for the exit probability that is higher or lower by a constant amount for firms with all types of trade activity. The difference in exit probability between firms with different degrees of involvement in international trade would not change.

substitute sales at home by sales abroad when a negative demand shock hits the home market and would force a firm to close down otherwise. Furthermore, non-exporters are in general less efficient than exporters (younger, smaller and less productive) and, as a result, one expects that non-exporters are more likely to fail than exporters. In line with this reasoning, empirical studies (summarized in table 1) as a rule find that the estimated chance of survival is higher for exporters, and this holds after controlling for firm characteristics that are positively associated with both exports and survival (like size, age, productivity).

However, the following points should be kept in mind when putting the results for Germany reported here into perspective:

- As regards the findings from other empirical studies remember that (with the exception of the studies using data from Chile) imports are ignored therein. This means that two-way traders and firms that only export are classified in one group called exporters. For this group of firms the link between survival and trade is positive for Germany, too – this is evident from the fact (reported in detail in Appendix I) that only exporters are a small fraction of firms that engage in exporting, while most exporting firms also import. As shown here these two-way traders have a much higher probability to survive than firms that do not export. However, looking at both exports and imports separately does reveal more insights into this link, and is, therefore, important for understanding the role of international trade activities in shaping the chances to survive in the market or not.

- What about the validity of the theoretical arguments discussed in section 1 for a positive role of exports *per se* for firm survival? A look at the percentage share of exports in total sales for firms that export only and firms that export and import reveals that firms that only export are to a large degree only marginal exporters. For

example, in West Germany in 2001[19] firms that only exported had an average share of exports in total sales of 11.8 percent compared to 27.7 percent for firms that exported and imported. A closer look at the distribution of the percentage share of exports in total sales shows that, indeed, firms that only exported very often did so to a small degree only – the median of the percentage share of exports was 4.7 percent (compared to 22.1 percent for firms that exported and imported). The big picture is similar for East Germany in 2001 with mean values of 10.5 percent and 22.3 percent for the share of exports in total sales for firms that only exported compared to firms that exported and imported and median values of 2.8 percent compared to 13.6 percent.

Furthermore, one should keep in mind that, on the one hand, many manufacturing enterprises in Germany that do not export directly do so indirectly by supplying their products to firms that use these goods as intermediate inputs in the production of goods that are exported. Think of a producer of sheet-steel that sells its product to a car manufacturer – even if the steel producer does not export directly the firm will profit from any positive effect of exporting in the form of risk diversification through the exports of its customer. In this sense, indirect exports, too, might act as a buffer against a negative demand shock that hits sales on the home market and that would force a firm to close down otherwise. This kind of spillover effects from exporters to suppliers that do not export directly can be expected to be quite common in the manufacturing sector in Germany, although empirical evidence on this topic is to the best of my knowledge not available. On the other hand, spillover effects of this kind might not play such a role when it comes to imports. If the benefit of using imported inputs lies in a combination of the relative price and the technology

[19] Results for the other years are roughly identical; details are available on request.

embodied in the inputs, imports lead to an increase in price competitiveness and non-price competitiveness of importers compared to firms that do not import only. Therefore, while imports *per se* can be expected to be positively linked to firm survival, this link can be expected to be much weaker and might not be observable at all for exports *per se*.

Given that Germany is one of the big players on the world market for goods and that international linkages of German manufacturing enterprises are extremely important for the short and for the longer run development of the economy the empirical evidence presented in this paper is interesting on its own. It would be even more interesting to see whether the pattern revealed for West Germany and East Germany is the same in other highly developed economies, and if not, why there is a difference. A replication and extension[20] of this study with data for other countries, therefore, is suggested as a step on the thorny road from estimation results in one study to the finding of stylized facts. These stylized facts then could be used both to guide economic policy makers in an evidence based way and to motivate the building of theoretical models that are based on "realistic" assumptions.[21]

[20] One way to extend this study is to consider the role of the share of exports in total sales and the ratio of imports to total sales for firm survival; unfortunately, this information is not available for Germany (see section 2 above). Another line of extension should consider the differences between firms that exported and / or imported for several years and firms that just started to trade or just stopped to trade (see Görg and Spaliara 2010); unfortunately, the period covered by the data for Germany is not long enough for this exercise (again, see section 2 above).

[21] See Wagner (2011c) for a discussion of these issues.

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**Table 1: Micro-econometric studies on international trade and firm survival**

| Country<br>Author(s)<br>(year of publication) | Period covered | Topics investigated | Methods used | Important findings |
|---|---|---|---|---|
| Canada<br>Baldwin and Yan<br>(2011) | 1979 – 1996 | Effects of changes in tariffs and real exchange rates on plant death | Probit estimates for exit | Exporters have much lower failure rates than non-exporters but their survival is more sensitive to changes in tariffs and real exchange rates. |
| Chile<br>López<br>(2006) | 1990 – 1999 | Imports of intermediate inputs and plant survival | Probit estimates for exit | Importers are more likely to survive. Exporters are more likely to survive but only if they import intermediate inputs. Exporting itself does not seem to decrease probability of exit. |
| Chile<br>Gibson and Graciano<br>(2011) | 2001 – 2006 | Costs of starting to trade and costs of continuing to trade | Transition probabilities to exit | Importers are less likely to exit than non-importers. |
| Chile<br>Namini, Facchini and López<br>(2011) | 1990 – 1999 | Export growth and factor market competition | Probit and IV-probit estimates for 3-year survival | Importers of intermediate inputs are more likely to survive than non-importers. Exporting firms are more likely to survive than non-exporting firms, but probability of survival decreases with sector-wide export volumes. |
| Denmark<br>Eriksson, Smeets and Warzynski<br>(2009) | 1993 – 2003 | Evidence on exports and imnports by product and origin / destination | Probit estimate for exit | Exporters are less likely to exit than non-exporters. |
| France<br>Görg and Spaliara<br>(2010) | 1998 - 2005 | Financial constraints, exports and firm survival | Probit estimate for exit | Continuous exporters face a higher probability of survival compared to starters, continuous non-exporters and firms exiting the exporting market. |

| | | | | |
|---|---|---|---|---|
| Italy<br>Amendola et al.<br>(2010) | 2002 – 2008 | Differential effects of firm and industry level variables on likelihood of survival | Probit estimates for exit | Exporting has a very high negative marginal impact on firm exit. |
| Japan<br>Kimura and Kiyota<br>(2006) | 1994 – 2000 | Export, FDI and productivity | Cox proportional hazard model | Exports have positive impacts on firm survival. Exporters face hazard rate that is lower than non-exporters. |
| Spain<br>Esteve-Pérez, Mánez-Castillejo and Sanchis-Llopis<br>(2008) | 1990 – 2002 | "Survial-by-exporting" effect for small and medium sized enterprises (SME) | Discrete time proportional hazard models | Exporting SMEs face a significantly lower probability of failure than non-exporters. |
| Sweden<br>Greenaway, Gullstrand and Kneller<br>(2008) | 1980 – 1996 | Effects of international trade on firms' strategies for industry exit | Descriptive statistics; multinomial logit | Firms which export are less likely to close down. |
| Sweden<br>Greenaway, Gullstrand and Kneller<br>(2009) | 1980 – 1996 | Role of firm and industry characteristics for exit decision of firms | Descriptive statistics; multinomial logit | Firms which export are less likely to close down. |
| United Kingdom<br>Görg and Spaliara<br>(2010) | 1998 - 2005 | Financial constraints, exports and firm survival | Probit estimate for exit | Continuous exporters face a higher probability of survival compared to starters, continuous non-exporters and firms exiting the exporting market. |
| U. S.<br>Bernard and Jensen<br>(2007) | 1992 – 1997 | Determinants of plant closures | Probit estimates for plant death | Exporting is associated with large reduction in probability of closedown. |

**Table 2: Exit cohorts 2001 – 2004: Descriptive statistics for West Germany**

| Cohort | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|
| Number of exits | 1,310 | 1,084 | 903 | 739 |
| Share of exits (percentage) | | | | |
| - in all firms | 7.55 | 6.03 | 5.17 | 4.25 |
| - in firms that do not trade | 8.82 | 8.04 | 7.61 | 5.83 |
| - in firms that only export | 9.48 | 9.04 | 8.06 | 7.23 |
| - in firms that only import | 8.19 | 5.96 | 5.48 | 4.51 |
| - in firms that export and import | 6.77 | 5.10 | 4.13 | 3.49 |
| - in firms with less than 50 employees | 7.66 | 6.39 | 5.97 | 4.62 |
| - in firms with 50 to 249 employees | 7.47 | 5.82 | 4.32 | 3.99 |
| - in firms with 250 to 499 employees | 7.22 | 5.62 | 4.40 | 3.16 |
| - in firms with 500 and more employees | 7.60 | 4.42 | 5.31 | 4.18 |
| - in firms that started before 1996 | 7.25 | 5.56 | 4.83 | 3.93 |
| - in firms that started in 1996 or later | 8.41 | 7.07 | 5.85 | 4.82 |
| - in firms with only one product | 7.56 | 6.07 | 5.25 | 4.38 |
| - in firms with two or more products | 7.55 | 6.01 | 5.12 | 4.17 |
| - in firms from the lower third of the distribution of labor productivity | 8.87 | 8.30 | 7.65 | 5.53 |
| - in firms from the middle third of the distribution of labor productivity | 6.80 | 4.72 | 3.82 | 3.51 |
| - in firms from the upper third of the distribution of labor productivity | 6.99 | 5.07 | 4.06 | 3.73 |

Note: For a definition of exits and survivors see text.

**Table 3: Exit cohorts 2001 – 2004: Descriptive statistics for East Germany**

| Cohort | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|
| Number of exits | 265 | 253 | 245 | 351 |
| Share of exits (percentage) | | | | |
| - in all firms | 7.66 | 7.04 | 6.55 | 8.78 |
| - in firms that do not trade | 9.52 | 8.10 | 9.21 | 17.16 |
| - in firms that only export | 11.21 | 9.46 | 7.56 | 5.24 |
| - in firms that only import | 7.17 | 6.22 | 5.45 | 6.25 |
| - in firms that export and import | 5.98 | 6.44 | 5.44 | 5.33 |
| - in firms with less than 50 employees | 7.69 | 7.62 | 6.61 | 9.22 |
| - in firms with 50 to 249 employees | 7.79 | 5.97 | 6.29 | 8.78 |
| - in firms with 250 to 499 employees | 3.75 | # | # | # |
| - in firms with 500 and more employees | 10.34 | # | # | # |
| - in firms that started before 1996 | 6.74 | 6.25 | 5.72 | 6.58 |
| - in firms that started in 1996 or later | 8.65 | 7.74 | 7.19 | 10.23 |
| - in firms with only one product | 7.79 | 7.29 | 6.21 | 5.36 |
| - in firms with two or more products | 7.57 | 6.87 | 6.80 | 11.16 |
| - in firms from the lower third of the distribution of labor productivity | 10.49 | 8.86 | 9.15 | 16.65 |
| - in firms from the middle third of the distribution of labor productivity | 6.42 | 4.93 | 4.90 | 4.88 |
| - in firms from the upper third of the distribution of labor productivity | 6.07 | 7.34 | 5.62 | 4.80 |

Note: For a definition of exits and survivors see text. '#' indicates that the results are confidential because only 2 or less firms fall into one of the indicated categories.

**Table 4: Probit estimates of determinants of firm exits: West Germany**

| Exit cohort | | 2001 | | 2002 | | 2003 | | 2004 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Model 1 | Model 2 | Model 1 | Model 2 | Model 1 | Model 2 | Model 1 | Model 2 |
| Firms that only export | ß | 0.004 | 0.006 | 0.005 | 0.008 | 0.0001 | 0.001 | 0.006 | 0.007 |
| | p | 0.790 | 0.732 | 0.495 | 0.303 | 0.986 | 0.845 | 0.374 | 0.338 |
| Firms that only import | ß | -0.008 | -0.008 | -0.019 | -0.017 | -0.018 | -0.017 | -0.013 | -0.013 |
| | p | 0.299 | 0.300 | 0.002 | 0.009 | 0.000 | 0.001 | 0.084 | 0.095 |
| Firms that export and import | ß | -0.023 | -0.024 | -0.033 | -0.029 | -0.041 | -0.038 | -0.031 | -0.030 |
| | p | 0.031 | 0.032 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 |
| Firms with 50 to 249 employees | ß | | 0.007 | | 0.006 | | -0.006 | | 0.001 |
| | p | | 0.128 | | 0.201 | | 0.048 | | 0.664 |
| Firms with 250 to 499 employees | ß | | 0.009 | | 0.010 | | -0.001 | | -0.004 |
| | p | | 0.309 | | 0.238 | | 0.827 | | 0.640 |
| Firms with 500 and more employees | ß | | 0.014 | | -0.003 | | 0.009 | | 0.008 |
| | p | | 0.310 | | 0.814 | | 0.385 | | 0.392 |
| Firms that started before 1996 | ß | | -0.011 | | -0.012 | | -0.004 | | -0.006 |
| | p | | 0.070 | | 0.014 | | 0.337 | | 0.050 |
| Firms with two or more products | ß | | 0.001 | | 0.0001 | | -0.0003 | | 0.0004 |
| | p | | 0.778 | | 0.972 | | 0.932 | | 0.923 |
| Labour productivity | ß | | -0.00002 | | -0.00005 | | -6.80e-6 | | 1.15e-6 |
| (sales per employee; 1000 Euro) | p | | 0.317 | | 0.046 | | 0.754 | | 0.878 |
| Number of firms | | 17,335 | 17,335 | 17,964 | 17,964 | 17,436 | 17,436 | 17,340 | 17,340 |

Note: The entries in the table are the marginal effects (ß) und the p-values (p). The reference categories for the dummy variables are: firms that do not trade; firms with less than 50 employees; firms that started in 1996 or later; firms with only one product. All models include a constant plus a full set of 2digit-level industry dummy variables. Standard errors are adjusted for clusters at 2digit-level industries.

**Table 5: Probit estimates of determinants of firm exits: East Germany**

| Exit cohort | | 2001 | | 2002 | | 2003 | | 2004 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Model 1 | Model 2 | Model 1 | Model 2 | Model 1 | Model 2 | Model 1 | Model 2 |
| Firms that only export | ß | 0.007 | 0.010 | 0.004 | 0.005 | -0.015 | -0.014 | -0.048 | -0.045 |
| | p | 0.801 | 0.720 | 0.878 | 0.864 | 0.259 | 0.288 | 0.006 | 0.007 |
| Firms that only import | ß | -0.024 | -0.022 | -0.023 | -0.021 | -0.032 | -0.032 | -0.058 | -0.055 |
| | p | 0.214 | 0.216 | 0.021 | 0.033 | 0.000 | 0.000 | 0.000 | 0.000 |
| Firms that export and import | ß | -0.040 | -0.038 | -0.026 | -0.022 | -0.032 | -0.033 | -0.065 | -0.059 |
| | p | 0.029 | 0.041 | 0.105 | 0.161 | 0.000 | 0.000 | 0.000 | 0.000 |
| Firms with 50 to 249 employees | ß | | 0.016 | | -0.010 | | 0.010 | | 0.013 |
| | p | | 0.095 | | 0.267 | | 0.124 | | 0.013 |
| Firms with 250 to 499 employees | ß | | -0.026 | | 0.037 | | 0.061 | | 0.031 |
| | p | | 0.480 | | 0.150 | | 0.077 | | 0.279 |
| Firms with 500 and more employees | ß | | 0.059 | | -0.023 | | 0.017 | | 0.005 |
| | p | | 0.277 | | 0.645 | | 0.753 | | 0.896 |
| Firms that started before 1996 | ß | | -0.017 | | -0.012 | | -0.013 | | -0.013 |
| | p | | 0.180 | | 0.188 | | 0.128 | | 0.141 |
| Firms with two or more products | ß | | 0.003 | | 0.0002 | | 0.004 | | 0.024 |
| | p | | 0.825 | | 0.986 | | 0.586 | | 0.025 |
| Labour productivity | ß | | -0.00005 | | 4.14e-6 | | -0.00003 | | -0.0001 |
| (sales per employee; 1000 Euro) | p | | 0.443 | | 0.353 | | 0.454 | | 0.012 |
| Number of firms | | 3,452 | 3,452 | 3,569 | 3,569 | 3,714 | 3,714 | 3,993 | 3,993 |

Note: The entries in the table are the marginal effects (ß) und the p-values (p). The reference categories for the dummy variables are: firms that do not trade; firms with less than 50 employees; firms that started in 1996 or later; firms with only one product. All models include a constant plus a full set of 2digit-level industry dummy variables. Standard errors are adjusted for clusters at 2digit-level industries.

**Table 6: Rare events logit estimates of determinants of firm exits: West Germany**

| Exit cohort | | 2001 | | 2002 | | 2003 | | 2004 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Model 1 | Model 2 | Model 1 | Model 2 | Model 1 | Model 2 | Model 1 | Model 2 |
| Firms that only export | ß | 0.066 | 0.084 | 0.093 | 0.142 | -0.004 | 0.021 | 0.125 | 0.141 |
| | P | 0.770 | 0.711 | 0.470 | 0.284 | 0.978 | 0.890 | 0.425 | 0.384 |
| Firms that only import | ß | -0.112 | -0.109 | -0.369 | -0.325 | -0.429 | -0.390 | -0.366 | -0.362 |
| | p | 0.302 | 0.309 | 0.002 | 0.008 | 0.000 | 0.000 | 0.075 | 0.081 |
| Firms that export and import | ß | -0.328 | -0.330 | -0.574 | -0.504 | -0.810 | -0.744 | -0.728 | -0.721 |
| | p | 0.031 | 0.034 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| Firms with 50 to 249 employees | ß | | 0.107 | | 0.110 | | -0.145 | | 0.036 |
| | p | | 0.123 | | 0.187 | | 0.039 | | 0.627 |
| Firms with 250 to 499 employees | ß | | 0.141 | | 0.177 | | -0.032 | | -0.087 |
| | p | | 0.268 | | 0.221 | | 0.824 | | 0.687 |
| Firms with 500 and more employees | ß | | 0.199 | | -0.046 | | 0.169 | | 0.192 |
| | p | | 0.287 | | 0.835 | | 0.383 | | 0.368 |
| Firms that started before 1996 | ß | | -0.151 | | -0.208 | | -0.077 | | -0.145 |
| | p | | 0.074 | | 0.019 | | 0.371 | | 0.045 |
| Firms with two or more products | ß | | 0.018 | | 0.002 | | -0.004 | | 0.005 |
| | p | | 0.785 | | 0.970 | | 0.953 | | 0.959 |
| Labour productivity | ß | | -0.0004 | | -0.001 | | -0.0001 | | 0.0001 |
| (sales per employee; 1000 Euro) | p | | 0.374 | | 0.075 | | 0.825 | | 0.511 |
| Number of firms | | 17,335 | 17,335 | 17,964 | 17,964 | 17,436 | 17,436 | 17,340 | 17,340 |

Note: The entries in the table are the estimated coefficients (ß) und the p-values (p). The reference categories for the dummy variables are: firms that do not trade; firms with less than 50 employees; firms that started in 1996 or later; firms with only one product. All models include a constant plus a full set of 2digit-level industry dummy variables. Standard errors are adjusted for clusters at 2digit-level industries.

**Table 7: Rare events logit estimates of determinants of firm exits: East Germany**

| Exit cohort | | 2001 | | 2002 | | 2003 | | 2004 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Model 1 | Model 2 | Model 1 | Model 2 | Model 1 | Model 2 | Model 1 | Model 2 |
| Firms that only export | ß | 0.089 | 0.124 | 0.063 | 0.084 | -0.246 | -0.237 | -0.904 | -0.830 |
| | p | 0.795 | 0.733 | 0.876 | 0.831 | 0.287 | 0.325 | 0.007 | 0.010 |
| Firms that only import | ß | -0.368 | -0.347 | -0.369 | -0.341 | -0.601 | -0.605 | -0.980 | -0.911 |
| | p | 0.198 | 0.201 | 0.024 | 0.039 | 0.000 | 0.000 | 0.000 | 0.000 |
| Firms that export and import | ß | -0.618 | -0.591 | -0.409 | -0.361 | -0.555 | -0.582 | -0.977 | -0.895 |
| | p | 0.028 | 0.039 | 0.102 | 0.159 | 0.000 | 0.000 | 0.000 | 0.000 |
| Firms with 50 to 249 employees | ß | | 0.238 | | -0.151 | | 0.162 | | 0.186 |
| | p | | 0.090 | | 0.286 | | 0.135 | | 0.011 |
| Firms with 250 to 499 employees | ß | | -0.323 | | 0.521 | | 0.822 | | 0.451 |
| | p | | 0.637 | | 0.114 | | 0.064 | | 0.200 |
| Firms with 500 and more employees | ß | | 0.790 | | 0.068 | | 0.490 | | 0.330 |
| | p | | 0.201 | | 0.945 | | 0.576 | | 0.572 |
| Firms that started before 1996 | ß | | -0.260 | | -0.204 | | -0.229 | | -0.183 |
| | p | | 0.169 | | 0.189 | | 0.139 | | 0.124 |
| Firms with two or more products | ß | | 0.046 | | 0.0007 | | 0.057 | | 0.355 |
| | p | | 0.812 | | 0.996 | | 0.696 | | 0.036 |
| Labour productivity | ß | | -0.0009 | | 0.00006 | | -0.0004 | | -0.0015 |
| (sales per employee; 1000 Euro) | p | | 0.537 | | 0.304 | | 0.626 | | 0.054 |
| Number of firms | | 3,452 | 3,452 | 3,569 | 3,569 | 3,714 | 3,714 | 3,993 | 3,993 |

Note: The entries in the table are the estimated coefficients (ß) und the p-values (p). The reference categories for the dummy variables are: firms that do not trade; firms with less than 50 employees; firms that started in 1996 or later; firms with only one product. All models include a constant plus a full set of 2digit-level industry dummy variables. Standard errors are adjusted for clusters at 2digit-level industries.

Table 8: Estimated probability of exit for enterprises with various degrees of international trade activities (percentage)

| Type of firm / Year | West Germany 2001 | 2002 | 2003 | 2004 | East Germany 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|
| 1 No trade | 8.47 | 7.76 | 7.28 | 5.30 | 8.08 | 6.42 | 8.02 | 28.2 |
| 2 Only exports | (8.98) | (8.45) | (7.25) | (5.96) | (8.77) | (6.79) | (6.83) | 13.7 |
| 3 Only imports | (7.64) | 5.50 | 4.86 | (3.74) | (5.74) | 4.52 | 4.56 | 12.8 |
| 4 Exports and imports | 6.24 | 4.53 | 3.37 | 2.63 | 4.53 | (4.35) | 4.76 | 12.9 |

Note: The estimated probability of exit is based on the results of the rare events logit estimates for model 1 reported in table 6 and table 7. The estimated probability of exit is computed as $\exp(x_j ß) / (1+\exp(x_j ß))$ where $x_j$ is a vector of variables and ß is a vector of estimated coefficients. It is assumed that the firm is from the reference industry (manufacture of food products and beverages) so all dummy variables for industries are zero. Results in brackets indicate that the estimated coefficient is not statistically significant at an error level of 0.05.

**Appendix I: Shares of firms from various groups in all firms (percentage)**

| | 2001 | | 2002 | | 2003 | | 2004 | |
|---|---|---|---|---|---|---|---|---|
| Part of German | West | East | West | East | West | East | West | East |
| Firms that do not trade | 18.0 | 29.5 | 18.6 | 28.3 | 17.2 | 26.0 | 16.7 | 27.3 |
| Firms that only export | 7.2 | 6.5 | 6.5 | 6.2 | 6.5 | 6.3 | 6.0 | 5.7 |
| Firms that only import | 15.3 | 25.1 | 14.8 | 25.0 | 14.3 | 24.5 | 14.9 | 24.8 |
| Firms that export and import | 59.5 | 39.0 | 60.1 | 40.6 | 62.0 | 43.2 | 62.4 | 42.2 |
| Firms with less than 50 employees | 49.0 | 59.4 | 49.4 | 60.2 | 48.9 | 59.5 | 48.5 | 60.2 |
| Firms with 50 to 249 employees | 40.8 | 37.4 | 40.5 | 36.4 | 40.8 | 37.0 | 41.4 | 36.4 |
| Firms with 250 to 499 employees | 6.1 | 2.3 | 6.1 | 2.6 | 6.1 | 2.5 | 6.0 | 2.5 |
| Firms with 500 and more employees | 4.2 | 0.8 | 4.0 | 0.7 | 4.2 | 0.9 | 4.1 | 0.9 |
| Firms that started before 1996 | 74.1 | 51.9 | 68.0 | 47.2 | 66.3 | 43.5 | 63.6 | 39.8 |
| Firms that started in 1996 or later | 25.9 | 48.1 | 32.0 | 52.8 | 33.7 | 56.5 | 36.4 | 60.2 |
| Firms with only one product | 39.8 | 40.5 | 38.8 | 40.4 | 39.3 | 41.8 | 40.0 | 41.1 |
| Firms with two or more products | 60.2 | 59.5 | 61.2 | 59.6 | 60.7 | 58.2 | 60.0 | 58.9 |

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**Appendix II: Descriptive statistics for variables included in the empirical models**

| **West Germany** | | 2001 | | 2002 | | 2003 | | 2004 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Exits | Survivors | Exits | Survivors | Exits | Survivors | Exits | Survivors |
| Firms that do not trade | | 21.0 | 17.7 | 24.7 | 18.2 | 25.2 | 16.8 | 22.9 | 16.5 |
| Firms that only export | | 9.0 | 7.0 | 9.8 | 6.3 | 10.1 | 6.3 | 10.1 | 5.8 |
| Firms that only import | | 16.6 | 15.2 | 14.7 | 14.9 | 15.2 | 14.3 | 15.8 | 14.9 |
| Firms that export and import | | 53.4 | 60.0 | 50.8 | 60.7 | 49.5 | 62.7 | 51.2 | 62.9 |
| Firms with less than 50 employees | | 49.7 | 48.9 | 52.3 | 49.2 | 56.4 | 48.4 | 52.6 | 48.3 |
| Firms with 50 to 249 employees | | 40.3 | 40.8 | 39.0 | 40.6 | 34.1 | 41.2 | 38.8 | 41.5 |
| Firms with 250 to 499 employees | | 5.8 | 6.1 | 5.7 | 6.1 | 5.2 | 6.2 | 4.5 | 6.0 |
| Firms with 500 and more employees | | 4.2 | 4.2 | 3.0 | 4.1 | 4.3 | 4.2 | 4.1 | 4.1 |
| Firms that started before 1996 | | 71.1 | 74.3 | 62.5 | 68.4 | 61.9 | 66.5 | 58.7 | 63.8 |
| Firms that started in 1996 or later | | 28.9 | 25.7 | 37.5 | 31.6 | 38.1 | 33.5 | 41.3 | 36.2 |
| Firms with only one product | | 39.8 | 39.8 | 39.0 | 38.8 | 39.9 | 39.3 | 41.1 | 40.0 |
| Firms with two or more products | | 60.2 | 60.2 | 61.0 | 61.2 | 60.1 | 60.7 | 58.9 | 60.0 |
| Labour productivity | mean | 126.4 | 135.2 | 118.2 | 133.8 | 126.2 | 136.8 | 134.6 | 144.0 |
| (sales per employee; 1000 Euro) | std. dev. | 128.3 | 148.8 | 112.2 | 143.3 | 176.0 | 145.6 | 172.9 | 164.5 |

| **East Germany** | | 2001 | | 2002 | | 2003 | | 2004 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Exits | Survivors | Exits | Survivors | Exits | Survivors | Exits | Survivors |
| Firms that do not trade | | 36.6 | 28.9 | 32.4 | 28.0 | 36.3 | 25.2 | 53.3 | 24.8 |
| Firms that only export | | 9.4 | 6.2 | 8.3 | 6.0 | 7.3 | 6.3 | 0.3 | 6.0 |
| Firms that only import | | 23.4 | 25.2 | 22.1 | 25.2 | 20.4 | 24.8 | 17.7 | 25.5 |
| Firms that export and import | | 30.6 | 39.7 | 37.2 | 40.8 | 35.9 | 43.7 | 25.6 | 43.8 |
| Firms with less than 50 employees | | 59.6 | 59.4 | 65.2 | 59.9 | 60.0 | 59.4 | 63.2 | 59.9 |
| Firms with 50 to 249 employees | | 38.1 | 37.3 | 30.8 | 36.9 | 35.5 | 37.2 | 33.9 | 36.6 |
| Firms with 250 to 499 employees | | 1.1 | 2.4 | 3.6 | 2.5 | 3.7 | 2.5 | 2.3 | 2.6 |
| Firms with 500 and more employees | | 1.1 | 0.8 | 0.4 | 0.8 | 0.8 | 1.0 | 0.6 | 0.9 |
| Firms that started before 1996 | | 45.7 | 52.4 | 41.9 | 47.6 | 38.0 | 43.8 | 29.9 | 40.8 |
| Firms that started in 1996 or later | | 54.3 | 47.6 | 58.1 | 52.4 | 62.0 | 56.2 | 70.1 | 59.2 |
| Firms with only one product | | 41.1 | 40.4 | 41.9 | 40.3 | 39.6 | 41.9 | 25.1 | 42.6 |
| Firms with two or more products | | 58.9 | 59.6 | 58.1 | 59.7 | 60.4 | 58.1 | 74.9 | 57.4 |
| Labour productivity | mean | 87.5 | 103.2 | 178.6 | 117.4 | 97.4 | 111.5 | 83.5 | 116.3 |
| (sales per employee; 1000 Euro) | std. dev. | 104.2 | 164.4 | 1237.9 | 665.4 | 128.6 | 169.8 | 124.0 | 178.5 |

Note: For a definition of exits and survivors see text. All variables with the exception of labour productivity are dummy variables coded as 1 if the firm belongs to the category and 0 else; the numbers in the table indicate the percentage share of firms from a category in all exits and all survivors, respectively, in the year.

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