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# Barriers to Exporting:
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## Abstract

Recent literature stresses the importance of low productivity as a barrier to the international expansion of firms. But financial frictions or adverse employment conditions at home could matter as well. In this paper, we present new empirical evidence on the importance of these factors. We use a detailed micro-level dataset of German firms which simultaneously provides information on exports, financial frictions, and labor market conditions. Our paper has three main findings. First, in line with earlier literature, we find a positive impact of size and productivity on firms' export activities. Second, financial constraints affect the entry into foreign market (extensive margin) more than the volume of exports (intensive margin). Third, labor market conditions have a mixed impact on export activities. The most consistent finding is that firms covered by collective bargaining agreements are less likely to be exporters and export less.

Keywords:            multinational firms, exports, firm heterogeneity, productivity, financial constraints, employment conditions

JEL-classification:    F2, G2

# 1 Motivation

The dominance of large firms in international markets has become one of the main stylized facts in the international trade literature. Multinational firms and exporters are larger than their domestic counterparts, and these size differences are largely driven by differences in productivity across firms. But productivity may not be the only factor affecting firms' export activities. In this paper, we explore whether firm-level heterogeneity with regard to internationalization is also driven by differences in firms' access to external finance or differences with regard to employment conditions that firms are facing at home. For this purpose, we use detailed micro-level data for German firms providing information on firms' export activities, their size and productivity, financial frictions, and labor market conditions.

From a theoretical point of view, our empirical approach is motivated by a model proposed by Melitz (2003). (See Greenaway and Kneller (2007) for a recent survey.) The key to the Melitz-model and its extensions is that, ex ante, firms do not know their productivity. Upon entry, firms draw their productivity level from a commonly known productivity distribution. Depending on the level of productivity, they exit the market, they produce only for the domestic market, or they become exporters. The reasons for different patterns of production and of market entry are fixed and variable costs of entering new markets. Costs of entering domestic markets are lower than the costs of exporting.

The implicit assumption in these models is that financial markets are fully developed and that firms can either finance foreign operations internally and/or without incurring an

external finance premium. This assumption is at odds with the large literature on financial restrictions that in particular smaller firms are facing. In the Melitz-model, firms are small and cannot enter foreign markets because they make a bad productivity draw. In reality, firms that are small are also particularly disadvantaged on capital markets due to information asymmetries. Hence, they face an additional barrier to going international. Our data indeed show that smaller firms are more likely to face financial constraints than larger firms (Table 1a). At the same time, the data indicate that larger firms are more likely to face restrictive employment conditions at home. They report expected wage cost problems, expected personnel shortages, or problems with workers protection laws more often than smaller firms. Larger firms are also covered by industry-wide wage agreements more often than smaller firms, and worker councils are active in larger firms only.

To motivate our analysis theoretically, we would ideally need a model which features firm-level heterogeneity with regard to productivity, financial frictions, and labor market conditions simultaneously. Yet, to the best of our knowledge, such a model is not available. We thus refer to models which extend the model by Melitz (2003) in order to take into account financial constraints. Chaney (2005) emphasizes the importance of firm-level liquidity constraints for sorting into foreign markets in the presence of exchange rate fluctuations. In Manova (2006), firms are heterogeneous with regard to their productivity, and they need external funds to finance the costs of exporting. The amount of external finance that firms can raise depends on the tangibility of firms' assets and on contract enforceability. Asset tangibility differs across sectors, and contract enforceability differs across countries. The model implies different productivity cut-off

levels for the selection into exporting. Highly productive firms can offer higher returns to creditors and are thus less credit constrained than less productive firms. In this sense, credit constraints reinforce the negative impact of low productivity for entry into foreign markets (extensive margin) and for the volume of exports (intensive margin). These predictions are tested using country-level data. Results show that financially developed countries are more likely to export bilaterally and to ship greater volumes.

Our focus will be in the impact of frictions at the firm-level. Previous firm-level evidence on the impact of financial constraints on the probability of exporting provides mixed results.[1] Greenaway et al. (2007) use a panel of 9,292 UK manufacturing firms over the period 1993 to 2002 and find that exporters exhibit better financial conditions than domestic firms. But when differentiating between continuous exporters and firms starting to export, they find that export-starters are in a worse financial state than continuous exporters and domestic firms. Exporting improves firms' financial health, but the hypothesis that financially healthy firms are more likely to become exporters is not supported. Similarly, Stiebale (2008) uses French firm-level data and fails to find a significant effect of financial constraints on exporting. In contrast, Du and Girma (2007) present empirical evidence on the role of financial constraints for Chinese exporters and find that better access to bank loans is associated with greater export market orientation.

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[1] Bridges and Guariglia (2006) test the impact of internationalization and financial constraints on firms' survival probabilities. Using a panel of 9,420 newly established UK firms over the period 1997-2002, they find that a higher collateral and a lower leverage ratio result in lower failure probabilities, while exporting or being foreign owned does not significantly affect these probabilities.

We depart from the existing literature in two ways. First, instead of using aggregated data as Manova (2006), we use firm level-data. Second, we simultaneously model the impact of productivity, financial frictions, and employment conditions on the foreign activities of German firms. We test three main hypotheses. The first is that low productivity serves as a barrier to foreign entry. The second is that firms with limited access to external finance are less likely to export. The third is that firms facing restrictive employment conditions which lower their productivity and/or increase wage costs are less likely to export.

To test these hypotheses, we use of a detailed firm-level survey of German firms. The main focus of this survey, the *IAB Establishment-Level Panel*, lies on labor market and employment conditions at the plant level.[2] In recent surveys, firms have additionally been asked about their international activities and about the financial constraints that they are facing. In the following second part, we develop the theoretical hypotheses underlying our study. In part three, we present descriptive statistics on productivity, financial constraints, employment conditions, and exports. Part four contains our regression results, and part five concludes. We find that larger and more productive firms are more likely to be exporters. They also export more than smaller and less productive firms. Financial frictions affect the probability of exporting more than the volume of exporting. Also, being covered by a collective bargaining agreement has a negative impact on export activities. Personnel shortages increase the probability of exporting.

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[2]     Throughout the paper, we use the term ‚firm' to denote the unit of observations in the empirical model, i.e. the individual plant. In 2006, 88% of the observed plants were independent firms. Our main findings do not change if the analysis is conducted with the sample of independent firms only.

## 2    Theoretical Hypotheses

The aim of this paper is to show the importance of (low) productivity, financial constraints, and employment conditions as barriers to entry into foreign markets. To motivate our analysis theoretically, we ideally need a model which features all of these aspects. Yet, to the best of our knowledge, such a model is not available. Hence, we mainly draw on a model by Manova (2006) which extends the model by Melitz (2003), in order to take financial constraints into account. The model assumes a world with $J$ countries and $S$ sectors. Since the theoretical framework is similar to the standard Melitz-model, we focus in the following on the model's implications arising from financial frictions.

Firms face different costs of operating in the home and in the foreign market. There are no fixed costs of serving the home market, and variable costs of production can be financed from cash flow. But production for the domestic market in country $j$ and sector $s$ requires variable costs $ac_{js}$, where $a$ denotes the inverse of the firm's productivity. The variable costs $c_{js}$ capture differences in factor prices across countries and differences in factor intensities across sectors. Although labor market frictions are not modeled explicitly, differences in productivity across firms can also be interpreted in terms of these frictions. Firms, for instance, which report wage cost problems or problems with worker protection laws, are likely to be less productive and to produce at higher costs than firms not reporting these problems.

Exporting by a firm from country $j$ to a foreign market $i$ involves a fixed cost $c_{js}f_{ij}$ for market entry and variable iceberg trading costs $\tau_{ij} > 0$. While variable costs can be

financed internally, the fixed costs of exporting require an industry-specific share of external finance $0 < d_s < 1$. Similarly, the share of intangible assets that firms can pledge as collateral is industry-specific: $0 < t_s < 1$.

A final parameter that describes the financial structure of the model is related to the level of financial contractibility. With probability $0 < \lambda_j < 1$, financial contracts are enforced. Since we consider firms from one country only, we have $\lambda_j = \lambda$.

Firms maximize their expected profits under the constraints (i) imposed by the production function, (ii) the investor's participation constraint, and (iii) the firm's participation constraint. In the absence of credit constraints, the investor's participation constraint does not bind, and the model has the same implications as the Melitz-model. If credit constraints bind though, the productivity cut-off for exporting depends on the importance of credit frictions.

In contrast to this model, which has predictions for the volume of exports between countries, our unit of analysis is the individual firm. Applying a similar logic as above, we can specify the probability of a given firm $k$ to export in period $t$ as:

$$\Pr(X_{kt}) = \alpha_0 + \alpha_s + \alpha_1 \left(\frac{Y}{L}\right)_{kt-1} + \alpha_2 \cdot d_{k,t-1}^K + \alpha_3 \cdot d_{k,t-1}^L + X_{k,t-1}{}'\alpha + \varepsilon_{kt} \qquad (1)$$

where $\Pr(X_k)$ is the probability of firm $k$ being an exporter. $\alpha_0$, $\alpha_1$, and $\alpha_2$ are scalar coefficients, $\alpha$ and $\alpha_3$ are column vectors of regression coefficients, $\alpha_s$ are sector fixed effects. $\varepsilon_{kt}$ is the error term. We include firm-level proxies for financial constraints

($d_{k,t-1}^{K}$), for employment conditions ($d_{k,t-1}^{L}$), and a set of control variables $\mathbf{x}_{k,t-1}$. We will return to the measurement of these factors below (Section 4.1).

We use equation (1) to test three main hypotheses. First, more productive firms are more likely to be exporters and also ship greater volumes. Hence, $\alpha_1$ should be positive. Second, tighter financial constraints lower the probability of exporting and export volumes. Hence, $\alpha_2$ should be negative. Third, firms facing adverse employment conditions at home which lower productivity are less likely to become exporters. Accordingly, if $d_{k,t-1}^{L}$ measures adverse employment conditions, we expect a negative sign for $\alpha_3$.

# 3    Data and Descriptive Statistics

The theoretical hypotheses derived above are tested using a representative establishment-level panel data-set for 16,000 German firms (*IAB-Betriebspanel*). (Table A1 in the Appendix provides an overview of the data.) Firms covered by the survey provide information on whether and how much they export. Most German firms are active only domestically. Only approximately 12% of all firms serve foreign markets via exporting. In this section, we describe the main patterns in the data with regard to financial constraints, employment conditions, and productivity, and we link these patterns to the export activities of firms.

## 3.1    *Financial Constraints*

Our data allow measuring financial constraints in two ways. First, we use self-reported information on the presence of financial constraints. In 2004, firms that invested into real

estate, information and communication technology, production facilities, plant and equipment, or transportation equipment were asked whether they faced problems to raise outside capital on the private capital market (*yes / no*). Firms also report whether these difficulties had negative implications for their plant-level investment activities. Second, firms report the share of investment that is financed by cash flow. We interpret a high share of cash flow as evidence for high internal funds and thus low financial constraints.

Overall, 9% of all firms that have invested in 2004 self-report financial constraints. Table 1a also shows that the presence of financial constraints is related to the size of firms. Whereas 10% of all firms with 1-4 employees report financial constraints, only 4% of those with more than 500 employees do so. If financial constraints constitute a barrier to exporting, this could explain why only the larger German firms export.

Table 1b provides additional evidence on the importance of financial constraints across sectors. A capital-intensive production may, for instance, call for higher financial needs. Also, industries with a large share of firm-specific capital used in the production process and low inventories of intermediate and final goods may have difficulties to pledge collateral. To check whether differences in financial constraints prevail across industries, Data reported in Table 1b indeed display heterogeneity between different industries regarding the share of credit constrained firms. The share of credit-constrained firms is lower in the service sector than in manufacturing and transportation.

## 3.2    Employment Conditions

The *IAB Establishment-Level Panel* also provides detailed information on employment conditions. We use information on the importance of personnel shortages, wage cost

problems, problems regarding worker protection laws, the existence of a worker council, and coverage by collective bargaining agreements. These frictions could be additional barriers or triggers to entry into foreign markets. Additionally, we have information on the share of high- and low-skilled employment.

Overall, about 39% of all firms are subject to collective bargaining agreements. Nearly a third of the firms (31%) expect high labor costs. Every fifth firm has a worker council and expects personnel shortages. Problems regarding worker protection laws and firm-specific collective bargaining agreements seem to be less of a problem for most firms.

While financial constraints are more binding for the smaller firms, Table 1a shows that most labor market constraints are more relevant for the larger firms. To some extent, this is due to the fact that some of these constraints are related to legislation that does not cover small firms with less than 20 employees. This particularly holds for worker councils and collective bargaining agreements. Yet, even for firms with more than 20 employees, reported employment problems increase continuously in firm size. For example, 64% of firms with more than 500 employees report to suffer from high labor costs. Every second firm in this size group reports personnel shortages.

## 3.3    Technology and Productivity

Lacking information on the capital stock, we measure productivity using sales or value added per employee. We correct for part-time workers and calculate value added as sales minus intermediate inputs. For the years 2003 and 2005, firms also provide information on their level of technology. Technology is measured in an ordinal scale from 1 (best) to 5 (worst). Since firms using more modern and efficient technologies are more productive,

we expect a negative impact of this variable on the extensive and intensive margin of exporting.

## 3.4    Are Exporters Different?

Evidence presented so far shows that smaller German firms are more likely to be financially constrained, that larger firms are more likely to face adverse employment conditions, and that firms also differ with regard to their productivity and technology used. In this section, we analyze whether these features are related to the export activities of firms.

Table 2 gives an overview on indicators of German firms, differentiated by their self-reported financial constraints and employment conditions. Table 2a shows that financially constrained firms differ significantly from unconstrained firms. Financially constrained firms are less productive than their non-restricted counterparts. These firms are smaller in terms of size (measured as the number of employees) and have lower sales. Additionally, their export volume is lower. There is one main exception. Even though their export volume is smaller, firms facing restricted access to outside credit are more likely to export. Furthermore, since these firms are smaller, they show a slightly higher export-sales-ratio.

Moreover, we can group firms into those exporting to the Euro area and those exporting to countries outside the Euro area. Because of higher export entry costs in the latter case, we expect that firms which export to these countries face lower credit constraints. We in fact find that firms exporting to countries outside the Euro area report to be financially

constrained less often (10% of the firms) than those exporting to countries outside the Euro area (12%).

One major proposition of Manova (2006) is that firms subject to credit constraints need to be more productive in order to become exporters than firms without financial restrictions. Table 3 displays mean labor productivity for credit constrained and unconstrained firms by export status. While export firms are more productive than domestic firms, the data do not support the hypothesis that financially constrained exporters are more productive than their unconstrained counterparts.

Table 2b gives similar information for different employment conditions. Firms subject to labor market restrictions differ from other firms. Firms facing high labor costs, personnel shortages, and problems regarding worker protection laws, as well as firms being covered by collective bargaining and having worker councils are bigger in terms employees and sales than firms not facing these conditions. With the exception of firms subject to collective bargaining these firms are also more export orientated: they export more often and they have a higher export-to-sales ratio. In the empirical analysis below, we will disentangle whether the higher propensity to export is related to employment conditions or whether it merely captures a size effect.

In terms of productivity, there are some differences. Firms that report labor cost problems are less productive than those which do not report such problems. Firms with a worker council or that are subject to collective bargaining agreements are more productive. This seems to be a size effect, though. There are no obvious effects of employment conditions on the level of technology used in the firms.

# 4 Barriers to Internationalization: Regression Results

Our aim in this paper is to disentangle productivity, financial frictions, and employment conditions as barriers for firms' entry into foreign markets. We have three main hypotheses. First, we expect a positive effect of productivity on the probability to become an exporter and the volume of exports. Second, we expect that financial constraints hinder exporting. Third, labor market conditions that lower firms' productivity can constitute a barrier to exporting as well.

## 4.1 *Explanatory Variables*

We test the effects of financial and employment conditions on the probability of becoming an exporter and on the volume of exports by estimating equation (1). The empirical analysis proceeds in two steps. First, we estimate a Heckman selection model to analyze the determinants of the selection into exporting (the extensive margin) and of the volume of exports (the intensive margin). Second, to check the robustness of our results, we run probit models to analyze the determinants of the probability of starting to export or to increase the volume of exports. In this latter specification, the dependent dichotomous variable takes the value of 1 if firms increase exports and 0 if firms decrease exports or do not export at all. For each model, we present specifications including and excluding proxies for financial constraints or variables measuring employment conditions to further check the robustness of our results.

We specify the explanatory variables in equation (1) as follows. Productivity is measured as $\left(\dfrac{Y}{L}\right)_{k,t-1}$ which gives labor productivity in $t$-1. The expected sign is positive.

Financial constraints ($d_{k,t-1}^{K}$) are measured using self-reported financial constraints. We expect a negative sign.[3] Firms that are able to finance a higher share of their investment with cash flow should also face less severe financial constraints; hence the expected sign is positive.

Employment conditions are measured by a vector $d_{k,t-1}^{L}$ which includes dummy variables indicating whether a firm reports adverse employment conditions. Additionally we include the share of unskilled employees. The sign of the employment variables is not clear a priori. Employment conditions could constitute a barrier to firms' export activities if they lower the productivity of firms. Accordingly, firms reporting high wage costs or personnel shortages should be less likely to be exporters. Similarly, if collective bargaining agreements, the presence of worker councils, or worker protection laws impose costs on firms and reduce their flexibility, firms should become less likely to export. At the same time, more rigid employment conditions at home may also increase the incentives of firms to engage in international markets and to stabilize their sales through exports. Through this channel, rigid employment conditions could also increase the probability of firms to export.

Among our lagged control variables $\mathbf{x}_{k,t-1}$ the reported level of technology as a discrete, ordinal variable from 1 (best) to 5 (worst) serves as a proxy for collateralizable assets. We expect this variable to have a negative impact. We also control for firm-level R&D activity and innovative output, which should have a positive impact on exporting, and

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[3]      We have also estimated an equation with an interaction term between productivity and financial constraints. Since this interaction term has been insignificant, results are not reported.

problems regarding innovation, for which we expect a negative impact. Finally, the vector of control variables includes a measure for firm size (log employment).

## 4.2    Heckman Selection Model

Our main empirical model to analyze the determinants of the extensive and intensive margin of firms' exports is a Heckman selection model (Table 4). For the identification of the selection equation, we include dummy variables for collective bargaining agreements, worker councils, and a variable indicating whether the firm is located in Eastern or Western Germany. These variables are excluded from the outcome equation. We report results for the maximum likelihood estimation; these do not differ significantly from the results of the two step estimation approach.

The first result is that selection into exporting (i.e. the extensive margin) does not affect the firms' choice of the volume of exports (i.e. the intensive margin). The coefficient estimate for the Mills Ratio is insignificant throughout.

Results presented in Table 5 also show that both, selection into exporting and the volume of exports are positively related to size and productivity. However, we cannot find any effects for the (self-reported) level of technology.

The self-reported measure of financial constraints affects the selection into exporting and the intensive margin of exporting in a different way. There is a significantly positive impact of financial constraints on the probability of being an exporter but no effect on the volume of exports. This result is robust with regard to including additional control variables. The positive impact of financial constraints on the probability of being an exporter is surprising at first sight as it suggests that exporters are more, not less

financially constrained than non-exporters. The fact that the majority of the firms in our sample do not switch exporter status over time can help explain this perhaps counterintuitive result. According to this interpretation, exporters have tighter financial constraints *ex post*. Below, we will also analyze whether tighter *ex ante* financial constraints affect the probability of starting to export. Cash flow as an additional measure of financial constraints has a positive and significant impact on firms' expansions along the extensive *and* the intensive margin, as expected.

Regarding employment conditions, we find the most consistent result for collective bargaining agreements. Being covered by a collective bargaining agreement lowers the probability of exporting. High wage costs have a negative impact on the volume of activities; problems with workers protection legislation lower the probability of exporting. These results would be consistent with the hypothesis that rigid employment conditions at home lower firms' productivity and limit their propensity to export. Problems with personnel shortages, in contrast, increase the probability of firms to become exporters. One explanation for this effect could be that some of the exporters in our sample are also multinationals which operate production facilities abroad. Finally, the presence of workers councils and the share of low-skilled employees have no significant impact.

Several control variables are significant. The dummy variable for R&D activity affects both, the export volume and the selection into exporting, in a highly significant and positive way. Innovation activity has an (positive) impact only on the extensive margin.

In sum, financial constraints affect the extensive more than the intensive margin. Productivity and technology, in contrast, matter relatively more for the expansion along the intensive margin. The impact of employment conditions is similar.

## 4.3 Probit Regressions

Tables 5 and 6 provide results for the determinants of being an export starter (extensive margin), and the probability to increase the share of exports in total sales (intensive margin).

Regression results with regard to export starters (Table 5) show a positive influence of productivity. However, the effect of productivity becomes weaker in terms of significance when additionally including measures of financial frictions. Financing constraints have a negative and significant impact on the probability to become an exporter. Taken together with the positive link between financial constraints and exporter status (see Table 4), this finding is consistent with a negative impact of *ex ante* financial constraints on the probability to start exporting and a positive link between *ex post* financial constraints on exporter status.

Measures for technology or R&D activity have no significant impact on the probability to start exporting. Size (the log of employment) has no significant impact on the probability to start exporting, which is consistent with the relatively small impact of productivity. Employment conditions have an impact on the probability to become an exporter as well. Firms covered by collective bargaining agreements are less likely to be exporters than firms not covered by these agreements.

Overall, results for the probit model support those for the Heckman selection equation concerning the impact of productivity and employment conditions. However, the implications for the impact of financial frictions differ. One explanation for these differences is that, in the probit model, we estimate the probability of becoming an exporter for the first time. In the Heckman selection equation, we estimate whether a firm is an exporter or not. Since first-time entry is associated with higher fixed costs, we would expect a stronger impact of financial constraints.

Turning next to the determinants of an increase in the volume of exports, i.e. the intensive margin, some of the above results change (Table 6). In contrast to results for the extensive margin of firms' exports, size is now positive and highly significant. Productivity is highly significant as well. Also, there is evidence that technology matters. Firms reporting R&D and innovations increase their exports relative to their total sales, and firms reporting innovation problems do not increase their export-to-sales ratios. As regards the impact of the employment situation, the picture is similar to the one painted before. Firms with personnel shortages increase exports, and firms covered by collective bargaining decrease exports. With regard to the impact of financial constraints, the picture is less clear cut. Cash flow is positive and significant. Self-reported financial constraints are insignificant. By and large, these results are in line with those for the determinants of the intensive margin obtained from the Heckman model.

## 5    Conclusions

Firms that are active on international markets are larger than their domestic counterparts. In this paper, we analyze to what extent differences in internationalization patterns of

firms are the result of differences in productivity and technology, differences in access to external finance, or differences in employment conditions at home.

We use a detailed firm-level dataset for German firms to analyze the importance of financial and employment conditions versus productivity constraints for exports of German firms. Our paper has three main findings.

First, being small and having a low productivity constitutes a barrier to exporting. In this sense, our results are in line with earlier research on export behavior at the firm-level.

Second, our results suggest a complementary interpretation of the fact that exporters are larger than domestic firms. Firms that are subject to financial constraints are smaller and less productive than other firms. Financial constrained firms, in turn, are less likely to become exporters for the first time and they export smaller volumes than larger, less financially constrained firms.

Third, employment conditions have a significant impact on export activities as well. Since adverse employment conditions affect large firms more than smaller firms, this effect partly counteracts the impact of productivity and financial frictions. In particular the presence of collective bargaining agreements has a significantly negative impact on firms' export activities. High wage costs and tight worker protection legislation have a negative impact in some specifications as well. Also, firms with personnel shortages at home are more likely to become internationally active. This could be due to the fact that some of the exporters under study here also maintain production affiliates abroad.

Our results have important policy implications as they show that financial constraints matter for the export activities of firms. Financial constraints could thus be one channel

through which the recent financial crisis spills over into the real economy. In fact, anecdotal evidence suggests that access to trade credit has become more restricted recently. According to our results, this tightening of credit may particularly affect new exporters.

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# 7 Appendix

**Table A1: Data Definitions and Availability**

The empirical analysis in this paper is based on data taken from the *IAB Establishment-Level Panel* (*IAB Betriebspanel*). (See http://betriebspanel.iab.de/infos.htm for details.) The following Table gives a summary of data available from the *IAB Establishment-Level Panel*, which are used for this project. The *IAB Establishment-Level Panel* is a large panel dataset, which is representative for German firms. The panel is a survey of German firms with a special focus on employment conditions. The survey has been conducted annually since 1993, and panel data are available for about 16,000 plants representative of all sectors and size classes.

| | Measurement | Measured in | | | Referring to period | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2004 | 2005 | 2006 | 2002 | 2003 | 2004 | 2005 | 2006 |
| Financial constraints | Dummy variable reporting problems to raise external capital for investments (see section 3.1) | | x | | | | x | | |
| Cash flow | Share of cash flow in investments | | x | | | | x | | |
| Export share | Share of foreign sales in total sales | x | x | x | (x) | x | x | x | (x) |
| Productivity | Labor productivity (value added / employment), Value added is sales less intermediate inputs | x | x | x | (x) | x | x | x | (x) |
| Investment subsidies | Share of subsidies in financing investments | x | x | | | x | x | | |
| Level of technology | Discrete variable from 1 (best) to 5 (worst) (self reported) | | x | x | | | | x | x |
| Expected personnel shortage | Dummy variable reporting personnel shortage, Reasons: 1. Lack of employees, junior staff or skilled employees; 2. Demand for vocational training; 3. Brain drain | x | | | | | | x | x |
| Expected wage cost problems | Dummy variable reporting wage cost problems, Reasons: 1. Abundance of human resources; 2. Problems with wage costs | x | | | | | | x | x |
| Expected problems with worker protection laws | Dummy variable reporting problems with worker protection laws Reasons: 1. Maternity protection; 2. Partial retirement; 3. Part-time occupation | x | | | | | | x | x |
| Worker council | Dummy variable reporting existence of a works council | x | | | | | x | | |
| Collective bargaining | Dummy variable reporting existence of collective bargaining in any modality | x | | | | | x | | |
| Share of unskilled employees | Number of unskilled employees divided by total employment | x | x | x | | | x | x | x |
| R&D | Dummy variable reporting existence of R&D activity | x | | | | | x | | |
| Innovations | Dummy variable reporting whether innovations are implemented | x | | | | x | x | | |
| Innovation problems | Dummy variable reporting innovation problems | x | | | | x | x | | |

**Table A2: Descriptive Statistics**

| Variable | Observations | Mean | Standard deviation |
|---|---|---|---|
| Sales productivity (sales / employment) (2006) | 10,191 | 131,453 | 222,031 |
| Labor productivity (value added / employment) (2006) | 9,243 | 58,221 | 105,841 |
| Value added (2006) | 9,244 | 889,959 | 11,439,708 |
| Employees (2006) (full time equivalent) | 15,444 | 14 | 98 |
| Employees (2006) | 15,449 | 17 | 109 |
| Expected wage cost problems (2004) | 10,923 | 31 % | 0.46 |
| Expected personnel shortage (2004) | 10,923 | 19 % | 0.39 |
| Expected problems with worker protection laws (2004) | 10,923 | 5 % | 0.23 |
| Worker council (2004) | 12,938 | 19 % | 0.40 |
| Industry-wide collective bargaining agreement (2004) | 10,899 | 39 % | 0.487 |
| Firm-specific collective bargaining agreement (2004) | 10,899 | 3 % | 0.17 |
| Share of unskilled employees (2006) | 15,499 | 17 % | 0.26 |
| Share of skilled employees (2006) | 15,449 | 7 % | 0.21 |
| R&D (0/1) (2004) | 10,923 | 5 % | 0.22 |
| Innovative firms (2004) | 10,923 | 28 % | 0.45 |
| Innovation problems (2004) | 10,923 | 8 % | 0.27 |
| Level of technology (1 best, 5 worst) (2005) | 12,727 | 2.19 | 1.08 |
| Mean share of cash flow used in investments (2005) | 8,370 | 69 % | 43 |

Source: IAB Betriebspanel, own calculations

**Table 1: Share of Firms Subject to Credit and Labor Market Constraints**

Data are for the year 2004 and are given in percent of all firms. For reason of data confidentiality, the agricultural and the financial sector as well as public services are not displayed. However, these sectors are included in the regression analysis.

<u>(a) By Size</u>

|  | 1-4 employees | 5-19 employees | 20-99 employees | 100-249 employees | 250-499 employees | 500 + employees |
|---|---|---|---|---|---|---|
| Share of credit constrained firms | 10% | 8% | 9% | 4% | 6% | 4% |
| Expected wage cost problems | 19% | 35% | 50% | 57% | 57% | 64% |
| Expected personnel shortage | 11% | 19% | 34% | 43% | 51% | 52% |
| Expected problems with worker protection laws | 1% | 6% | 12% | 23% | 24% | 33% |
| Industry-wide collective bargaining | 27% | 43% | 51% | 63% | 68% | 80% |
| Firm-specific collective bargaining | 1% | 3% | 6% | 10% | 12% | 11% |
| Worker council | 7% | 20% | 50% | 79% | 90% | 96% |

<u>(b) By Sector</u>

|  | Manufac-turing | Construc-tion | Retail and whole sale | Transpor-tation | Business services | Other services |
|---|---|---|---|---|---|---|
| Share of credit constrained firms | 11% | 8% | 10% | 12% | 9% | 7% |
| Expected wage cost problems | 40% | 42% | 29% | 32% | 26% | 29% |
| Expected personnel shortage | 27% | 20% | 17% | 23% | 17% | 17% |
| Expected problems with worker protection laws | 5% | 1% | 5% | 4% | 4% | 7% |
| Industry-wide collective bargaining | 45% | 59% | 37% | 32% | 15% | 39% |
| Firm-specific collective bargaining | 3% | 2% | 3% | 4% | 2% | 3% |
| Worker council | 24% | 10% | 15% | 23% | 13% | 22% |

Source: *IAB Betriebspanel*, own calculations

**Table 2: Performance Indicators by Type of Firm**

(a) By Financial Constraints

|  | Financial constraints (Self-reported) | |
|---|---|---|
|  | Yes | No |
| Share of exporting firms (%) | 19 | 15 |
| Export-sales-ratio (%) | 6 | 4 |
| Mean export volume (1,000 Euro) | 253.8 | 797.4 |
| Mean number of employees | 17 | 24 |
| Mean sales (1,000 Euro) | 1,862 | 9,743 |
| Mean labor productivity (1,000 Euro) | 41.7 | 62.5 |
| Mean level of technological equipment (1 newest, 5 oldest) | 2.1 | 2.3 |

(b) By Employment Conditions

|  | Wage cost problems | | Personnel shortage | | Worker protection laws | | Collective bargaining | | Worker council | |
|---|---|---|---|---|---|---|---|---|---|---|
|  | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No |
| Share of exporting firms (%) | 13 | 10 | 20 | 9 | 16 | 10 | 8 | 12 | 19 | 9 |
| Export-sales-ratio (%) | 3 | 3 | 5 | 2 | 4 | 3 | 2 | 4 | 5 | 2 |
| Mean export volume (1,000 Euro) | 732.9 | 261.8 | 1,081.1 | 255.2 | 2,153.3 | 323.3 | 751.9 | 231.5 | 2,328.4 | 83.8 |
| Mean number of employees | 28 | 13 | 34 | 14 | 57 | 15 | 26 | 12 | 53 | 9 |
| Mean sales (1,000 Euro) | 3,759.9 | 1,793.9 | 4,802.9 | 1,867.3 | 9,105.7 | 2,079.9 | 3,968.7 | 1,594.2 | 10,289.1 | 1,003.6 |
| Mean labor productivity (1,000 Euro) | 54.4 | 63.1 | 60.5 | 60.1 | 62.8 | 60.0 | 66.3 | 56.7 | 78.7 | 55.0 |
| Mean level of technological equipment (1 newest, 5 oldest) | 2.3 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 |

Source: *IAB Betriebspanel*, own calculations

**Table 3: Mean Labor Productivity by Export Status and Credit Constraints**

Credit constraints are based on self-reported answers to the question whether a given firm faced credit constraints. Data are in Euro for the year 2004.

|  | Domestic firms | Exporters |
|---|---|---|
| Unconstrained firms | 60,467 | 79,521 |
| Financially constrained firms | 39,583 | 65,158 |

Source: *IAB Betriebspanel*, own calculations

## Table 4: Determinants of Exports – Heckman Selection Model

This Table gives results of the distributed lag cross-sectional Heckman selection regression of the volume of export activity on various lagged regressors. The dependent variable is the natural logarithm of volume of exports (in Euro) in 2005. The variables worker council, collective bargaining, and East Germany are excluded from the volume regression for identification. Robust z statistics in parenthesis * significant at 10%; ** significant at 5%; *** significant at 1%.

| | (1) | | (2) | | (3) | | (4) | |
|---|---|---|---|---|---|---|---|---|
| | Volume | Selection | Volume | Selection | Volume | Selection | Volume | Selection |
| log Productivity (*t*-1) | 1.061*** | 0.307*** | 1.108*** | 0.342*** | 1.164*** | 0.325*** | 1.108*** | 0.310*** |
| | (18.00) | (10.45) | (19.98) | (13.96) | (21.17) | (12.97) | (19.24) | (10.25) |
| log Employees | 1.128*** | 0.256*** | 1.158*** | 0.270*** | 1.093*** | 0.223*** | 1.087*** | 0.184*** |
| | (32.50) | (13.93) | (36.94) | (17.38) | (39.43) | (13.98) | (37.60) | (9.43) |
| Financial constraints 0/1 (*t*-1) | 0.105 | 0.183** | | | | | -0.006 | 0.079*** |
| | (0.81) | (2.06) | | | | | (0.15) | (2.92) |
| Cash flow (share) (*t*-1) | 0.002** | 0.002*** | | | | | | |
| | (2.29) | (3.67) | | | | | | |
| Wage cost problems 0/1 (*t*-1) | | | -0.175*** | -0.063 | | | -0.111* | -0.054 |
| | | | (2.80) | (1.57) | | | (1.65) | (1.11) |
| Personnel shortage 0/1 (*t*-2) | | | 0.054 | 0.257*** | | | -0.019 | 0.153*** |
| | | | (0.81) | (6.18) | | | (0.28) | (3.08) |
| Problems with worker protection laws 0/1 (*t*-1) | | | -0.019 | -0.185*** | | | -0.011 | -0.130* |
| | | | (0.21) | (2.92) | | | (0.12) | (1.78) |
| Share of unskilled employees (*t*-1) | | | -0.184 | -0.153* | | | -0.008 | 0.091 |
| | | | (1.45) | (1.86) | | | (0.05) | (0.89) |
| Worker council 0/1 (*t*-1) | | -0.013 | | -0.013 | | -0.064 | | -0.020 |
| | | (0.25) | | (0.25) | | (1.20) | | (0.33) |
| Collective bargaining 0/1 | | -0.528*** | | -0.537*** | | -0.481*** | | -0.498*** |
| | | (10.12) | | (12.17) | | (10.55) | | (9.32) |
| R&D (*t*-1) | | | | | 0.703*** | 0.654*** | 0.576*** | 0.654*** |
| | | | | | (7.34) | (12.30) | (5.51) | (11.07) |
| Innovations 0/1 | | | | | 0.027 | 0.301*** | 0.004 | 0.240*** |
| | | | | | (0.32) | (6.88) | (0.04) | (4.65) |
| Innovation problems 0/1 (*t*-1) | | | | | -0.089 | 0.032 | -0.038 | 0.072 |
| | | | | | (1.10) | (0.54) | (0.45) | (1.09) |
| Bad technology 1/5 (*t*-1) | | | | | -0.045 | 0.027 | | |
| | | | | | (1.11) | (1.04) | | |
| East Germany 0/1 | | -0.205*** | | -0.263*** | | -0.250*** | | -0.210*** |
| | | (4.08) | | (6.04) | | (5.79) | | (3.91) |
| Mills Ratio | -0.1593 | | 0.081 | | 0.199 | | -0.169 | |
| | (0.79) | | (0.47) | | (1.13) | | (0.83) | |
| Constant | -2.722*** | -4.040*** | -3.347*** | -4.383*** | -4.173*** | -4.485*** | -3.186*** | -4.108*** |
| | (3.16) | (11.22) | (4.12) | (14.44) | (4.97) | (14.11) | (3.71) | (10.83) |
| Observations | 4,689 | 4,689 | 7,742 | 7,742 | 7,493 | 7,493 | 4,789 | 4,789 |

## Table 5: Determinants of Export Starters (Extensive Margin)

In this Table we present the output of the distributed lag cross-sectional probit regression of export starters (0/1) on various lagged regressors. The dependent variable takes the value 1 if a firm has not been exporting in 2004 but started to export in 2005 and 0 otherwise. Robust z statistics in parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| log Productivity ($t$-1) | 0.079*** | 0.052 | 0.061 | 0.089*** | 0.074** | 0.067* |
| | (2.64) | (1.51) | (1.58) | (2.80) | (2.37) | (1.82) |
| log Employees | 0.017 | 0.006 | -0.008 | 0.056** | 0.011 | 0.042 |
| | (1.01) | (0.30) | (0.39) | (2.28) | (0.57) | (1.48) |
| Financial constraints 0/1 ($t$-1) | | -0.035** | -0.043** | | | -0.041** |
| | | (2.03) | (2.29) | | | (2.35) |
| Cash flow (share) ($t$-1) | | | -0.001 | | | |
| | | | (1.56) | | | |
| Wage cost problems 0/1 ($t$-1) | | | | 0.005 | | 0.023 |
| | | | | (0.08) | | (0.31) |
| Personnel shortage 0/1 ($t$-2) | | | | 0.113 | | 0.145** |
| | | | | (1.64) | | (1.97) |
| Problems with worker protection laws 0/1 ($t$-1) | | | | -0.037 | | -0.053 |
| | | | | (0.34) | | (0.47) |
| Worker council 0/1 ($t$-1) | | | | -0.109 | | -0.135 |
| | | | | (1.16) | | (1.38) |
| Collective bargaining 0/1 ($t$-1) | | | | -0.225*** | | -0.240*** |
| | | | | (3.26) | | (3.19) |
| Share of unskilled employment ($t$-1) | | | | -0.163 | | -0.074 |
| | | | | (1.31) | | (0.55) |
| R&D 0/1 ($t$-1) | | | | | -0.053 | -0.004 |
| | | | | | (0.54) | (0.04) |
| Innovations 0/1 | | | | | 0.133* | 0.056 |
| | | | | | (1.92) | (0.74) |
| Innovation problems 0/1 ($t$-1) | | | | | -0.058 | -0.022 |
| | | | | | (0.59) | (0.22) |
| Bad technology 0/1 ($t$-1) | | | | | -0.056 | |
| | | | | | (1.40) | |
| Constant | -2.786*** | -2.441*** | -2.416*** | -2.892*** | -2.615*** | -2.662*** |
| | (8.10) | (6.16) | (5.33) | (7.88) | (6.90) | (6.27) |
| Industry dummies | yes | yes | yes | yes | yes | yes |
| Observations | 8,069 | 6,332 | 5,028 | 8,053 | 7,822 | 6,323 |
| Pseudo R–squared | 0.0202 | 0.0156 | 0.0181 | 0.0304 | 0.0244 | 0.0290 |

**Table 6: Determinants of an Increase of Export Volume (Intensive Margin)**

In this Table we present the output of the distributed lag cross-sectional probit regression of an increase in export activity (0/1) on various lagged regressors. The dependent variable takes the value 1 if the firm increased its share of exports in total sales from 2004 to 2005 and 0 otherwise. Robust z statistics in parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| log Productivity (*t*-1) | 0.180*** | 0.139*** | 0.127*** | 0.194*** | 0.164*** | 0.151*** |
| | (7.75) | (5.52) | (4.56) | (8.05) | (6.74) | (5.72) |
| log Employees | 0.125*** | 0.113*** | 0.117*** | 0.159*** | 0.090*** | 0.115*** |
| | (10.84) | (8.90) | (8.10) | (9.65) | (6.86) | (6.18) |
| Financial constraints 0/1 (*t*-1) | | -0.015 | -0.01 | | | -0.028* |
| | | (1.04) | (0.63) | | | (1.95) |
| Cash flow (share) (*t*-1) | | | 0.001** | | | |
| | | | (2.06) | | | |
| Wage cost problems 0/1 (*t*-1) | | | | -0.043 | | -0.045 |
| | | | | (0.97) | | (0.93) |
| Personnel shortage 0/1 (*t*-2) | | | | 0.153*** | | 0.113** |
| | | | | (3.26) | | (2.27) |
| Problems with worker protection laws 0/1 (*t*-1) | | | | -0.018 | | -0.003 |
| | | | | (0.26) | | (0.04) |
| Worker council 0/1 (*t*-1) | | | | 0.007 | | -0.041 |
| | | | | (0.11) | | (0.64) |
| Collective bargaining 0/1 | | | | -0.356*** | | -0.322*** |
| | | | | (7.37) | | (6.21) |
| Share of unskilled employment (*t*-1) | | | | -0.09 | | 0.054 |
| | | | | (1.07) | | (0.59) |
| R&D (*t*-1) | | | | | 0.334*** | 0.336*** |
| | | | | | (5.75) | (5.67) |
| Innovations 0/1 | | | | | 0.230*** | 0.165*** |
| | | | | | (4.74) | (3.15) |
| Innovation problems 0/1 (*t*-1) | | | | | -0.132** | -0.097 |
| | | | | | (1.99) | (1.46) |
| Bad technology 1/5 (*t*-1) | | | | | -0.034 | |
| | | | | | (1.16) | |
| Constant | -3.407*** | -2.849*** | -2.776*** | -3.550*** | -3.244*** | -3.102*** |
| | (12.94) | (9.92) | (8.60) | (12.83) | (11.11) | (10.18) |
| Industry dummies | yes | yes | yes | yes | yes | yes |
| Observations | 8,069 | 6,332 | 5,028 | 8,053 | 7,822 | 6,323 |
| Pseudo R–squared | 0.1383 | 0.1273 | 0.1296 | 0.1517 | 0.1584 | 0.1533 |