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Barriers to Internationalization: Firm-Level Evidence from Germany

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Barriers to Internationalization:
Firm-Level Evidence from Germany

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Abstract

Exporters and multinationals are larger and more productive than their domestic counterparts. In addition to productivity, financial constraints and labor market constraints might constitute barriers to entry into foreign markets. We present new empirical evidence on the extensive and intensive margin of exports and FDI based on detailed micro-level data of German firms. Our paper has three main findings. First, in line with earlier literature, we find a positive impact of firm size and productivity on firms' international activities. Second, small firms suffer more frequently from financial constraints than bigger firms, but financial conditions have no strong effect on internationalization. Third, labor market constraints constitute a more severe barrier to foreign activities than financial constraints. Being covered by collective bargaining particularly impedes international activities.

Keywords: foreign direct investment, exports, firm heterogeneity, productivity, financial constraints, labor market constraints

JEL-classification: F2, G2

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1   Motivation

The recent global financial and economic crisis has been accompanied by an unprece-dented decline in international trade volumes (Freund 2009). Apart from the slump in global demand, restricted access to trade finance could be one reason for this decline. The associated tightening of financial market conditions may also have a negative feedback effect on the activities of multinational firms (UNCTAD 2008). While it is too early to assess the impact of the financial crisis, this paper adds to a growing literature stressing the importance of financial constraints for international activities of firms. Moreover, we analyze the importance of labor market constraints. We use a detailed firm-level dataset for Germany, which provides information on firms' international activities, access to external capital, size, productivity, labor market constraints, and their R&D activity. Our results confirm earlier studies that find an important effect of firm size and productivity on foreign activities. The impact of financial constraints is weak, but labor market constraints matter in particular for the extensive margin of foreign activities.

From a theoretical point of view, the impact of firm-level characteristics on exports and FDI is motivated by the observation that highly productive firms self-select into exporting (Melitz 2003, Helpman et al. 2004). The key to the Melitz model 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 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.

Recently, the role of financial constraints on the international activity of heterogeneous firms has been addressed in theoretical models that stand in the tradition of Melitz (2003). Chaney (2005) or Berman and Hericourt (2008) find that more productive firms that generate large amounts of liquidity from their domestic sales and wealthier firms that inherit a high amount of liquidity are more likely to export. In Manova (2008), credit constraints reinforce the negative impact of low productivity for entry into foreign markets (extensive margin) and for the volume of exports (intensive margin). Buch et al. (2009) simultaneously analyze the impact of financial constraints on export and FDI decisions of firms. The model shows that firms are more likely to engage in FDI the higher their productivity and the weaker financial constraints. Also, financial constraints increase the productivity cut-off required for entry into foreign markets.

The insight that entry into foreign markets is affected not only by the productivity of firms but also by financial constraints has also spawned a small but growing empirical literature. A few papers show that tighter financial constraints have a negative impact on exports. Bellone et al. (2008) use French data, Du and Girma (2007) use data for for Chinese firms, and Berman and Hericourt (2008) use a cross-country dataset. Using country-level data, Manova (2008) shows that financially developed countries are more likely to export bilaterally and to ship greater volumes. For British firms, Greenaway et al. (2007) find the reverse causality: Exporting improves a firm's financial health, but financially healthy firms are not more likely to become exporters. Stiebale (2008) supports this using French data.

In this paper, we use a detailed firm-level survey of German firms, the *IAB Establishment Panel* (*IAB Betriebspanel*).[1] The original purpose of this survey is to deliver high-quality data for the analysis of the labor market.[2] In recent years, firms have additionally been asked about their international activities and their financial constraints. Our data allow going beyond the existing literature in three ways.

First, we analyze exports and foreign investment activities, and we measure financial constraints using accounting information (cash flow) and self-reported financial constraints. We find that self-reported financial constraints do not affect exports or FDI. Cash flow has an impact on the volume of exports and a weak effect on selection into FDI.

Second, our findings suggest that labor market constraints might constitute more important barriers to foreign activities than financial constraints. Being covered by a collective bargaining scheme lowers the probability of exporting or FDI. Domestic shortages in terms of qualified personnel increase these probabilities. Wage cost problems lower the volume of exports. In general, labor market constraints seem to affect the extensive margin of international activities more than the intensive margin.

Third, we consistently measure these constraints as well as other factors that may affect the propensity of firms to engage internationally such as productivity or R&D activity at the firm-level. In line with the existing literature, we find that larger and

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[1] Data access (during research visits and by controlled remote data processing) was granted by the Center for Research Data of the Institute for Employment Research at the Federal Employment Agency in Nuremberg.

[2] Throughout the paper, we use the term ‚firm' to denote the unit of observation in the empirical model, i.e. the individual plant. In 2006, 88% of the observed plants were independent firms.

more productive firms as well as firms active in R&D are more likely to export and to engage in FDI than smaller and less productive firms.

The remainder of this paper is organized as follows. In section 2, we develop our main hypotheses. In section 3, we present descriptive statistics. Section 4 introduces our econometric approach and presents the main results. Section 5 concludes.

2   Hypotheses

The aim of this paper is to show the importance of productivity, financial constraints, and labor market constraints as barriers to entry into foreign markets. Recent theoretical work analyzes the impact of financial constraints on export activities (Berman and Hericourt 2008, Chaney 2005, Manova 2008). Buch et al. (2009) also analyze the implications for FDI decisions. One feature of these models is that firms can choose between being active on the domestic or on the foreign market. To serve the foreign market, the firm has to incur a fixed cost that depends on the mode of entry. The fixed costs of FDI are higher than the fixed costs of exports since additional overhead functions must be maintained abroad. In addition to choosing whether to produce abroad (the extensive margin), the firm also has to decide how large a capacity to set up for production (the intensive margin). The firm faces a cash-in-advance constraint as the set up costs have to be paid before production is taken up and before revenues are generated.

Despite differences in the modelling strategies, these models yield the following hypothesis concerning the impact of productivity and financial constraints on the export and FDI decisions of firms (see, e.g. Buch et al. 2009).

Hypothesis 1: *The probability of setting-up an affiliate abroad (or to export) depends positively on the productivity of the project, on the size of the foreign market, on the*

volume of internal funds (and thus weaker financial constraints), and on the tangibility of a firm's assets (and thus its ability to pledge collateral). Similar parameters affect the intensive margin of firms' foreign activities and thus the volume of FDI or exports.

When applying the insights of the models sketched above to our analysis of German firms' internationalization decisions, it is important to note that we have no information about the host markets in which firms invest. Therefore, our analysis is confined to variables that can be measured at the level of the (German) company.

In our empirical model, financial constraints are firm-specific. From a theoretical point of view, firms may, for instance, differ with regard to the relative importance of soft and hard information (Petersen 2004) and thus the ability of banks to assess the quality of their business plan and of their management. They may also differ with regard to the intensity of lending relationships, the tangibility of assets and thus the degree of collateralizable assets, or the ability of the management. Finally, the customer structure of firms and thus the riskiness of their revenues might differ. Hence, even within the same industry, financial constraints differ significantly between firms, and these differences can be expected to reflect more than differences in firms' productivities.

In addition to financial constraints stressed by the models, firms may also differ with regard to the labor market constraints they are facing, which in turn, may affect their international activities. Our dataset provides information on labor market conditions faced by the firms in terms of personnel shortages, problems with worker protection laws, the share of unskilled employees, the presence of a works council, and coverage by a collective bargaining system. Generally, these variables should affect the internationalization decision in the following way.

Hypothesis 2: *The probability of setting-up an affiliate abroad (or to export) increases if labor market constraints increase the fixed costs of operating at home relative to the fixed costs of operating abroad or the productivity of domestic workers. This probability depends negatively on the variable costs of domestic production. In a similar way, labor market constraints affect the intensive margin of firms' foreign activities and thus the volume of FDI or exports.*

Hence, the effects of labor market constraints on exports and FDI are less straightforward than the effects of financial constraints, and their sign may even be ambiguous. To give an example, being covered by a collective bargaining scheme could have a positive or a negative impact on foreign activities. On the one hand, collective bargaining may reduce the flexibility of a firm, which could result in a lower productivity. Collective bargaining may increase the bargaining power of workers and thus lead to higher wages. This, in turn, makes production at home relatively unattractive. On the other hand, search and contracting costs may be lower compared to firms without collective bargaining schemes, thus lowering the fixed costs of domestic production. Ultimately, it is thus an empirical question which of the effects dominates.

3   Data and Descriptive Statistics

The theoretical hypotheses derived above will be tested using representative micro-level panel data of 16,000 German establishments.[3]

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[3] Table A1 in the appendix provides an overview of the data as well as of the various measurement issues discussed in the following.

3.1 International Activity

Approximately 10% of all firms serve foreign markets via exporting. Hence, most firms in our sample are active only domestically. With regard to FDI, the data allow to identify whether firms have invested into FDI objects in the years 2004 and/or 2005. Hence, we measure FDI flows into new or already existing foreign investment objects. Only about 0.5% of all firms have invested into foreign affiliates. Considering that our data include also the smallest firms (with at least one employee covered by the social insurance system), this seems to be a reasonable number.

3.2   Financial Constraints

Measuring financial constraints is not a trivial task since balance-sheet information might be affected by accounting standards and self-reported financial constraints might contain subjective information. (See Greenaway et al. (2007) for a detailed discussion of different approaches.) Some authors also use financial indicators (see, e.g., Bellone 2008), but these indices typically also include variables that are related to the productivity of firms.

Our data have the advantage that they include both, self-reported financial constraints as well as accounting information. For the year 2005, firms that have realized investments of any kind had to report whether or not they have faced problems raising external finance and whether these difficulties have had negative implications for their investment activities. Of course, one objection against such self-reported financial constraints is that firms might always be interested in increasing their leverage; hence the responses might be biased. We try to accommodate this concern by including other variables that might affect firms' access to external capital such as their productivity and R&D potential. Hence, the self-reported financial constraints measure the partial influence conditional on other, observable covariates.

Overall, 8% of all firms that have invested in 2004 self-report financial constraints.[4] Table 1a also shows that the presence of financial constraints is declining in 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. Furthermore, Table 1a suggests a non-linear relation between firm size and the relative frequency of self-reported financial constraints. This is consistent with theories stressing asymmetric information problems particularly for small firms.

Table 1b also shows heterogeneity across industries. The share of credit-constrained firms is lower in the service sector than in manufacturing or transportation. This reflects the fact that production in the latter industries is more capital-intensive and hence requires higher financial funds. Another reason may be that 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.

As a further control variable, we measure the firms' dependence on external capital by the share of investment that is financed by cash flow. We include this variable since the cash flow sensitivity of investment has often been used as a measure of the financial constraints that firms are facing. Following this interpretation, a positive impact of cash flow on investment would be an indication that firms are financially constrained. However, this interpretation has been criticized (George et al. 2008), hence the expected sign on cash flow is not clear cut a priori.

3.3 Exposure to Labor Market Constraints

The *IAB Establishment Panel* provides detailed information on employment conditions and labor market constraints. We use firm-level information on the importance

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[4] The question that was posed in 2005 was with regard to the year 2004.

of shortages of qualified personnel, wage cost problems, problems regarding worker protection laws, the existence of a works council, and firms' coverage by collective of firm-specific bargaining agreements.

Table A2 shows that 39% of all firms are subject to industry-wide collective bargaining agreements. Nearly one third of the firms (31%) expect problems because of high labor costs in the following two years. Every sixth firm has a works council (16%) and every fifth firm expects personnel shortages (19%). Worker protection laws are an issue for only 5% of the firms. Note that worker protection laws, for instance, apply to all firms in a given size group. However, whether these laws are binding or not depends on the presence of a works council and the degree of self organization of the workforce.

While financial constraints are more important for smaller firms than for larger firms, reported labor market 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. Problems regarding worker protection laws differ widely across firms. They are hardly relevant for the very small firms (as only 1-6% of the firms with up to 20 employees report problems) but they are important for one third of the large firms (500+ employees). The importance of firm-specific collective bargaining agreements varies less across firms, with only 1-3% of the very small and 11% of the very large firms being affected.

The link between firm size and the severity of labor market constraints is non-linear. Many labor market regulations do not apply to small firms, such as the possibility to maintain works councils (which applies only to firms with at least 5 employees) or firing constraints (which apply only to firms with more than 10 employees).

3.4   *Productivity and Technology*

The key variable determining entry into foreign markets stressed in theory is a firm's productivity. Ideally, we would compute a measure of total factor productivity. Lacking information on the capital stock, we measure productivity using sales per employee and value added per employee.[5]

For the years 2003 and 2005, firms also provide information on their level of technology. Technology is measured on 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 decision to engage in international activities. Also, including a direct measure of R&D activity addresses the point made by Aw, Roberts, and Xu (2009) that productivity and exporting might be driven simultaneously by the R&D intensity of firms.

3.5   *Are Exporters and Multinationals Special?*

The evidence presented above reveals the heterogeneity of German firms with respect to financial and labor market constraints as well as with respect to the level of productivity and technology. Financial constraints are more common among smaller firms, while adverse labor market conditions prevail particularly among larger firms. Next, we analyze whether these features are also related to firms' international activities.

As regards export status, financially constrained firms differ significantly from unconstrained firms (Table 2a). Financially unconstrained firms are slightly more often exporters than financially constrained firms, whereas their mean export volume

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[5] We correct for the importance of part-time workers by using full-time equivalents, and we calculate value added as sales minus intermediate inputs.

is considerably higher. Unconstrained firms are also larger on average (measured by the number of employees) and have higher sales. But financial constraints do not matter much for the volume of exports or FDI. There are no observable differences in the export-to-sales ratio across the two groups. And the share of firms that engage in FDI is even lower for unconstrained firms, which contrasts with the higher share of exporting firms in that group.

In Table 2b, similar comparisons are made for labor market constraints. The share of exporting firms, the mean export volume, and the export-to-sales ratio are significantly higher among the firms subject to labor market constraints like wage cost problems, personnel shortages, problems regarding worker protection laws, and works councils. Likewise, the share of firms that engage in FDI is higher among firms facing labor market constraints. Coverage by collective bargaining agreements is an exception. Firms covered by such agreements are less often exporters, have a lower export-to-sales ratio, and do less often invest abroad.

4   Regression Analysis

Next, we analyze the impact of firm size, productivity, firm-specific capital and labor market constraints on a firm's decision to engage in international markets. We analyze both, the decision of firms to export (Table 3) and to invest abroad (Table 4), and we analyze the extensive margin (the selection into export and FDI status) as well as the intensive margin (the volume of activities).

4.1   Model Specification

We estimate a two-step Heckman selection model, which allows analyzing the extensive and intensive margin of firm-level exports (or FDI) simultaneously. In order to check the robustness of our results, we have specified the extensive and the

intensive margins separately by running probit and OLS regressions, respectively. Since the qualitative results are identical, we do not report them. Our baseline selection equation is the following:

$$\Pr(X_i > 0) = \alpha_j + \alpha_1 \log\left(\frac{Y}{L}\right)_{i,-1} + \alpha_2 \log L_{i,-1} + d'^K_{i,-1}\alpha_3 + d'^L_{i,-1}\alpha_4 + C_{i,-1}\alpha_5 + excl'_i \cdot \alpha_6 + \varepsilon_i \quad (1)$$

with $\Pr(X_i > 0)$ being the probability to export in 2005 *or* to invest abroad in 2004/2005 of firm i.

Our corresponding equation for estimating the volume of exports (or FDI) is:

$$X_i = \beta_j + \beta_1 \log\left(\frac{Y}{L}\right)_{i,-1} + \beta_2 \log L_{i,-1} + d'^K_{i,-1}\beta_3 + d'^L_{i,-1}\beta_4 + C_{i,-1}\beta_5 + \beta_6 \cdot mills_i + \mu_i \quad (2)$$

with X_i being the volume of exports in 2005 or FDI in 2004/2005.

α_j (β_j) are industry-specific fixed effects ($j=1,...,41$). α_1 (β_1), α_2 (β_2), and β_6 are scalar coefficients, $\alpha_{3,4,5,6}$ as well as $\beta_{3,4,5}$ are column vectors of regression coefficients. ε_i and μ_i are the error terms.

In order to address simultaneity issues we use lagged values in order to measure the firms' characteristics prior to the internationalization decision in the year 2005 (for exports) or 2004 and/or 2005 (for FDI).

We arrange our explanatory variables into four groups. A first group of variables includes measures for <u>productivity and firm size</u>. One-period lagged productivity is measured as $\log(Y/L)_{i,-1}$ which gives the natural logarithm of labor productivity *before* the international activity takes place. The expected sign of the coefficient is positive. The same holds for log employment ($\log L_{i,-1}$) as our measure for firm size.

A second group of variables, stacked in the column vector $d^K_{i,-1}$, captures <u>financial constraints</u>. We measure these using self-reported constraints regarding the access to the capital market and a cash flow variable. We expect a negative sign of the esti-

mated coefficient for the self-reported constraints. Finding a positive sign on the cash flow variable could be taken as an indication that firms are financially constrained.

A third group of variables in the column vector $d_{i,-1}^L$ addresses <u>labor market constraints</u>. It includes several dummy variables indicating whether a firm reports different labor market constraints. Additionally, we include the share of unskilled employees. The signs of the labor market related variables are not clear a priori, as laid out in section 2, and depend on the impact of these constraints on the fixed and variable costs of domestic operations and on the productivity of firms.

A fourth group of variables, collected in the column vector $C_{i,-1}$ includes lagged <u>control variables</u>. We control for firm-level R&D activity and expect a positive impact. Firm age is used as a dummy variable that takes the value 1 if the firm was founded before 1990. We include a dummy variable that takes the value 1 if the firm is not part of a group. In the export equation, we include an FDI dummy; in the FDI equation, we include information on the export intensity of a given firm. The vector of control variables also includes a set of industry dummies.

In order to identify the selection equation of the Heckman model, we include several exclusion variables ($excl_i$). The first one is a dummy variable indicating whether the firm is located in Eastern Germany. In general, East Germany is less integrated internationally in terms of trade and FDI than West Germany. We also include dummy variables for innovation activity, problems regarding innovation, and a variable measuring the level of technology used in the firm. The expectation is that the less innovative firms have a lower productivity and are thus less likely to enter foreign markets. $mills_i$ is the Mills' ratio.

4.2 The Extensive and Intensive Margin of Exports

Our results show that selection into exporting (i.e. the extensive margin) affects the firm's choice of the volume of exports (i.e. the intensive margin) (Table 3). The Mills' ratio is positive and significant. Consistent with expectations, the dummy variable indicating firm location in Eastern Germany has a significantly negative impact on the probability to be an exporter. Innovative activity has a positive impact.

Consistent with the Melitz-model and previous empirical evidence, selection into exporting and the volume of exports are positively related to size and productivity. The dummy variable for R&D activity affects both, the export volume and the selection into exporting, in a highly significant and positive way. The positive coefficient on the age dummy would be consistent with the interpretation that older (and presumably more productive) firms are more likely to export.

The self-reported measure of financial constraints does not affect the selection into exporting or export volumes. The share of cash flow used in financing investments has a positive and significant impact on firms' expansions along the intensive margin. This result would be consistent with literature interpreting the sensitivity of investment as a measure of the presence of financial constraints.

Regarding labor market constraints, we find the most consistent result for collective bargaining agreements. Being covered by a collective bargaining agreement significantly lowers the probability of exporting. Following our above interpretation, this would imply that collective bargaining lowers firms' productivities and thus their ability to expand abroad. High wage costs have a negative impact on the volume of exports because they negatively affect the price competitiveness of firms in foreign markets. Problems with personnel shortages, in contrast, increase the probability of firms to be exporters. The interpretation of this effect is that these shortages refer to

qualified personnel, which could be an indication of high demand from export markets. The presence of workers' councils, problems with worker protection laws and the share of low-skilled employees have no significant impact.

Overall, the main determinants of exports are size and productivity. Financial constraints in the form of cash flow constraints have a significantly negative impact as well, and our results also show the importance of labor market constraints.

4.3 The Extensive and Intensive Margin of FDI

The Mills' ratio is insignificant in the FDI equation. Also, the decision to invest abroad is not affected by being located in East Germany, but firms operating with outdated technology have a lower probability to invest abroad.

Firm size has a significantly positive effect on the probability to engage in FDI as well as on the volume of investments; an increase in the size of the firms by one percent increases the volume of FDI nearly proportionally. Labor productivity has a significantly positive effect on FDI, and the size of the effects is larger than the effect of firm size.

Self-reported financial constraints have no impact on firms' FDI activity. Cash flow has a weakly significant positive effect on the probability to invest abroad but not on the volume.

Labor market constraints affect the selection into FDI activity but not the volume of activities. Wage cost problems and collective bargaining agreements have a negative effect on the decision to invest abroad, whereas personnel shortage has a positive impact on the probability to engage in FDI. Labor market constraints have no significant impact on the volume of FDI.

As regards the remaining control variables, lagged export intensity as a proxy for experience on foreign markets has a significantly positive effect on the selection into FDI activity, which declines with a rising export intensity. This variable has no effect on the volume of FDI. Firm-level R&D activity has a positive impact on the decision to invest abroad, but a mostly insignificant effect on the volume. The negative sign of firm age suggests that younger firms decide more often to invest abroad. The variable controlling for firm group status has a significant effect on the selection into FDI. Single-plant firms invest abroad less often. Again, we do not find an effect on the volume of FDI.

In sum, productivity and size are the main drivers of FDI activity. Financial constraints do not seem to matter, but labor market constraints considerably affect the extensive margin of FDI.

5   Conclusions

There is a strong consensus in the theoretical and empirical literature that heterogeneity across firms with regard to productivity is a powerful explanation for the dominance of large exporters and multinational firms. In this paper, we distinguish productivity, financial constraints, and labor market constraints as barriers to entry into foreign markets. We use a detailed and representative firm-level dataset for German firms which contains information on productivity, R&D, financial constraints, labor market constraints, as well as export and FDI activities. We use a Heckman selection model to analyze both the intensive and the extensive margin of international activity. Our main results are as follows.

First, in line with the existing literature, larger and more productive firms as well as firms with more R&D activity are more likely to export and to engage in FDI than

smaller and less productive firms. Size and productivity affect both margins and are the main determinants of foreign activities at the firm level.

Second, self-reported financial constraints have no impact on exports but firms with higher cash flow have higher export volumes. We did not find any relevant effect of financial variables on FDI activity.

Third, labor market constraints have a significant impact on the decision to invest abroad and to export. Being covered by a collective bargaining scheme has a negative effect on foreign investment and exporting. Wage cost problems have significant but less robust effects as well. Domestic personnel shortages push firms into foreign activities. In general, labor market constraints affect the extensive margin more than the intensive margin of international activity.

What do our results imply for policymakers who would like to promote the entry of smaller or mid-sized firms into foreign markets? Policies aimed at improving productivity and at promoting innovations certainly have a key role to play. Financial constraints, in contrast, do not play an important role. Perhaps the most interesting finding in this paper is the importance of labor market constraints. Institutional arrangements on labor markets and labor market conditions particularly affect the decision to invest abroad. Firms with wage cost problems and firms covered by collective bargaining have a lower probability to invest abroad, firms with personnel shortages and works councils have a higher probability. Results for exports are similar. At the same time, the prevalence of these problems increases in firm size. Potential policies aimed at promoting entry into foreign markets thus need to take complex interactions between firm size, labor market constraints, and foreign activities into account.

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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 *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 labor market conditions. The survey has been conducted annually since 1993, and panel data are available for about 16,000 plants representative of all industries and size classes.

	Measurement	Measured in			Referring to period				
		2004	2005	2006	2002	2003	2004	2005	2006
Cash flow	Share of cash flow in investments		x				x		
Financial constraints	Dummy variable reporting problems to raise external capital for investments (see section 3)		x				x		
Collective bargaining	Dummy variable reporting existence of collective bargaining in any modality	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 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
Expected wage cost problems	Dummy variable reporting wage cost problems, Reasons: 1. Abundance of human resources; 2. Problems with wage costs	x						x	x
Export share	Share of foreign sales in total sales	x	x	x	(x)	x	x	x	(x)
Innovation problems	Dummy variable reporting innovation problems	x			x	x	x		
Innovations	Dummy variable reporting whether innovations are implemented	x			x	x	x		
Level of technology	Discrete variable from 1 (best) to 5 (worst) (self-reported)		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)
R&D	Dummy variable reporting existence of R&D activity	x					x		
Share of unskilled employees	Number of unskilled employees divided by total employment	x	x	x			x	x	x
Works council	Dummy variable reporting existence of a works council	x					x		

Table A2: Descriptive Statistics

Variable	Observations	Mean / Share	Standard deviation
International activities			
Share of exporting firms (2006)	12,141	10 %	0.30 %
Export-to-sales ratio (2006)	12,141	2.8 %	12 %
Share of FDI firms (2006)	12,051	0.5 %	0.07 %
FDI volume (Euro) (2006)	239	623,840	2,792,411
Export volume (Euro) (2006)	10,100	392,099	19,000,000
Size and productivity			
Employees (number) (2006)	15,449	17	109
Employees (number, full time equivalent) (2006)	15,444	14	98
Share of firms expecting personnel shortage (2004)	10,923	19 %	0.39 %
Share of firms expecting innovation problems (2004)	10,923	8 %	0.27 %
Share of innovative firms (2004)	10,923	28 %	0.45 %
Labor productivity (value added / employment) (2006)	9,243	58,221	105,841
Level of technology (1 best, 5 worst) (2005)	12,651	2.23	0.78
Share of firms with R&D activity (2004)	10,923	5 %	0.22 %
Sales productivity (sales / employment) (2006)	10,191	131,453	222,031
Value added (Euro) (2006)	9,244	889,959	11,439,708
Financial constraints			
Share of cash flow used in investments (2005)	8,033	71 %	42 %
Share of firms reporting financial constraints	7,645	8 %	0.27 %
Labor market constraints			
Share of firms expecting problems with worker protection laws (2004)	10,923	5 %	0.23 %
Share of firms expecting wage cost problems (2004)	10,923	31 %	0.46 %
Share of firms subject to industry-wide collective bargaining agreement (2004)	10,899	39 %	0.487 %
Share of skilled employees (2004)	10,923	6 %	0.17 %
Share of unskilled employees (2004)	10,923	19 %	0.26 %
Share of firms with works council (2004)	10,910	16 %	0.37 %

Source: _IAB Establishment-Level Panel_, own calculations

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

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

(a) By size

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

(b) By sector

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

Source: *IAB Establishment-Level Panel*, own calculations

Table 2: Performance Indicators by Type of Firm

(a) By Financial Constraints

	Financial constraints (Self-reported)	
	Yes	No
Share of exporting firms (%)	11	13
Mean export volume (1,000 €)	342.5	704.1
Export-to-sales ratio (%)	4	4
Share of FDI-firms (%)	0.6	0.5
Mean labor productivity (1,000 Euro)	42.7	63.3
Mean sales (1,000 Euro)	2,058	3,514
Mean number of employees	16	24
Mean level of technological equipment (1 newest, 5 oldest)	2.3	2.1

(b) By Labor Market Constraints

	Wage cost problems		Personnel shortage		Worker protection laws		Collective bargaining		Works council	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Share of exporting firms (%)	13	10	20	9	16	10	9	12	22	9
Mean export volume (1,000 €)	732.9	261.8	1,081.1	255.2	2,153.3	323.3	813.7	174.1	2,944.5	94.6
Export-to-sales ratio (%)	3	3	5	2	4	3	2	3	6	3
Share of FDI firms (%)	0.7	0.4	0.9	0.4	1.4	0.4	0.4	0.6	2	0.3
Mean labor productivity (1,000 Euro)	54.4	63.1	60.5	60.1	62.8	60.0	66.4	56.2	84.3	57.0
Mean sales (1,000 Euro)	3,759	1,793	4,802	1,867	9,105	2,079	4,374	1,254	13,200	1,074
Mean number of employees	28	13	34	14	57	15	28	10	62	9
Mean level of technological equipment (1 newest, 5 oldest)	2.3	2.2	2.2	2.3	2.2	2.3	2.2	2.2	2.2	2.3

Source: *IAB Establishment-Level Panel*, own calculations

Table 3: Determinants of Exports – Heckman Selection Model

This table gives results of the Heckman selection regression (two-step estimator) of the volume of export activity on various lagged regressors. The dependent variable is the natural logarithm of the volume of exports (in Euro) in 2005. The variables innovations, innovative problems, outdated technology, and East Germany are excluded from the volume regression for identification. Robust z statistics in parenthesis. The constant is omitted in the table. *, **, *** significant at the 10%, 5%, 1%-level.

	(1)		(2)		(3)		(4)	
	Volume	Selection	Volume	Selection	Volume	Selection	Volume	Selection
Size and productivity								
Log productivity (*t*-1)	1.245***	0.328***	1.212***	0.320***	1.235***	0.333***	1.221***	0.335***
	(19.93)	(10.07)	(18.29)	(8.11)	(19.53)	(9.92)	(18.04)	(8.22)
Log employees (*t*-1)	1.147***	0.259***	1.127***	0.237***	1.142***	0.277***	1.145***	0.246***
	(28.64)	(14.80)	(27.10)	(11.00)	(26.87)	(12.93)	(26.01)	(9.45)
Financial constraints								
Self-reported financial constraints (*t*-1) (0/1)			-0.003	-0.044			0.016	-0.055
			(0.02)	(0.42)			(0.12)	(0.52)
Cash flow (share) (*t*-1)			0.003***	0.001			0.003***	0.001
			(2.85)	(1.16)			(2.94)	(1.27)
Labor market constraints								
Wage cost problems (*t*-1) (0/1)					-0.202***	-0.069	-0.186**	-0.095
					(2.92)	(1.39)	(2.50)	(1.59)
Personnel shortage (*t*-1) (0/1)					0.063	0.153***	0.035	0.143**
					(0.88)	(2.89)	(0.47)	(2.33)
Problems with worker protection laws (*t*-1) (0/1)					-0.041	-0.093	-0.019	-0.017
					(0.39)	(1.07)	(0.18)	(0.17)
Share of unskilled employees (*t*-1)					0.123	0.011	0.142	0.174
					(0.81)	(0.11)	(0.85)	(1.38)
Works council (*t*-1) (0/1)					0.120	0.089	0.051	0.112
					(1.38)	(1.41)	(0.55)	(1.54)
Collective bargaining (*t*-1) (0/1)					-0.116	-0.350***	-0.178**	-0.353***
					(1.36)	(6.32)	(1.96)	(5.42)
Control variables								
R&D (*t*-1)	0.796***	0.523***	0.807***	0.568***	0.770***	0.507***	0.807***	0.558***
	(7.78)	(7.33)	(7.27)	(7.02)	(7.65)	(7.05)	(7.33)	(6.84)
Foreign direct investment activity (0/1)	0.574***	0.658***	0.506***	0.666***	0.535***	0.612***	0.484***	0.640***
	(4.34)	(4.10)	(3.92)	(3.86)	(4.12)	(3.81)	(3.78)	(3.69)
Firm founded before 1990 (0/1)	0.057	0.191***	0.066	0.148**	0.038	0.153***	0.038	0.112*
	(0.79)	(3.44)	(0.86)	(2.21)	(0.51)	(2.72)	(0.47)	(1.65)
Establishment = firm (*t*-1) (0/1)	0.144	-0.017	0.140	-0.083	0.148	-0.006	0.137	-0.074
	(1.42)	(0.20)	(1.33)	(0.86)	(1.46)	(0.07)	(1.31)	(0.77)
Selection:								
Innovations (*t*-1) (0/1)		0.333***		0.303***		0.321***		0.285***
		(6.42)		(4.86)		(6.12)		(4.52)
Innovation problems (*t*-1) (0/1)		0.011		0.040		-0.001		0.024
		(0.15)		(0.49)		(0.01)		(0.29)
Outdated technology		0.061*		0.069*		0.070**		0.080**
		(1.92)		(1.79)		(2.19)		(2.04)
East Germany (0/1)		-0.305***		-0.239***		-0.345***		-0.244***
		(5.25)		(3.41)		(5.55)		(3.23)
Mills' ratio	0.666***		0.486**		0.618***		0.487**	
	(0.196)		(0.223)		(0.197)		(0.225)	
Industry dummies	yes	yes	yes	yes	yes	yes	yes	yes
Observations	5,864	5,864	3,711	3,711	5,851	5,851	3,705	3,705

Source: *IAB Establishment Panel*, own calculations

Table 4: Determinants of FDI – Heckman Selection Model

This table gives the results of the Heckman selection regression (two-step estimator) of the volume of foreign direct investment activity on various lagged regressors. The dependent variable is the natural logarithm of the volume of foreign direct investment (FDI) (in Euro) in 2004 and/or 2005. The variables innovations, innovative problems, outdated technology, and East Germany are excluded from the volume regression for identification. Robust z statistics in parenthesis. The constant is omitted in the table. *, **, *** significant at the 10%, 5%, 1%-level.

	(1)		(2)		(3)		(4)	
	Volume	Selection	Volume	Selection	Volume	Selection	Volume	Selection
Size and productivity								
Log productivity (*t*-1)	1.299***	0.191***	1.228***	0.132	1.214***	0.165**	1.187***	0.114
	(4.33)	(2.67)	(4.77)	(1.58)	(4.31)	(2.20)	(4.78)	(1.31)
Log employees (*t*-1)	0.852***	0.056	0.848***	0.074*	0.867***	0.052	0.871***	0.072
	(6.12)	(1.47)	(5.94)	(1.69)	(5.79)	(1.14)	(5.56)	(1.38)
Financial constraints								
Self-reported financial constraints (*t*-1) (0/1)			0.237	0.289			0.396	0.280
			(0.44)	(1.47)			(0.73)	(1.39)
Cash flow (share) (*t*-1)			-0.001	0.003*			-0.001	0.003*
			(0.31)	(1.67)			(0.28)	(1.79)
Labor market constraints								
Wage cost problems (*t*-1) (0/1)					0.017	-0.215*	0.132	-0.143
					(0.05)	(1.95)	(0.43)	(1.18)
Personnel shortage (*t*-1) (0/1)					0.539	0.224**	0.418	0.216*
					(1.43)	(2.06)	(1.20)	(1.82)
Problems with worker protection laws (*t*-1) (0/1)					-0.374	0.104	-0.489	0.050
					(0.97)	(0.71)	(1.28)	(0.31)
Share of unskilled employees (*t*-1)					0.377	-0.168	0.371	-0.125
					(0.46)	(0.67)	(0.45)	(0.44)
Works council (*t*-1) (0/1)					0.119	0.259*	-0.083	0.182
					(0.29)	(1.89)	(0.22)	(1.20)
Collective bargaining (*t*-1) (0/1)					-0.531	-0.289**	-0.256	-0.217
					(1.28)	(2.36)	(0.70)	(1.62)
Control variables								
R&D (*t*-1)	1.850**	0.750***	1.500*	0.780***	1.481*	0.742***	1.327	0.765***
	(2.02)	(5.31)	(1.78)	(4.89)	(1.66)	(5.15)	(1.61)	(4.73)
Export share of sales (*t*-1)	0.042	0.039***	0.034	0.039***	0.032	0.038***	0.029	0.037***
	(1.04)	(5.94)	(0.96)	(5.31)	(0.81)	(5.72)	(0.82)	(5.10)
Export share of sales (squared) (*t*-1)	-0.000	-0.000***	-0.000	-0.000***	-0.000	-0.000***	-0.000	-0.000***
	(0.84)	(4.39)	(0.68)	(4.09)	(0.62)	(4.25)	(0.56)	(3.93)
Firm founded before 1990 (0/1)	-0.833	-0.292**	-0.922	-0.398**	-0.832	-0.321**	-0.983	-0.417**
	(1.62)	(2.14)	(1.57)	(2.47)	(1.48)	(2.30)	(1.58)	(2.55)
Establishment = firm (*t*-1) (0/1)	-0.998	-0.748***	-0.846	-0.769***	-0.942	-0.748***	-0.880	-0.765***
	(1.29)	(6.17)	(1.22)	(5.81)	(1.23)	(6.07)	(1.27)	(5.72)
Selection:								
Innovations (*t-1*) (0/1)		-0.038		0.004		-0.060		-0.002
		(0.28)		(0.03)		(0.43)		(0.01)
Innovation problems (*t-1*) (0/1)		0.059		0.041		0.046		0.034
		(0.44)		(0.28)		(0.34)		(0.23)
Outdated technology		-0.210***		-0.253***		-0.208***		-0.255***
		(2.92)		(3.05)		(2.82)		(3.01)
East Germany (0/1)		-0.072		-0.157		-0.125		-0.196
		(0.49)		(0.92)		(0.81)		(1.08)
Mills' ratio	1.99		1.615		1.799		1.549	
	(1.290)		(1.121)		(1.311)		(1.134)	
Industry dummies	yes	yes	yes	yes	yes	yes	yes	yes
Observations	6,251	6,251	3,872	3,872	6,237	6,237	3,865	3,865

Source: *IAB Establishment Panel*, own calculations

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