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**Firm-Specific Factor Market Constraints and FDI:
Evidence from Germany**

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Firm-Specific Factor Market Constraints and FDI: Evidence from Germany

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Abstract

Firms that invest abroad are large and more productive than their domestic counterparts. But to what extent are the international activities of firms also driven by differences across firms in terms of their access to external finance and the labor market conditions that there are facing? In this paper, we present new empirical evidence based on a detailed micro-level dataset of German firms. Our paper has three main findings regarding the firm-level determinants of FDI. First, in line with earlier literature, we find a positive impact of size, productivity, and R&D activity on firms' FDI activity. Second, labor market conditions have a mixed impact on FDI. Personnel shortage tends to have a significantly positive impact on the probability to invest abroad, whereas wage cost problems and the existence of collective bargaining agreements have a negative effect. Third, financial constraints have a mixed impact as well. While self-reported financial constraints do not significantly affect FDI activity, cash flow has a positive impact.

Keywords: multinational firms, firm heterogeneity, productivity, financial constraints, labor market constraints

JEL-classification: F2, G2

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1 Motivation

The recent financial crisis has been accompanied by a decline in international trade volumes. Apart from the slump in global demand, restricted access to trade finance is 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 (see, e.g., UNCTAD 2008). While it is too early to assess the impact of the financial crisis on FDI activities, this paper adds to a growing literature stressing the importance of financial constraints for multinational activity. We use a detailed firm-level dataset for Germany, which provides information on firms' access to external capital, the volume of their foreign direct investment, their size and productivity, the labor market constraints they are facing, and their R&D investments. Hence, our data allow painting a very detailed picture of firm characteristics and their effects on international activities.

From a theoretical point of view, the impact of firm-level characteristics on FDI is motivated by the observation that highly productive firms self-select themselves into exporting (Melitz 2003). Helpman, Melitz, and Yeaple (2004) extend this approach to foreign direct investment and multinational activity. 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 reasons for different patterns of production and of market entry are fixed and variable costs of entering new markets.

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).

Our main hypothesis in this paper is thus that productivity may not be the only driving factor that determines FDI activity. In particular, we suggest that firm-specific financing constraints and labor market rigidities can have an important impact on the decision to invest abroad. Therefore, we shed some light on the relevance of such other factors.

Recently, the role of financial frictions on the international activity of heterogeneous firms has been addressed in theoretical models in the tradition of Melitz (2003). A first group of papers analyzes the impact of financial frictions on the probability of exporting. Chaney (2005) analyzes the interaction of firm-level liquidity constraints and exchange rate fluctuations. He finds that more productive firms that generate large liquidity from their domestic sales and wealthier firms that inherit a large amount of liquidity, are more likely to export. (See Berman and Hericourt (2008) for a similar modeling approach.) In Manova (2008), firms 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 industries, and contract enforce-

ability differs across countries. Hence, 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). Her empirical results using country-level data show that financially developed countries are more likely to export bilaterally and to ship greater volumes.

Buch, Kesternich, Lipponer, and Schnitzer (2008) provide a model which analyzes the impact of financial constraints on export and FDI decisions of firms simultaneously. The model shows that firms are more likely to engage in FDI the higher their productivity, the weaker financial constraints, the larger foreign markets, the lower the fixed costs of investment, the lower project risk, the better contract enforcement, and the lower liquidation costs. Also, financial frictions 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 the firms' ability to finance the costs of entry (or the expansion of activities abroad) has also spawned a small but growing empirical literature. Most of these papers analyze the export decisions of firms, providing somewhat mixed results. Greenaway, Guariglia, and Kneller (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. Berman and Hericourt (2008) use a cross-country dataset and find that firms' access to external finance has an impact on the entry into export markets. Arndt, Buch, and Mattes (2008) use a dataset similar to ours and find that financial constraints affect the decision to start exporting, but do not affect the volume of exports. Labor market restrictions seem to play an important role though.

In this paper, we go beyond the existing literature in three ways. First, whereas the recent theoretical and empirical literature has been dedicated to the analysis of the nexus between financial frictions and exporting, we focus on FDI activity. Second, we do not only look at the role of financial constraints, but also on labor market restrictions. Third, we consistently measure financial constraints and labor market related constraints as well as other factors that may affect the propensity of firms to engage in FDI such as exporter status, productivity, or R&D activity at the firm-level.

For this purpose, we use a detailed firm-level survey of German firms, the *IAB Establishment-Level Panel (IAB Betriebspanel)*. The original purpose of this survey is to deliver high-quality data for the analysis of the demand side of the labor market.¹ In

¹ 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.

recent years, firms have additionally been asked about their engagement in FDI, their investment behavior, and the financial constraints they are facing.

Our paper has three main findings regarding the firm-level determinants of FDI. First, in line with earlier literature, we find a positive impact of size, productivity, and R&D activity on firms' FDI activity. Second, labor market conditions have a mixed impact on FDI. Personnel shortage tends to have a significantly positive impact on the probability to invest abroad, whereas wage cost problems and collective wage agreements have a negative effect. Third, financial constraints have a mixed impact as well. While self-reported financial constraints do not significantly affect FDI activity, cash flow has a positive impact.

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

2 Hypotheses

The aim of this paper is to show the importance of productivity, financial constraints, and labor market restrictions as barriers to entry into foreign markets. While recent theoretical work analyzes the impact of financial constraints on export activities (Berman and Héricourt 2008, Chaney 2005, Manova 2008), Buch et al. (2008) also analyze the implications for FDI decisions.

In the following, we will draw heavily from the model proposed in Buch et al. (2008), but we will enrich our set of hypotheses also with regard to effects from frictions in the firms' access to the labor market. Buch et al. (2008) model the decision problem of a firm

that has three choices. First, it can produce at home and serve only the home market. Second, it can produce at home and serve both the home and the foreign market via exports. Third, it can invest abroad and set up a foreign affiliate to serve the foreign market via FDI.

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 where to produce, the multinational also has to decide how large a capacity to set up for production. To produce a given quantity, the firm has to set up a capacity, and these capacity costs decline in the level of productivity of the firm. 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. Firms borrow from banks to finance these upfront costs, and the optimal lending contract needs to take into account that revenues that can be generated on the foreign market are uncertain.

The model assumes that financial constraints are firm-specific. 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, we argue that even within the same industry, financial constraints are likely to differ significantly between firms, and these differences can be expected not only to reflect differences in firms' productivity.

The model is solved by determining the zero profit conditions for FDI (and exports), which determine the extensive margin of foreign entry. Given that firms decide to enter a foreign market, firms also maximize their profit function with regard to the optimal capacity – i.e., the intensive margin of foreign activities.

Solving the model shows that the probability of setting up an affiliate abroad 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), on the quality of the legal environment for contract enforcement, and on the tangibility of a firm's assets (and thus its ability to pledge collateral). Higher project risk and higher fixed costs have a negative impact on entry. Similar parameters affect the intensive margin of firms' foreign activities and thus the volume of FDI. The optimal capacity investment reacts positively to an increase in the firm's productivity, a decrease in the risk of the project, an increase in the efficiency of contract enforcement and in liquidation costs.

When applying the insights of the model sketched above to our analysis of German firms' FDI decisions, four issues must be addressed.

First, we have no information about the host markets in which firms invest. Hence, we cannot analyze the impact of differences in host country conditions in terms of, for instance, contract enforcement or liquidation costs on FDI activity. Also, we do not have direct measures of project risk. Therefore, our analysis is confined to variables that can be measured at the level of the (German) parent company.

Second, in addition to financial frictions stressed by the model, firms may also differ with regard to the labor market restrictions they are facing, which in turn, may affect their FDI activities. But the direction of this effect is not clear from a purely theoretical view. On

the one hand, rigid labor market conditions might negatively affect the productivity of firms, and this may lower the probability of setting up an affiliate abroad as well as the volume of FDI. For example, a collective bargaining scheme may reduce the flexibility of a firm, which could result in a lower productivity. Furthermore, collective bargaining may increase the bargaining power of workers and thus lead to higher wages. But at the same time, search and contracting costs may be lower compared to firms without collective bargaining schemes. Moreover, powerful works councils might try to oppose foreign investment activities fearing international sourcing and subsequent employment cuts. On the other hand, binding labor market restrictions may increase the fixed costs of operations at home relative to the fixed costs of operating abroad. This may increase the probability of firms to invest abroad. Recent theoretical work in fact stresses the importance of labor market conditions on the industry-level for exporting or FDI decisions.²

Third, in Germany, labor market conditions, e.g. bargaining schemes, works councils etc., vary not only across industries but also with regard to the size of firms (see also Section 3.2 below). Hence, measuring the effects of these factors at the firm-level as we do in this paper should be the preferred approach.

Fourth, given the same productivity level, firms may differ with regard to their success in attracting highly qualified employees due to soft conditions like the firm's image or fringe benefits. Even if overall labor market conditions should be the same for all firms in the same sector, the access to this market may vary considerably from firm to firm. In a

² Helpman, Melitz, and Rubinstein (2008), for instance, show that labor market constraints reduce the share of exporting firms. Felbermayr, Prat, and Schmerer (2008) model the impact of trade openness on the domestic labor demand under different wage bargaining schemes.

similar vein, worker protection laws may be identical across firms of the same size, but for some they are binding and for some they are not.

In sum, we thus expect firms which are more productive and less financially constrained to be more likely to be multinationals than less productive or more financially constrained firms. These factors should also affect the volume of investment. Also, differences across firms with regard to the labor market conditions they are facing are likely to affect the probability of investing abroad, some are expected to matter with regard to the volume, too. Finally, in the case of the labor-market restrictions the direction of the effects is not clear ex-ante.

3 Data and Descriptive Statistics

The theoretical hypotheses derived above will be tested using a representative establishment-level panel data-set for 16,000 German firms. (Table A1 in the appendix provides an overview over the data.) With regard to FDI, the data allow to identify whether firms have been investing into FDI projects in the years 2004 and/or 2005. Only a small share of the firms in our data (about 1% of the total) are firms which are investing into affiliates abroad. Considering that our data include also the smallest firms (with at least one employee contributing to the social insurance system) and given that we are not measuring FDI stocks but new foreign investment flows (into new or already existing foreign investment objects), this seems to be a reasonable number and shows once more that it is only the most productive firms that invest abroad. Hence, most German firms are active only domestically, and the group of multinational firms is dominated by the large firms. In this section, we describe the main patterns in the data with regard to financial con-

straints, labor market frictions, and productivity, and we link these patterns to the FDI activity of firms.

3.1 Financial Constraints

The 2004 survey contains a direct question on the presence of financial constraints. Firms that have invested into real estate, information and communication technology, production facilities, plant equipment, or transportation equipment self-report whether they have faced problems with raising external finance (*yes / no*). Firms also report whether these difficulties have had negative implications for their plant-level investment activities.

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 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.

Table 1b provides additional evidence on the importance of financial constraints across industries. We find strong heterogeneity between different industries. Particularly, the share of credit-constrained firms is lower in the service sector than in manufacturing and transportation. This may reflect 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.

Finally, as a further control variable we also measure the firms' dependence on external capital by the share of investment that is financed by cash flow. Hence, we use an *ex post* measure of the importance of cash flow. *Ceteris paribus*, we would expect that a higher cash flow share – and thus a lower share of external finance – can be taken as an indication that the firm is financially constrained.

3.2 Labor Market Frictions

The *IAB Establishment-Level Panel* also provides detailed information on the level of employment and restrictions on the labor market. We use information on the importance of personnel shortages, wage cost problems, problems regarding worker protection laws, the existence of a works council, and firms' coverage by collective bargaining agreements. Although labor market restrictions should partly apply at the industry- or regional level, we focus on firm-specific differences, as laid out earlier. These labor market frictions could be additional barriers or triggers to entry into foreign markets. In fact, our results show that even after controlling for industry-specific factors, there remains a sufficient degree of heterogeneity of firms with regard to labor market conditions.

Table A2 shows that, overall, about 39% of all firms are subject to collective bargaining agreements. Nearly a third of the firms (31%) expects problems because of high labor costs in the following two years. Every fifth firm has a works council and expects personnel shortages. Worker protection laws are an issue for only 5% of the firms, while firm-specific bargaining agreements affect only 3% of the firms.

While financial constraints are more binding for smaller firms than for larger firms, Table 1a thus shows that the relation is reverse in the case of labor market constraints. Yet, even for firms with more than 20 employees, 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 a 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.

Our data particularly show that the link between size and the severity of labor market restrictions is highly non-linear. Whereas, in the year 2007, about 34% of all firms in Germany were under a collective bargaining scheme, in the sub-group of firms with at least 500 employees this share is as high as 80%. Whereas among small firms (1 to 20 employees) more flexible firm-specific collective bargaining schemes do hardly exist (about 1 to 2% of these firms), about 8% of the firms in the sub-group with at least 500 employees dispose of such firm-wide bargaining schemes.

In addition, many labor market regulations do not apply to small firms, such as the possibility to maintain works councils (which is possible only for firms with at least 5 employees) or firing restrictions (which apply only to firms with more than 10 employees).

3.3 Technology and Productivity

Evidence provided so far shows that firms differ with regard to the importance of financial and labor market constraints. Next, we turn to the key variable determining

entry into foreign markets – firms’ productivity. Ideally, we would compute a measure of total factor productivity. Yet, lacking information on the capital stock, we measure productivity using sales per employee and value added per employee. We correct for the importance of part-time workers by using full-time equivalents, and we 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 decision to engage in FDI. Also, including a direct measure of R&D intensity 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. A similar argument is likely to apply to FDI activities of firms.

3.4 Are Multinationals Different?

The evidence presented above reveals the heterogeneity of German firms with respect to financial and labor market frictions as well as with respect to the level of productivity and technology. Financial frictions are more common among smaller firms, while adverse labor market conditions prevail particularly among larger firms. In this section, we analyze whether these features are also related to the FDI activity.

Table 2 provides an overview of indicators of German firms, differentiated by their self-reported financial constraints and their labor market constraints. 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, firms facing restricted access to external capital are less likely to invest abroad.

In Table 2b, these comparisons are made for different labor market conditions. Firms subject to high labor costs, personnel shortages, problems regarding worker protection laws, collective bargaining, and works councils are bigger in terms of employees and sales than firms not facing these conditions. 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. On the other hand, firms with a works council or firms that are subject to collective bargaining agreements are more productive. This seems to be a size effect, though.

When comparing the mean labor productivity for purely domestic and multinational firms, we find that multinational firms are significantly more productive. Also, within the group of financially constrained firms, multinationals are significantly more productive than domestic firms (84,703 versus 39,583 Euros). In relative terms, this difference in productivity is smaller for the unconstrained firms (98,169 versus 60,467 Euros). (Table 3). These patterns in the data are consistent with the interpretation that financial constraints hinder multinational activities and lower productivity.

4 Regression Analysis

In this section, we analyze the impact of firm size and productivity and of firm-specific capital and labor market frictions on a firm's decision to invest abroad. Our main dependent variable is the logarithm of the volume of foreign direct investments (in Euros) realized by a firm in the years 2004 and/or 2005, i.e. the intensive margin of firms'

foreign activities. But we are also interested in the firms' decision to invest abroad, i.e. the extensive margin.

4.1 *Model Specification*

We apply a Heckman selection model, which allows analyzing the extensive and intensive margin of firm level FDI activity simultaneously.

Our baseline selection equation is the following:

$$\Pr(FDI_{kt}) = \alpha_0 + \alpha_5 + \alpha_1 \left(\frac{Y}{L} \right)_{kt-2} + \alpha_2 \cdot d_{k,t-2}^K + d_{k,t-2}^L \alpha_3 + X'_{k,t-2} \alpha + \varepsilon_{kt}$$

with $\Pr(FDI_{kt})$ being the probability to invest abroad in 2004 and/or 2005. α_0 , α_1 and α_2 are scalar coefficients, α and α_3 are column vectors of regression coefficients, α_5 are industry fixed effects. ε_{kt} is the error term. Moreover, we include firm-level proxies for financial constraints ($d_{k,t-2}^K$), for labor market constraints ($d_{k,t-2}^L$), and a set of control variables ($X_{k,t-2}$). In general, we use two-period lagged values in order to measure the firms' characteristics prior to the investment decision in the years 2004 and/or 2005.

We arrange our explanatory variables into four groups.

A first group of variables includes measures for productivity and firm size. Productivity

is measured as $\left(\frac{Y}{L} \right)_{k,t-2}$ which gives labor productivity in the period before the FDI

investment. The expected sign is positive. The same holds for log employment as a general measure for firm size. Among our lagged control variables $X_{k,t-2}$ is the reported level of technology as a discrete, ordinal variable from 1 (best) to 5 (worst) and 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 FDI activity, and problems regarding innovation, for which we expect a negative impact.

A second group of variables captures financial frictions. We measure these ($d_{k,t-2}^K$) using self-reported constraints in the access to the capital market. We expect a negative sign. We argue that it is important to control for dependence on external finance. As a proxy to the dependence on external finance, we additionally use the share of cash flow in total investments.

A third group of variables addresses labor market conditions. The column vector $d_{k,t-2}^L$ includes dummy variables indicating whether a firm reports adverse employment conditions. Additionally, we include the share of unskilled employees. The signs of the employment variables are not clear a priori. Labor market constraints could constitute a barrier to firms' international activities if they lower the productivity of firms. Accordingly, firms reporting high wage costs or personnel shortages should be less likely to invest abroad. 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 engage in FDI. At the same time, more rigid employment conditions at home may also increase the incentives of firms to engage in international markets and to start production abroad. Through this channel, rigid labor market conditions could also increase the probability of firms to invest abroad.

A fourth group of variables includes control variables. Our most important control variable is export market experience. We measure export experience as the share of turnover earned on export markets. Again, we use two-period lagged values in order to

measure the firms' trade-related expertise previous to the investment decision. We also include a squared term to control for nonlinear effects. Firm age is used as a dummy variable that takes the value 1 if firm formation took place before 1990. Finally, the vector of control variables includes a set of industry dummies. These capture financial and labor market constraints that differ across industries, not firms.

In order to identify the selection equation, we include dummy variables indicating the existence of a works council, whether the firm is ruled by a collective bargaining scheme, as well whether it is situated in Eastern Germany. These variables are dropped from the volume equation in order to fulfill the exclusion restriction and identify the model. The economic intuition is that these variables are more likely to affect the fixed costs of entry into foreign markets rather than the volume of investment.

4.2 Results

The Heckman selection model allows analyzing the intensive and extensive margin of firm level FDI activity. Results for the Mill's Ratio – which is insignificant in all models – suggest that the selection into the FDI activity (the extensive margin) does not affect the determinants of the volume of FDI (the intensive margin).

As expected, we observe a positive effect of size and productivity on FDI activity. Firm size in terms of employees has a significantly positive effect on the selection into FDI activity as well as on the volume of investments. The coefficient suggests a rather large economic impact with a size-elasticity of FDI volume of about 0.8. Hence, an increase in the size of the firms by one percent increased the volume of FDI by 0.8 percent.

Productivity has a significantly positive effect on FDI activity. Again the results suggest that productivity has a significantly positive effect on the extensive margin as well as on the intensive margin. The size of the effects is similar to the effect of firm size. In contrast to earlier literature, we can measure the link between FDI and productivity by including firm-specific technology measures. Firm-level R&D activity and the use of modern technology both have a positive impact on the decision to invest abroad, but no effect on the volume. There is, in contrast, no effect of innovative activity or reported impediments to innovations on FDI activity.

Self-reported financial constraints have no impact on the firms' FDI activity. This holds true both for the selection equation and for the volume equation. Hence, firms that are productive enough to invest abroad do not seem to suffer from credit constraints in a relevant way. Hence, after controlling for size, productivity, and R&D intensity, financial constraints have no independent impact on FDI activities. A higher share of investment financed by cash flow makes the selection into the FDI mode more likely. This result is surprising as we would expect that a lower share of external finance can be interpreted in terms of tighter financial restrictions. One possible interpretation of this finding is that firms generating high cash flow might be sufficiently liquid to finance an investment project of a given size out of their own funds.

Several variables capture the effect of labor market frictions on FDI activity. We cannot observe significant effects of reported wage cost problems, personnel shortage, problems regarding worker protection laws, or the share of unskilled employees on the firm level FDI activity. There are only two exceptions. Wage cost problems seem to have a negative

effect on the decision to invest abroad in just a few specifications, whereas personnel shortage has a positive impact on the selection into FDI activity.

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, but no effect on the volume of FDI. We included a squared term to control for nonlinear effects and can observe a decreasing relevance with rising export intensity. The negative sign on firm age suggests that younger firms decide more often to invest abroad. Again, we do not find an effect on the volume of FDI.

The variables we excluded from the volume equation in order to identify the selection equation are dummy variables for the existence of a works council, collective bargaining agreements, and a Eastern Germany dummy. We observe a negative effect of collective bargaining agreements on the selection into FDI activity. The existence of a works council has no impact on the decision to invest abroad, and we find a significantly negative effect of the Eastern Germany dummy only in very few specifications.

In sum, productivity and size are the main drivers of FDI activity. This holds true for both, the decision to invest abroad and the volume of investments. We cannot observe that frictions regarding the supply of external capital and labor market constraints have a significant effect on firm level FDI activity. In general we are able to explain the decision to invest abroad quite well.

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 multinational firms. In this paper, we analyze whether the heterogeneous patterns in the data might also be due to differences across firms with regard to access to external finance and exposure to adverse labor market conditions.

We use a detailed, firm-level dataset, a representative sample of German firms which contains information on productivity, R&D, financial frictions, labor market frictions, export activities, and the volume of FDI. We use a Heckman selection model to analyze both the intensive and the extensive margin of multinational activity. Our main results are as follows.

First, in line with the existing literature, we find that larger, more productive, and more R&D intensive firms are much more likely to engage in FDI than smaller and less productive firms. Size and productivity affects both, the intensive and the extensive margin of foreign activities.

Second, self-reported financial constraints have no effect on the FDI-decision. This is in contrast to the case of exporting, where the impact of financial constraints has been mixed in the literature. Firms which finance a larger share of their investment from internal cash flow are more likely to invest into existing or new foreign affiliates. This would be at odds with the interpretation of a high share of cash flow finance as a proxy for financial frictions. It could indicate though that some firms generate sufficient internal funds to be independent of external finance.

Third, labor market conditions have a significant impact on the decision to invest abroad. Among the frictions that have a negative effect on foreign investment is the existence of a collective bargaining scheme and, at least in some regressions, situations in which firms

report wage cost problems. Domestic personnel shortages push firms into establishing new foreign affiliates or into investing more into existing foreign affiliates.

Fourth, high export intensity shows a significantly positive effect on the selection into FDI activity, indicating that previous trade-experience from foreign markets can be an important trigger to foreign investments.

In sum, the most important drivers of the volume of FDI at the firm-level are size and productivity. Yet, our results also suggest that financial and labor market frictions are important, in particular as the former may affect R&D investments of firms. In this sense, the results presented in this paper do not rule out a negative feedback effect between the recent financial crisis on multinational activity. This effect may be aggravated by the positive link between exports and FDI. With regard to future theoretical modeling, it might be important to model frictions in the access to capital or labor markets not only at the aggregated but also at the firm-level.

References

- Arndt, C., C.M. Buch and A. Mattes (2008). Barriers to Internationalization: Firm-Level Evidence from Germany. LdA Working Paper. Milan.
- Aw, B.Y., M.J. Roberts, and D.Y. Xu (2009). R&D Investment, Exporting, and Productivity Dynamics. NBER Working Paper No. 14670. Cambridge, MA.
- Berman, N., and J. Hericourt (2008). Financial Factors and the Margins of Trade: Evidence from Cross-Country Firm-Level Data. Documents de Travail du Centre d'Economie de la Sorbonne 2008.50. Paris.
- Buch, C., I. Kesternich, A. Lipponer, and M. Schnitzer (2008). Real versus Financial Barriers to Multinational Activity. University of Tübingen, University of Munich, and Deutsche Bundesbank. Mimeo.
- Chaney, T. (2005). Liquidity Constrained Exporters. University of Chicago. Mimeo.
- Du, J. and S. Girma (2007). Finance and Export in China. *Kyklos* 60(1): 37-54.
- Felbermayr, G., J. Prat and H.-J. Schmerer (2008). Globalization and Labor Market Outcomes: Wage Bargaining, Search Frictions, and Firm Heterogeneity. IZA Discussion Paper 3363. Bonn.
- Greenaway, D., A. Guariglia, and R. Kneller (2007). Financial Factors and Exporting Decisions, *Journal of International Economics* 73: 377-395.
- Helpman, E., M.J. Melitz and S.R. Yeaple (2004). Export versus FDI with Heterogeneous Firms. *The American Economic Review* 94 (1): 300-316.
- Helpman, E., M.J. Melitz and Y. Rubinstein (2008). Export versus FDI with Heterogeneous Firms, *The Quarterly Journal of Economics* 123 (2): 441-487.
- Manova, K. (2008). Credit Constraints, Heterogeneous Firms, and International Trade. NBER Working Paper 14531. Cambridge, M.A.
- Melitz, M.J. (2003). The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity, *Econometrica* 71: 1695-1725.
- Petersen, M.A. (2004). Information: Hard and Soft. Kellogg School of Management. Northwestern University and NBER. Mimeo.

Stiebale, J. (2008). Do Financial Constraints Matter for Foreign Market Entry? A Firm-level Examination. Ruhr Economic Papers 51. Essen.

United National Conference on Trade and Development (UNCTAD) (2008). *World Investment Report 2008: Transnational Corporations and the Infrastructure Challenge*. New York and Geneva.

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.) This 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 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		
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)
Financial constraints	Dummy variable reporting problems to raise external capital for investments (see section 3)		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		
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
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	Standard deviation
Employees (2006)	15,449	17	109
Employees (2006) (full time equivalent)	15,444	14	98
Expected personnel shortage (2004)	10,923	19 %	0.39
Expected problems with worker protection laws (2004)	10,923	5 %	0.23
Expected wage cost problems (2004)	10,923	31 %	0.46
Firm-specific collective bargaining agreement (2004)	10,899	3 %	0.17
Industry-wide collective bargaining agreement (2004)	10,899	39 %	0.487
Innovation problems (2004)	10,923	8 %	0.27
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)	12,727	2.19	1.08
Mean share of cash flow used in investments (2005)	8,370	69 %	43
R&D (0/1) (2004)	10,923	5 %	0.22
Sales productivity (sales / employment) (2006)	10,191	131,453	222,031
Share of skilled employees (2006)	15,449	7 %	0.21
Share of unskilled employees (2006)	15,499	17 %	0.26
Value added (2006)	9,244	889,959	11,439,708
Works council (2004)	12,938	19 %	0.40

Source: *Establishment-Level Panel*, 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 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%
Firm-specific collective bargaining	1%	3%	6%	10%	12%	11%
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%
Firm-specific collective bargaining	3%	2%	3%	4%	2%	3%
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: *Establishment-Level Panel*, own calculations

Table 2: Performance Indicators by Type of Firm**(a) By Financial Constraints**

	Financial constraints (Self-reported)	
	Yes	No
Mean labor productivity (1,000 Euro)	41.7	62.5
Mean level of technological equipment (1 newest, 5 oldest)	2.1	2.3
Mean number of employees	17	24
Mean sales (1,000 Euro)	1,862	9,743
Share of FDI-firms (%)	0,3	0,5

(b) By Labor Market Conditions

	Wage cost problems		Personnel shortage		Worker protection laws		Collective bargaining		Works council	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Export-sales-ratio (%)	3	3	5	2	4	3	2	4	5	2
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
Mean number of employees	28	13	34	14	57	15	26	12	53	9
Mean sales (1,000 Euro)	3,759	1,793	4,802	1,867	9,105	2,079	3,968	1,594	10,289	1,003
Share of exporting firms (%)	13	10	20	9	16	10	8	12	19	9

Source: *Establishment-Level Panel*, own calculations

Table 3: Mean Labor Productivity by FDI 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	Multinational Firms
Unconstrained firms	60,467	98,169
Financially constrained firms	39,583	84,703

Source: *Establishment-Level Panel*, own calculations

Table 4: Determinants of FDI – Heckman Selection Model

This table gives the results of the distributed lag cross-sectional 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 works 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_{-2}	0.754*** (2.93)	0.211*** (3.53)	0.702*** (3.31)	0.127** (2.03)	0.830*** (3.61)	0.168** (2.57)	0.816*** (3.43)	0.140* (1.86)
Log employees t_{-2}	0.772*** (4.13)	0.244*** (6.67)	0.806*** (5.00)	0.199*** (5.24)	0.804*** (5.87)	0.149*** (3.75)	0.829*** (5.05)	0.179*** (4.03)
R&D t_{-2}					0.645 (1.05)	0.704*** (5.48)	0.551 (0.72)	0.745*** (5.27)
Innovative activity t_{-2} (0/1)					-0.229 (0.61)	-0.033 (0.25)	-0.169 (0.40)	0.030 (0.21)
Innovation problems t_{-2} (0/1)					0.120 (0.41)	-0.008 (0.07)	0.174 (0.57)	-0.011 (0.08)
Outdated technology t_{-1} (1/5)					0.024 (0.12)	-0.210*** (3.06)		
Financial constraints (0/1)	-0.191 (0.39)	0.096 (0.53)					-0.033 (0.07)	0.047 (0.24)
Cash flow (share) t_{-2}	-0.003 (0.87)	0.003** (2.29)						
Wage cost problems t_{-2} (0/1)			0.083 (0.32)	-0.202** (2.08)			0.029 (0.11)	-0.167 (1.50)
Personnel shortage t_{-2} (0/1)			0.272 (0.88)	0.260*** (2.72)			0.239 (0.80)	0.124 (1.15)
Problems with worker protection laws t_{-2} (0/1)			-0.097 (0.31)	-0.004 (0.03)			-0.263 (0.76)	-0.058 (0.40)
Share of unskilled employees t_{-2}			0.390 (0.60)	-0.258 (1.21)			-0.102 (0.16)	-0.171 (0.68)
Works council (0/1) t_{-2}		0.190 (1.57)		0.198 (1.63)		0.209* (1.65)		0.131 (0.94)
Collective bargaining t_{-2} (0/1)		-0.336*** (3.21)		-0.340*** (3.17)		-0.332*** (2.95)		-0.299** (2.48)
Firm founded before 1990 (0/1)	-0.115 (0.24)	-0.220* (1.73)	-0.104 (0.24)	-0.282** (2.28)	-0.180 (0.40)	-0.302** (2.34)	-0.506 (0.83)	-0.408*** (2.78)
Export share of sales t_{-2}			-0.008 (0.20)	0.044*** (7.72)	-0.015 (0.48)	0.035*** (5.68)	-0.008 (0.23)	0.034*** (4.97)
Export share of sales ² t_{-2}			0.000 (0.37)	-0.000*** (5.69)	0.000 (0.62)	-0.000*** (4.28)	0.000 (0.40)	-0.000*** (3.79)
East Germany (0/1)		-0.315** (2.31)		-0.138 (1.03)		-0.158 (1.15)		-0.231 (1.45)
Mill's ratio		-0.169 (-0.20)		0.117 (0.13)		0.112 (0.12)		0.26 (0.24)
Industry dummies	yes	yes	yes	yes	yes	yes	yes	yes
Constant	0.727 (0.15)	-4.785*** (6.42)	0.264 (0.06)	-4.348*** (5.54)	-1.235 (0.25)	-4.480*** (5.32)	-1.586 (0.28)	-4.535*** (4.73)
Observations	3945	3945	5981	5981	5896	5896	3604	3604

Source: *Establishment-Level Panel*, own calculations